UNITED NATIONS ENVIRONMENT PROGRAMME

MEDITERRANEAN ACTION PLAN

BLUE PLAN

FUTURES OF THE MEDITERRANEAN BASIN:

environment development 2000-2025

MEDITERRANEAN BLUE PLAN REGIONAL ACTIVITY CENTRE
SOPHIA ANTIPOLIS - FRANCE

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This document is the final version of the report on the Blue Plan scenarios prepared by the Blue Plan Regional Activity Centre as requested in 1985.

Minor corrections only may be introduced in the text, diagrams or boxes, for subsequent publication.

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The Blue Plan studies were carried in Sophia Antipolis, at the Blue Plan Regional Activity Centre for the Mediterranean, Place Sophie Laffitte, Sophia Antipolis, 06560 Valbonne, France.

"It is of utmost importance to provide the governments of the Mediterranean countries with an overall picture of the economic and environmental situation in the mediterranean region and of close interdependance between all its components"

Split 1977

Mostafa K. TOLBA
Executive director
of the United Nations Environment Programme.

FUTURES OF THE MEDITERRANEAN BASIN

ENVIRONMENT-DEVELOPMENT 2000-2025

INTRODUCTION :

FUTURE ORIENTED PROCESS

I. INCEPTION AND OBJECTIVES OF THE BLUE PLAN

By the end of the 1960s, the effects of economic growth, still steady in many countries, on the environment had become a cause of concern in most parts of the world. As a result, the United Nations Environment Programme (UNEP) was established following the United Nations Conference on the Human Environment held in Stockholm in 1972. One of the first projects launched under this programme was entitled "The Health of the Oceans", involving action on the "regional seas".

The Mediterranean Sea was to pave the way. At the time, the possibility of "the death of the Mediterranean, mother of civilization" was advanced. This concern, together with the implicit geographical solidarity of the Mediterranean coastal countries and the need to tackle pollution hazards upstream, both in time and space, induced the Executive Director of UNEP to convene an intergovernmental meeting on the protection of the Mediterranean Sea, held in Barcelona from 28 January to 4 February 1975. Representatives of the seventeen Mediterranean states adopted the "Mediterranean Action Plan", focusing not only on the sea itself, but also on all the surrounding land. While recognizing the difficulties related to geographical diversity and unequal economic and social development among the coastal countries, emphasis was placed from the outset on the need for joint in-depth study of the possibilities for "integrated" development, ensuring the optimal use of resources and the prerequisites for sound long-term management of the Mediterranean environment.

The Mediterranean Action Plan (MAP) comprises an institutional component (the Barcelona Convention and its protocols on the prevention of pollution by dumping from ships and aircraft, combating pollution by oil, protection against land-based pollution, and on specially protected areas) ; a scientific research component (MEDPOL), basically aimed at taking stock of the state of the sea ; and an economic and social planning component comprising both the Blue Plan and the Priority Actions Programme (PAP).

The aim of the Blue Plan -subject of this report- is to provide a long-term view of intra-Mediterranean co-operation by taking an anticipatory look at the next half-century. The original project*, a "Blue Book" on the trends in relationships between the environment and development, was reviewed. in 1977 at an intergovernmental meeting held in Split (Yugoslavia), and the name was changed to "Blue Plan" to stress its goal of identifying and formulating actions to ensure lasting development, both at the national level and at that of the region as a whole.

The objectives of the Blue Plan, its resources, the methods of future-oriented reflection, institutional framework and main areas of interest were defined during this meeting. The objectives were phrased as follows :

> **"to make available to the authorities and planners of the various countries in the Mediterranean information which will enable them to formulate their own plans to ensure optimal socio-economic development without causing environmental degradation"** and
>
> **"to help the governments of the states bordering the Mediterranean region to deepen their knowledge of the common problems facing them, both in the Mediterranean Sea and its coastal regions"**.**

* Suggested by Mr. Serge Antoine.

** UNEP/IG.5/7, paragraph 29.2 (1977)

THE TEN PRIORITIES OF THE

GENOA MINISTERIAL DECLARATION (1985)

The bordering States will attach priority to :

1) Establishment of reception facilities for dirty ballast waters and other oily residues in ports of the Mediterranean ;

2) Establishment as a matter of priority of sewage treatement plants in all cities around the Mediterranean with more than 100,000 inhabitants and appropriate outfalls and/or appropriate treatment plants for all towns with more than 10,000 inhabitants ;

3) Applying environmental impact assessment as an important tool to ensure proper development activities ;

4) Co-operation to improve the safety of maritime navigation and to reduce substantially the risk of transport of dangerous toxic substances likely to affect the coastal areas or induce marine pollution ;

5) Protection of the endagered marine species (e.g. monk seal and Mediterranean turtle) ;

6) Concrete measures to acheave substantial reduction in industrial pollution and disposal of solid waste in the Mediterranean ;

7) Identification and protection of at least 100 historic sites of common interest ;

8) Identification and protection of at least 50 new marine and coastal sites of reserves of Mediterranean interest ;

9) Intensify effective measures to prevent and combat forest fires, soil loss and desertification ;

10) Substantial reduction in air pollution which adversly affects coastal areas and the marine environment with the potential danger of acid rains.

The intergovernmental meeting held in Monaco in January 1978, while confirming the objectives of the Blue Plan, specified the methodology based on functional or systemic analysis and the tools of future-oriented work : "one process would be preferred : the formulation of "scenarios" designed as the construction of future patterns of the evolution and transformation of complex social sets". The "scenarios", which were to play an increasingly important role in the preparation of the Blue Plan, were thus designed to identify key problems and also to enable countries to pinpoint their overall development/ environment strategies and policies covering the mains sectors of economic activity. The Blue Plan work, as it progressed, naturally took into account the findings and advances which had occurred in other components of the Mediterranean Action Plan since 1975 : application of additional protocols, priority actions programmes, MEDPOL, etc., as well as the Genoa Ministerial Declaration (1985) which commits the coastal countries to the objectives of a ten-year programme.

At the same time, work drew from reflection taking place outside the Mediterranean basin on the real nature of relationships between the environment and development, particularly the report of the World Commission on Environment and Development, the UNEP study entitled Environmental perspectives up to the Year 2000 and Beyond, and other reports on the same subject, particularly by the United Nations Economic Commission for Europe.

Since the Blue Plan involves the building-up of a common stock of knowledge, the coastal states' joint exploration of the relationships between natural environments and human activities, and reflection on the possible futures of the Mediterranean basin as a whole, it is clearly not a "Plan" in the sense of some kind of centralization of economic trends or resource management decision-making. It merely aims at providing a common reference framework to stress the complex interactions of development and environment problems in the region, within and among the various countries, and to highlight the areas in which the need or opportunity for action exists.

For the first time, the studies undertaken within the Blue Plan bring together a consistent set of data on the various factors likely to exert considerable influence on the evolution of the Mediterranean environment. The processing of these data in the context of a long-term future-oriented exercise based on the scenarios should enable the government authorities involved to improve the attention paid to these factors, formulating policies likely to have an impact on the Mediterranean environment, and to assess the local and international implications of the decisions they may take. The work of the Blue Plan may therefore be instrumental in fostering greater intra-Mediterranean co-operation for lasting development.

II. THE THREE PHASES OF THE BLUE PLAN

The work undertaken since 198O has been divided into three phases envisaged from the outset : an initial exploratory phase, a second phase of in-depth study, and a final phase for submitting and discussing findings.

The first phase of the Blue Plan (1980-1984) was defined by country representatives during a meeting in Cannes (1979) with respect to its content, structure, budget and institutional relations. This phase was intended for the initial exploration work : twelve expert reports, both sectoral and cross-sectional, were prepared by twelve two-man teams of experts, one from the north, the other from the south of the Mediterranean (this very important principle for conducting research has been applied as systematically as possible for the whole of the Blue Plan).

The experts' reports focused on the following subjects :

1. Land/marine system and subsystems
2. Water resources, competing uses and human priorities
3. Industrial growth, industrialization strategies and subsoil resources
4. Old and new forms of energy
5. Health, population and population movements
6. Land use, soil conservation, agriculture and rural development, urbanization, shore-line development and town-country balance
7. Tourism, tourist areas and the environment
8. Intra-Mediterranean economic relations
9. Transport and communications
10. Cultural heritage and cross-cultural relations
11. Awareness of the environment and value systems
12. Impact of non-Mediterranean influences on the Mediterraneanbasin.

Each report was guided by two seminars, one for launching the work, the other for reviewing the preliminary report and helping to draw up the final report.

Co-ordination of the first phase was entrusted to a Group of Co-ordination and Synthesis (GCS) comprising a Co-ordinator assisted by representatives of six member countries*.

The task of the GCS was to prepare detailed specifications for the twelve expert reports, ensure their follow-up and co-ordination, and draft the summary report.

At the same time, the coastal countries and the Commission of the European Economic Communities appointed "focal points", i.e. specialists responsible for representing them in the regular meetings to supervise Blue Plan implementation**.

Work on the first phase was officially launched on 1 September 1980 in Sophia Antipolis (near Antibes, France), with help from a support structure provided by the French government in agreement with UNEP.

* The GCS was chaired by Mr Ismaïl Sabri Abdalla and included Messrs. El Mohamed El Hadi Bennadji (Algeria), Franjo Gasparovic (Yugoslavia), Panayotis Lagos (Greece), Erredine Makhlouf (Tunisia),José Maria Pliego (Spain), and Michel Grenon (France).

** Meetings of the Blue Plan Focal Points : first : Geneva (1-2 February 1979) ; second : Cannes (1-5 October 1979), detailed definition of the first phase ; third : Sophia Antipolis (3-4 april 1981), review of progress of the first phase ; fourth : Sophia Antipolis (31 January-2 February 1983), initial review of the summary reports of the first phase ; fifth : Sophia Antipolis (23-27 January 1984), adoption of the conclusions and reports of the first phase ; sixth : Athens (6-9 May 1985), agreement on the programme proposals, second phase ; seventh : Athens (28-30 April, 1986, review of progress of the second phase ; eighth : Sophia Antipolis (20-22 July 1987), review of the preliminary report on the scenarios.

On the basis of the reports prepared by the twenty-four experts from southern and northern countries of the Mediterranean basin* and contributions of some three hundred Mediterranean consultants participating in the seminars, a conspectus of the first phase was drafted by the GCS in 1983 and, duly revised and amended, was approved by the Blue Plan Focal Points (Sophia Antipolis, 1984).

The intergovernmental meeting held in Athens in April 1984 then decided to implement the second phase of the Blue Plan, to last two years, the outcome of which was to be the submission of a number of future-oriented scenarios on the relationships between the environment and development in the Mediterranean basin. The meeting also requested the dissemination of an abridged version of the work of the first phase : a booklet entitled "Overview of the Mediterranean Basin" was accordingly distributed in French, English and Arabic in 1985.

At the same time, some twelve thousand series of data drawn up by the countries over several years were to be gathered, i.e. approximately 150,000 items of statistical data on the current socio-economic and demographic situation and the situation over the past ten to fifteen years, since the Mediterranean basin is unfortunately not a common reference framework in the yearbooks and studies of international bodies or in scientific and economic works in general.

The second phase started in spring 1985* after a one-year transition period. Most of the work was carried out by a very reduced central team (which did not exceed a staff of three researchers), under the guidance of the scientific director***, assisted by thirty consultants from various Mediterranean countries, grouped if necessary into specialized working parties on agriculture, tourism, transport, etc..

In order to ensure the "open book" participation of Mediterranean countries in this stage of the proceedings, the Athens Intergovernmental Meeting decided to establish a Steering Committee****si, representing the Focal Points.

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* Messrs. A Gharbo (Egypt) and J.P. Foret (France) : expert report 1 ; M. Ennabli (Tunisia) and Y. Emsellem (France) : expert report 2 ; K. Maksoud (Egypt) and G. Luciani (Italy : expert report 3 ; N. Berrah (Algeria) and R. Rigopoulos (Greece) : expert report 4 ; T. Nacef (Tunisia) and I Baucic (Yugoslavia) : expert report 5 ; L. Khaldoun (Algeria) and C. Muscara (Italy) : expert report 6 ; A. Smaoui (Tunisia) and M. Baretje/J.M. Thurot (France) : expert report 7 ; K. Abdel-Nour (Syria) and M. Papayannakis (Greece) : expert report 8 ; M. Benchekroun (Morocco) and J. Cuena (Spain) : expert report 9 ; Mrs K. Nestoros (Greece) and Mr R. Habachi (Lebanon) : expert report 10 ; Messrs. S. Ghabbour (Egypt) and F. Gonzalez Bernaldez (Spain) : expert report 11 ; A. Najib (Morocco) and V. Vukasovic (Yugoslavia) : expert report 12.

** with the signing of a new contract between UNEP and France, and the setting up of a better suited technical and administrative structure in France: the Blue Plan Regional Activity Centre (BP/RAC) in Sophia Antipolis, under the presidency of Mr Michel Batisse.

*** Mr Michel Grenon, who had already assisted the co-ordinator of the Blue Plan during the first phase. He was helped by a reduced team comprising

**** composed as follows :

<u>1984-1986</u> : under the chairmanship of Italy (Mr F. Ciarnelli) : Spain (Mrs M.C. de Andres Condé), Morocco (Mr J. El Amrani), Syria (Mr A. Hamwi), Turkey (Mrs A. bulka), Yugoslavia (Mr F. Gasparovic).

<u>1986-1987</u> : Italy (Mr F. Ciarnelli), Egypte (Mr E. Eid), Greece (Mr D. Tsotsos), Israel (Mr A. Pruginin), Malta (Mr E. Scicluna), EEC (Mr M. Zampetti).

<u>1987-1988</u> : under the chairmanship of Tunisia (Mrs H. Baccar) : Algeria, Cyprus (Mr A. Antoniou), France (Mr S. Antoine), Lebanon (Mr E. Maalouf), Libya (Mr Y. Elmehrik), Monaco (Mr P. Van Klaveren).

In order to base the scenarios as much as required on the realities of the different countries concerned, the Blue Plan Focal Points requested that the Mediterranean countries endeavour to formulate their own national development/ environment scenarios, in accordance with a common framework defined beforehand by the Blue Plan Secretariat. This decision, and the ensuing national studies, in fact motivated the work of the second phase as a whole and the drafting of this version of the report.

Since it was particularly difficult to define the scenarios (choice of dimensions, hypotheses, distinguishing features, horizons, methods, etc.), the central team was eventually assisted by an open group of some twenty scientific experts from various Mediterranean countries : the "Study Group on Mediterranean Scenarios"***. Within the Group, basic choices were always reached through consensus. On the basis of the Group's work, a "Guide for the Formulation of National Scenarios" was forwarded in December 1985 to the officials responsible for the national scenarios, appointed by the countries.

In 1986 work started on the national scenarios in most countries, as well as on the preparation by the permanent team of studies at the Mediterranean level on population, macroeconomic development, urbanization, agriculture, industry, energy, tourism, transport, environment/development relationships, specific impact on the coastline, etc. The global studies were undertaken for all countries and concentrated on analysing the Mediterranean regions when the availability of data so permitted. At the same time, the socio-economic data bank and the stock of environmental data were built up. The gathering of environmental data proved difficult, in particular for lack of homogeneous figures, but it was bolsteredd by answers to questionnaires sent to the countries.

A number of environmental "chains" were also established in order to link development activities quantitatively to impact on Mediterranean areas and environments, and so initiate reflection on some of the key issues for the Mediterranean basin.

The first reports on the national scenarios arrived at the end of 1986. Although there were some delays, it is indicative that most of the countries did undertake this exercise, true to the concerns expressed in Barcelona in 1976 to "study thoroughly together" development requirements, the optimal use of resources, and sound long-term management of the Mediterranean environment. The national scenarios were taken into account in the work of the central team. Preparation of the Mediterranean scenarios submitted in this report was therefore a collective undertaking and a stimulating task for all those who took an active part in it.

The third phase, aimed at ensuring the dissemination and discussion of the findings (interaction) began in June 1987 with the forwarding of the preliminary report on the scenarios. The focal points reviewed the main lines of the report in Sophia Antipolis in July 1987 and discussed in detail the content of the summary intended for decision-makers. Representatives of the states meeting in Athens in September 1987 decided that the report should be prepared in its final form and that the dialogue started up in 1987 should continue in 1988, as soon as the report was distributed in several languages to the countries concerned. The following report, finalized during the early months of 1988, notably on the basis of comments received on the preliminary text, is the final report on the Blue Plan Mediterranean scenarios.

To avoid over-burdening the report and slowing down reading, only a few essential tables are included.

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* Under the Chairmanship of Mr Jacques Lesourne

The main statistical tables have been assembled in a "Mediterranean Basin data base" where basic data are presented in the form of two booklets, one on population and economic activities and the other on the environment.

In addition, in order to facilitate reading for the different kinds of decision-maker (municipal and regional authorities, town planners, forest managers, tourism officials, etc.), it was decided to attach a number of specialized booklets to the summary report on the Mediterranean scenarios, which could be read more or less independently of the main report. These booklets, to be published later, are all studies that deepen and broaden the Blue Plan. They are being prepared by groups of Mediterranean specialists under the aegis of the Regional Activity Centre and are devoted to either the major sectors of human activity or the main geographic environments, and will focus in principle on the following topics :

1. Development of the coast and coastal regions
2. Evolution of urban systems
3. Evolution of intensive agriculture
4. Evolution of the hinterland and mountain regions
5. Conservation of fragile areas, wildlife and plant life
6. The future of the Mediterranean forest
7. Prospective study on water resources and needs
8. The future of the islands
9. Developments in the state of the sea and marine pollution
10. Living marine resources (fisheries and aquaculture)
11. Industry and the environment
12. Energy and the environment
13. Tourism and the environment
14. Transport and the environment
15. Natural hazards and their sequelae
16. Health, environment and development
17. Trends in perception and behaviour in the Mediterranean
18. Development of regional and local institutions for the environment and resources.

III. PROCESS AND LOGIC OF THE REPORT

The aim of the Blue Plan is to provide planners and decision-makers with information likely to assist them in formulating suitable plans and programmes for ensuring the socio-economic development of their country or region in harmony with the Mediterranean environment, and to identify, wherever necessary, areas of co-operation between Mediterranean countries likely to further or promote the achievement of this objective. It was not intended that the Blue Plan should define development policy -always a difficult compromise between economic and social objectives, and between internal balance and international interactions-, but explore the consequences of possible policies on the Mediterranean environment : impact on resources and environments, including feedback effects, identification of thresholds and/or irreversible situations, conflicting use or activities, particularly sensitive areas, etc. The Blue Plan incidentally brought to the fore very serious problems such as unemployment or food imbalance in some countries. Its task, however, was not to define policies likely to provide solutions to these issues, and it confined work to analysis of the environmental consequences of development policies, including the attendant problems of employment, or subsistence.

As from the Monaco Meeting in 1978, interest had been shown in resorting to two kinds of scenarios to explore the future of the Mediterranean : the "reference scenarios" based on the progression of current major trends (with or without breaking points) and "alternatives scenarios" for a "goal-oriented" type of development.

These scenarios on relationships between development and the environment necessarily include arbitrary hypotheses. The most important criterion was to be able to explore a large range of possible situations and to ensure a minimum of logic and a maximum of consistency. The figures providing the basis for quantifying the hypotheses and the figures in the ensuing results should not mislead the reader : only orders of magnitude count, only the insight which may stem from them is meaningful. It is not a matter of prediction or forecasting, but of exploration.

Keeping to the overall Mediterranean level would have made the exercise appear over-abstract, by giving in particular mean values to which the reader is unaccustomed.

The figures on individual countries, intended to help pinpoint problems, were mostly obtained from rational econometric relationships, taking into account, as far as possible, the most recent situation. The prime aim was to respect overall consistency among countries and sectors of activity, bearing in mind their interdependence. Whenever possible, these figures were discussed with the countries concerned and corrected if necessary. Some figures were also occasionally aggregated by groups of countries. However, although some countries have certain affinities which would facilitate, even encourage, grouping them together in the studies, they still differ considerably.

The period under review covers the past (from 1960 whenever possible) and the long-term future. Most ecological phenomena are slow cumulative processes, with a delayed impact or threshold (save rapidly developing ecological "disasters"). This long delay means using horizons which often seem very far off compared to other activities. Horizon 2000 (long term) and 2025 (very long term) were chosen. These horizons are, however, quite different : many things that will happen in 2000 are already underway, and the outcome envisaged for this date can be fairly accurate. Beyond 2000, uncertainty is greater and futures less circumscribed, although some phenomena (such as the depletion of certain resources) are likely to occur during the first quarter of the next century. Confining the horizon to 2000 would have concealed phenomena that have serious impacts, and would not have underscored the range of possible actions which, if started in time, can have an effect on the future of the Mediterranean.

The nature of the exercise and in particular the many interactions studied prevented working within a rigidly fixed geographical framework. Thus the studies are always centred on the Mediterranean Sea (as defined in the Barcelona Convention) and emphasis is laid on coastal regions, whose surface areas may vary from one place to another, depending on the problems to be considered and the nature of the disciplines involved.

For some coastal countries, the Mediterranean regions are the main part of the country. For others, they represent no more than a small part of national production. As regards the overall analysis of economic development, considerations could not be confined only to the Mediterranean regions as such, and national data had to be used (inter alia macroeconomic analyses), often the only ones available. When tackling the sectors of economic activity, an attempt was made, as far as possible, to step down from the starting point at the national level to the level of the Mediterranean region. As regards considerations on the environment, these have generally been restricted to the Mediterranean region strictly speaking, while specifying as often as possible its boundaries, as no single definition exists suited to all purposes. Finally, for some studies such as tourism, an effort was made to "zoom in", i.e. to go down to the local level, to provide an example or to improve understanding of the practical problems involved at various levels, not only geographic and/or economic, but also political, in order to take into account the decentralization of decision-making. With this method, the transitions from one level to another were never a one-way process, but implied moving backwards and forwards, depending on the methods of systems analysis.

Thus the Blue Plan scenarios have been constructed on the scale of the entire Mediterranean basin, giving preference wherever possible to the study of trends concerning the regions nearest to the coast, which are also those subject to the strongest constraints and pressures. The global nature of the Blue Plan may conceal local trends stemming from specific circumstances and clearly does not permit specifying what may happen in a given place in the basin. Nor can this process take into account unexpected events or sudden disruptions. Nevertheless, it provides the general context, according to different sets of hypotheses, in which these local trends and events may occur and by which, in the final analysis, they are deeply affected.

IV. PLAN OF THE REPORT

The report on the Blue Plan Mediterranean scenarios is presented in five main parts.

The first part outlines the geographical context of the study. It recalls the distinctive features of the Mediterranean basin, with respect to both physical and human geography, and identifies the major stable features of the Mediterranean environment (climate, relief, ecosystems, etc.) to be considered as invariables as regards the scenarios. It indicates the geographical boundaries which may be adopted for the studies, and the time scales needed to assess trends.

The second part defines the five scenarios to be formulated for the 2000 and 2025 horizons. After recalling the interest in using this method of future-oriented study, an explanation is given of how the variable factors of the scenarios were chosen, whether environmental variables or economic and population variables. This is followed by a description of the different kinds of scenario selected, their structure and outline, placing them in the context of economic and environmental policies. In particular a choice is made of the hypotheses concerning population (demography, migration, dependency rate, etc.) on the one hand, and economic factors (growth rates, trade, etc.) on the other. The scenarios are then depicted in detail to the 2000 and 2025 horizons according to the set of hypotheses chosen.

The third part presents the findings on economic activities and their impact on the environment for the five major sectors chosen : agriculture, industry, energy, tourism and transport, as well as for urban systems and urbanization. The sectoral scenarios drawn up are presented in each case, distinguishing, wherever possible, trends specific to the coast and to Mediterranean regions strictly speaking.

The fourth part is devoted to an analysis of possible trends of the Mediterranean environment according to the different scenarios, with an assessment of environmental impact emerging from the findings of the study of subsystems within the five environmental variables chosen : soil, the forest, water resources, the coastline and the sea. As regards the sea, subject of the in-depth work of the MEDPOL programme, the Blue Plan centred on a prospective study of the potential interactions with the main sectors of human activity.

The fifth part reiterates and summarizes the main findings and major potential lines of change stemming from the scenarios, which makes it possible to identify a number of guidelines for action at both national and local level, and at that of intra-Mediterranean co-operation.

The guidelines for action are again advanced in a summary for decision-makers which, together with the data base and the specialized booklets already mentioned, complete this report on the Blue Plan Mediterranean scenarios.

PART ONE :

THE GEOGRAPHICAL CONTEXT

CHAPTER I.1

SPECIFIC CHARACTERISTICS AND PERMANENT FEATURES

On account of both its geography and history -one being closely related to the other- the Mediterranean basin is an outstandingly original region. The sea itself -Mediterranean mean "in the midst of land"- the complex and tortured landscape that surrounds it, its unique climate, have all strongly influenced the extraordinary development of civilization along its shores. And this development, with its long evolution dating back to prehistory and its increasing intensity, has deeply marked and often irreversibly transformed a fragile environment with limited resources. Perhaps nowhere else has nature done so much for man, and man in turn has so transformed nature. The geographical context predominates any study or prospective exercise on the Mediterranean, a geography which is both physical and human.

It is not the intention here to provide a detailed picture of this Mediterranean geographical context, so often described elsewhere. It should be noted however, that in the Blue Plan prospective study requires the selection of several variable parameters for the scenarios, and this choice should not conceal other important parameters considered as "invariables". These basic features of the Mediterranean environment, such as relief, climate, wildlife and plant life, and also urban sites and socio-cultural data, provide the setting for the scenarios ; a framework for the study of possible futures. This does not mean that these features do not evolve within the basin's highly fragile system, but that their development is rather slow compared to the time scales chosen.

I. <u>THE MEDITERRANEAN RELIEF</u>

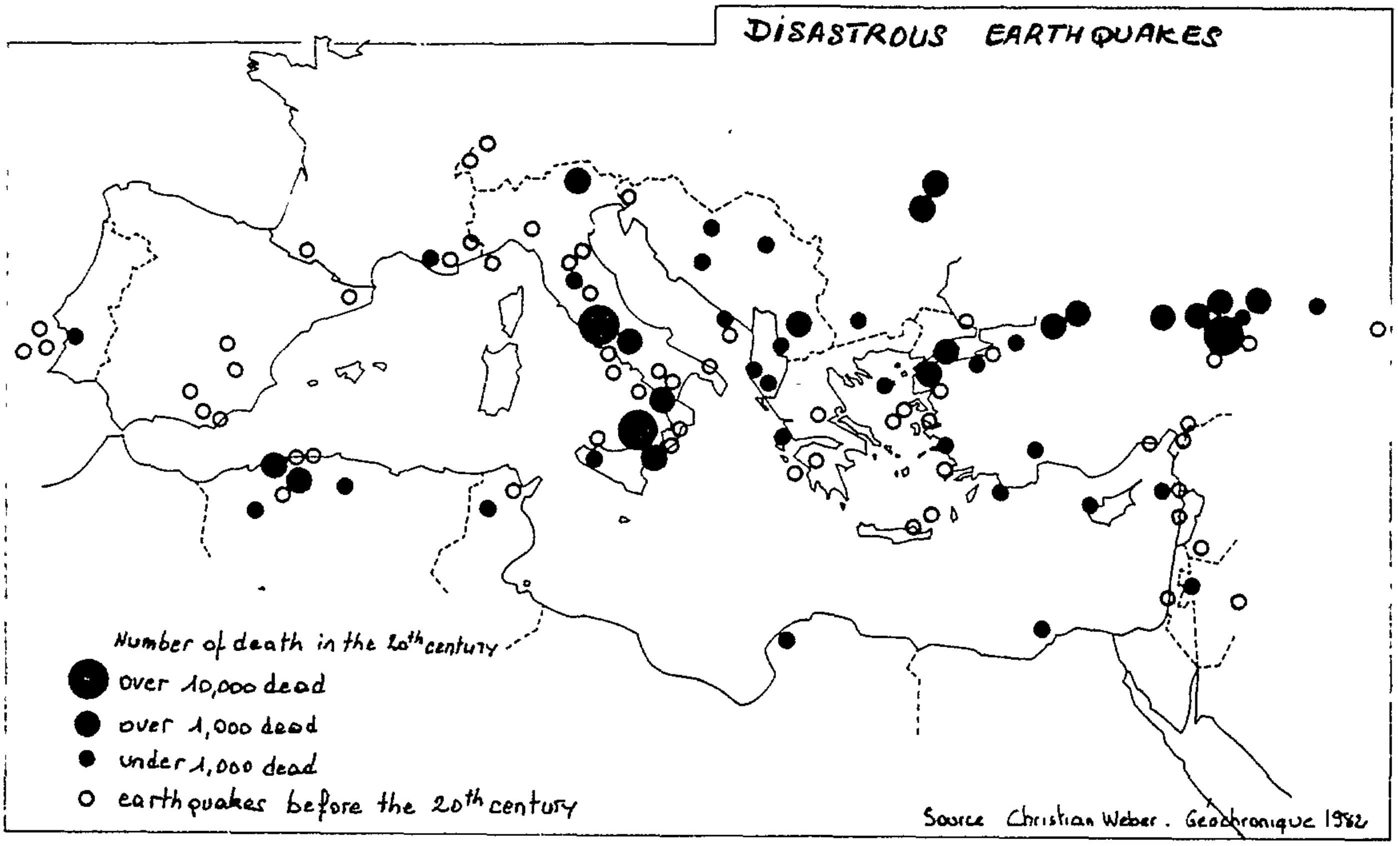
The growing artificiality of our world, the ever-increasing liberty taken as regards obstacles to physical geography, the upheaval in transport and communication, cannot efface a basic fact : the Mediterranean basin is a region with a complex and fragmented relief. It lies at the centre of a very complicated patchwork formed by the tectonic plates of the earth's crust sliding under one other, and is marked by the larg Tertiary alpine fold, with here and there some later alterations due to glaciers, volcanic phenomena, or erosion.

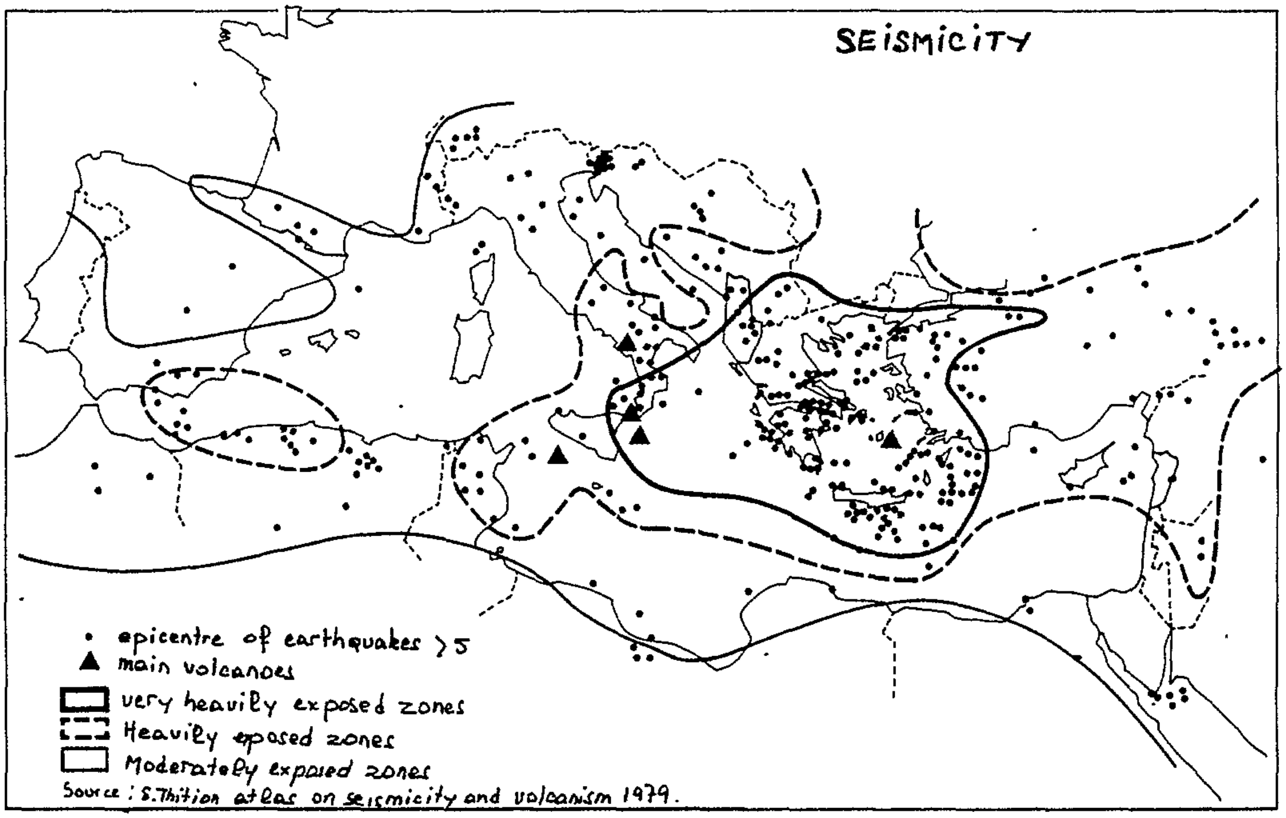
The outcome is strong seismic and volcanic activity, whose repercussions on human life and society are a permanent feature of the region, but which cannot be taken into account directly in the different scenarios because of its random nature. The Mediterranean Sea itself, from Gibraltar to the Dardanelles, is in turn broken up into a "complex" of smaller seas, each with individual features, different biocenoses, and very deep trenches.

The consequences of the young relief and the close contact between the sea and the mountains, are important ; for example, there are few large plains, little good agricultural land, few broad river basins, and ports and harbours are closely hemmed in between sea and rock.

Aside from the south-east and some 3,000 kilometres along the Libyan and Egyptian coasts where the Saharan platform directly meets the sea, mountains

The Mediterranean mountains -somewhat removed from the activity of the cities and lowlands, for centuries often self-sufficient units forced to diversify output even if the soil or climate were not particularly suitable, optimizing their modest resources through hard and endless work- have played a very important role in the


DISASTROUS EARTHQUAKES
Number of death in the 20th century
over 10,000 dead
over 1,000 dead
under 1,000 dead
earthquakes before the 20th century
Source Christian Weber. Geochronique 1982


SEISMICITY
epicentre of earthquakes > 5
main volcanoes
very heavily exposed zones
Heavily exposed zones
Moderately exposed zones
Source: S.Thition atlas on seismicity and volcanism 1979.

past and will continue to do so. For the mountains receive the largest amount of rainfall, which plenishes the watercourses. In the mountains, the forest and vegetation must hold down the soil and stabilize the Mediterranean water cycle, by nature very uneven. Traditionally, the mountains were abandoned by the surplus population they could not support. Because mountain resources, although varied, are not plentiful and cannot bear overexploitation. Already the terraces, so typical of the Mediterranean countryside, are being abandoned, and are not suited to modern tools. Man finds little reward for his labour there, resulting in degradation of landscapes, erosion, fires and desertification.

Lying between the high mountains and the plains are the plateaux : the high Algerian plateaux, Emilia and Apulia in Italy, etc., and the hilly, but scarce, regions soon inhabited by man : Languedoc, Provence, Tuscany, Sicily, Greece, and the Maghreb with, the Algerian and Tunisian Sahel.

The plains are very different, usually small. Those with a reduced surface area were easier to develop ; the larger ones were harder to master, an event which sometimes occurred only recently, in areas such as the Mitidja near Algiers at the beginning of the century, the plain of the Salonica around 1925, and the Ebro delta or the Pontine Marshes on the eve of the Second World War. Mastery of these few large plains required long and drawn-out efforts (often made by governments, always highly capitalistic), with repercussions on forms of ownership and water control.

The struggle to transform stagnant water into irrigation water and convert insalubrious (malarial) plains into high-yield land has been very hard for Mediterranean people, and one of the outstanding features of its rural history (comparable to northern Europe's mastery of its border forest regions). These improvements, in which Arab civilization and techniques played an essential role, were often a response to the growing needs of nearby cities (Cairo, Rome, Tunis, Algiers, etc.). Nowadays, because of their all-consuming urbanization, these cities tend in turn to invade the same plains they had won to feed themselves, simultaneously appropriating the water traditionally used for agriculture.

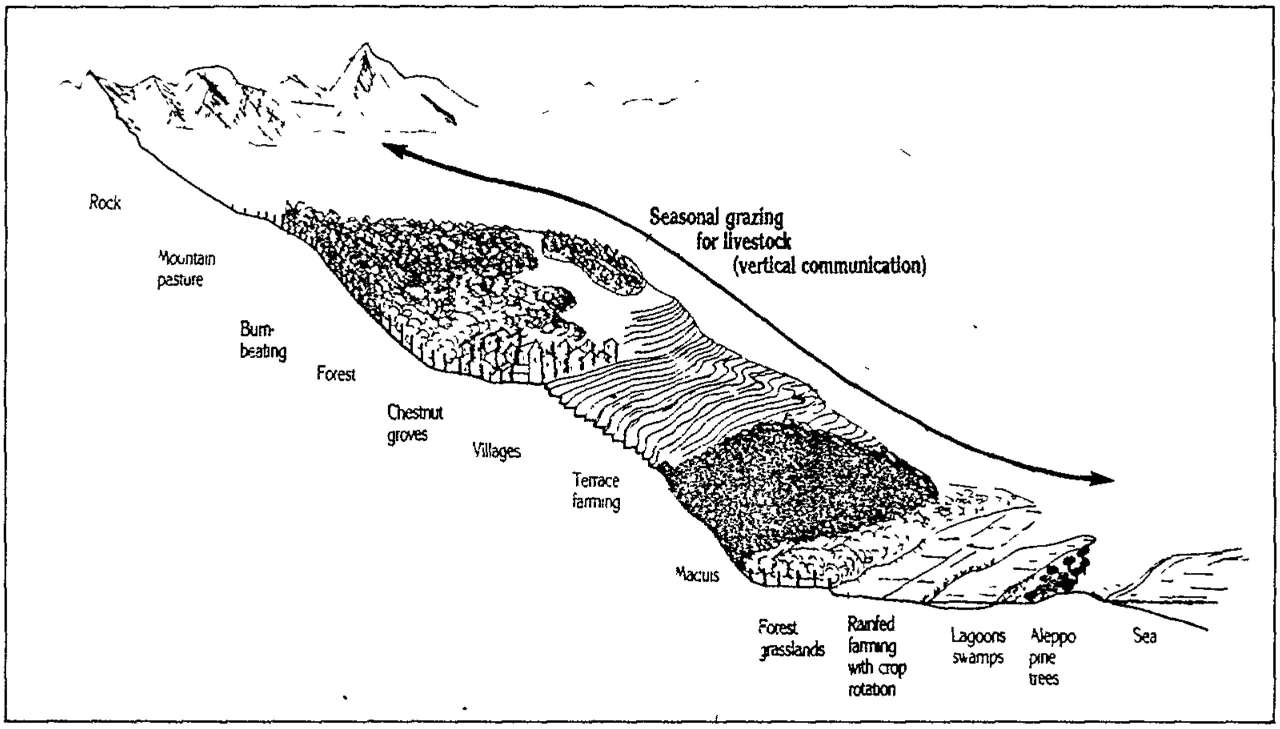
There are many islands in the Mediterranean, sometimes grouped together in families or archipelagos. Their environment is fragile, their resources are never abundant and water is often scarce. Unable to live off their own resources they were obliged to open up to the outside world and look for economic or strategic "niches".

Apart from the coastal or delta plains, the Mediterranean coast, one of the main subjects in this report, is often very compartmentalized because of the relief. Its 46,000 Km of shore are often broken up by the mountains falling abruptly into the sea (the Balearic coast, the creeks in Provence or the Adriatic canali) and the virtually adjoining "rivieras" Liguria, Provence, Catalonia, Valencia and Andalusia), subject to the strongest human pressure.

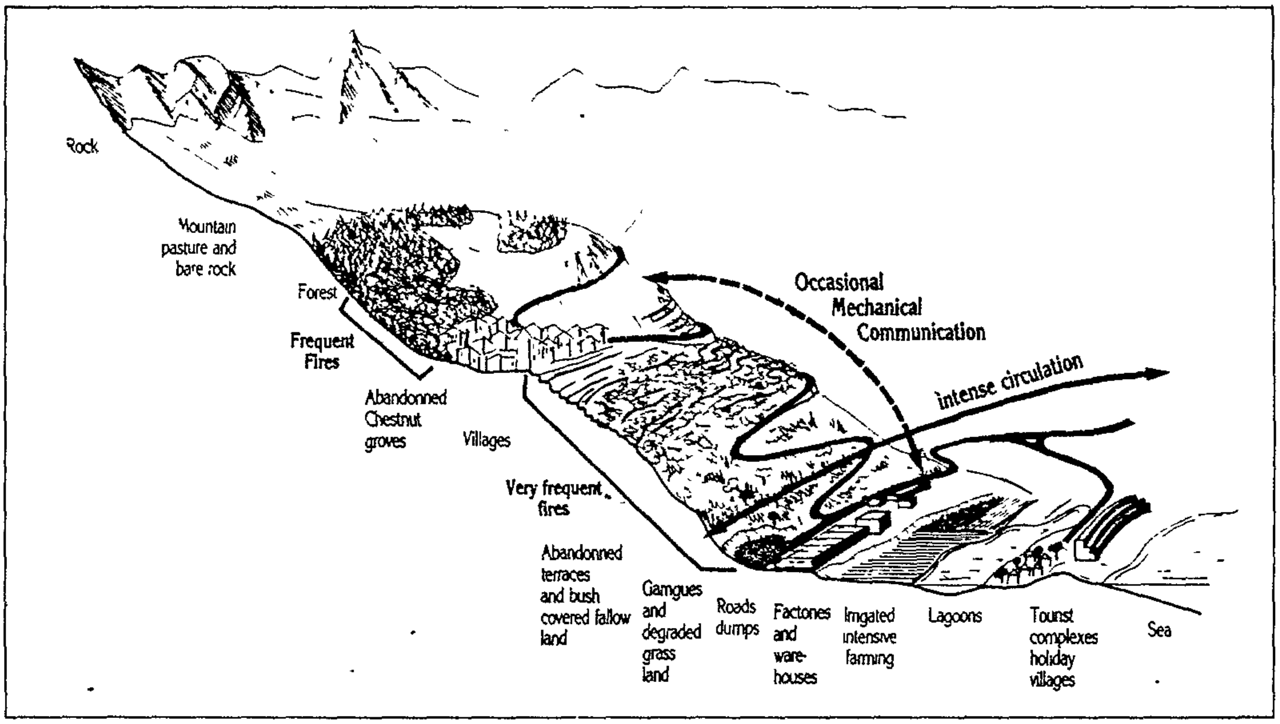
The traditional maritime provinces usually backed onto wooded mountains, which in the past they stripped to a large extent for housing or naval construction.

Finally, the four major river deltas -Rhone, Ebro, Po and Nile- and the narrower deltas (Medjerda, Axois, Aliakmon, Calamas, Acheron, Ceyhan, etc.) are unstable areas, which have changed greatly in the course of history. They are very sensitive to variations in the sea level, with rapidly alternating periods of erosion and sedimentation, reflected by advancing or retreating shorelines.

A TRADITIONAL MEDITERRANEAN SLOPE



A MEDITERRANEAN SLOPE IN 1983



Although in this study the relief is considered as permanent feature, this naturally does not imply that it is impervious to change, either abrupt from seismic movements, eruptions or landslides, or from human activity. In fact man has become a particularly active geological agent in the Mediterranean. His buildings, works, and domestic animals all contribute actively to deforestation and subsequent soil erosion. He can construct virtually anywhere ; the barrier to traffic long posed by the Mediterranean relief is now overcome. Motorways cross the mountain chains and coastal valleys through tunnels and bridges, as in the Genoa area. In three years time, Sicily will no longer be an island, and a project exists to link Africa to Europé via Gibraltar.

II. THE MEDITERRANEAN CLIMATE

The climate is another fairly permanent feature of the Mediterranean environment as regards the scenarios. It is so typical, with its associated plant life, that geographers made it a specific type, identifiable on other continents (in California, Chile, Australia and South Africa). It is distinguished by hot, dry summers and mild, damp winters. In the Mediterranean basin, this climate produces interactions between the desert zone in south and the Atlantic Ocean in the west, i.e. between outside influences. Rainfall is distinctly irregular during the year and from one year to the next, especially in the south, where there is no assurance of rainfed crops are not assured.

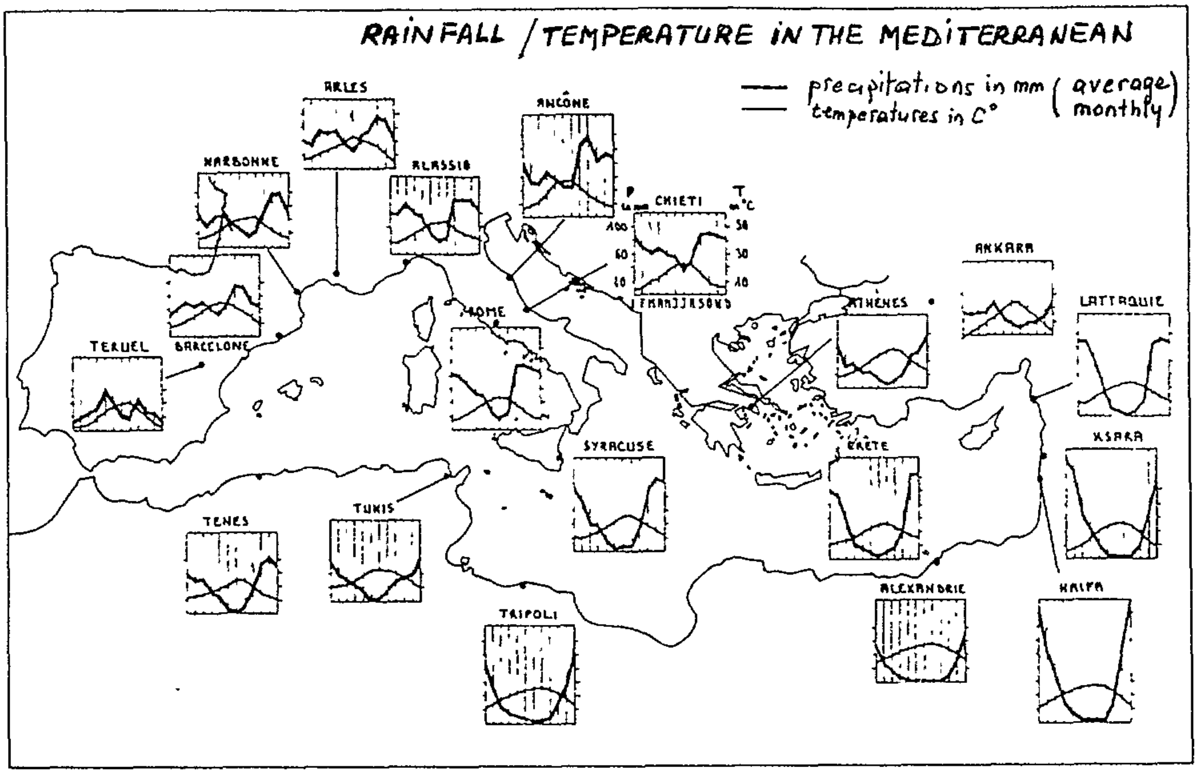
Rainfall may be violent, likely to produce huge flash floods in a few hours, which are often disastrous, tearing up and carrying away precious top soil. In 1981, in Larnaka (Cyprus), for example, 192 millimetres of rain fell in four hours, and the loss of soil from erosion was 25 times higher than during the whole previous year.

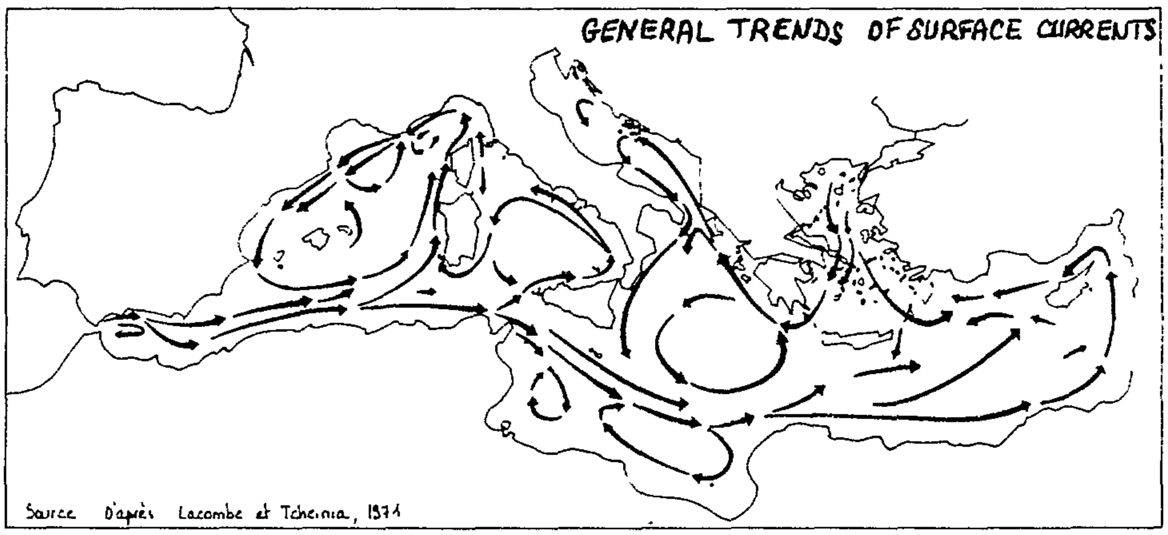
Since ancient times, constant and patient work was needed not only to avoid the accumulation of stagnant water in the low plains but to make it useful for farming : the planning and development of water and soil have to go together.

Even if the Mediterranean climate is a basically consistent, closer analysis reveals significant differences. The rainfall-temperature charts (Figure 2) indicate the contrast between the north of the basin (autumn rain) and the south (winter rain). In summer, the concurrence of the highest temperatures and the lowest rainfall causes strong evapotranspiration in plants.

Climate is not an absolute constant and evolves slowly over time. Between 10 000 and 12 000 years ago, the Sahara was covered with grassland ; the Tassili paintings prove it. On the shorter scale of human experience, there have been less marked variations towards drier or wetter weather. A few years' drought can have a destabilizing effect on farming societies, their output and food, especially in marginal areas such as the southern edge of the Mediterranean basin. In Africa, the Sahélian countries have been suffering a series of droughts for some fifteen years, and a random phenomenon of this kind cannot be excluded in the Mediterranean basin.

But most important of all, a prospective study has to mention the possible trend of the world climate towards heating up, due to the "greenhouse effect" caused by the accumulation of carbon dioxide and other gases in the atmosphere. This trend will not fail to have repercussions on the Mediterranean climate, which could occur as soon as during the next forty to fifty years. It is generally recognized that the region will


RAINFALL / TEMPERATURE IN THE MEDITERRANEAN
— precipitations in mm (average
— temperatures in C° monthly)
ARLES
ANCÔNE
NARBONNE
ALASSIO
CHIETI
ANKARA
ATHENES
LATTAQUIE
TERUEL
BARCELONE
ROME
SYRACUSE
CRETE
KSARA
TENES
TUNIS
ALEXANDRIE
HAIFA
TRIPOLI


GENERAL TRENDS OF SURFACE CURRENTS
Source D'après Lacombe et Tchernia, 1971

experience a shift of cyclonic systems towards the north, which will affect its central and western areas in winter. In these areas rainfall would continue to depend heavily on relief and would be higher in the north, but conversely areas of uncertain rainfall in the south could spread and evapotranspiration would rise everywhere. It goes without saying that a change of this kind would have serious consequences, notably for agriculture. Ensueing changes in the thermal structure of water bodies, could also produce modifications in marine current, which in turn would affect air currents .

Moreover, it is recognized that the expected heating up of the climate will bring about a general rise in the sea level. Historically speaking, Mediterranean shores have been unstable because of variations in the sea level or localized tectonic movements, and there are records of submersions or emergences that occurred over past millenia. The general trend since the end of the glacial periods has been a rise in the sea level, amounting to approximately 1.3 mm per year during the past century.

Whatever the case may be, it is currently estimated at an average increase in sea level from 15 to 40 cm is to be expected by 2025. In current MAP work it is estimated that a rise not exceeding 30 cm could be controlled to a great extent by protection works, but that a higher rise would certainly have very serious consequences, especially in the Egyptian and other deltas, and in inhabited lagoons such as Venice.

Whether it is a matter of climatic variations such as drought or the permanent changes mentioned above, their development is still too uncertain for them to be usefully incorporated as such into the scenarios. Nevertheless, they remain present throughout the exercise in the form of "hazards".

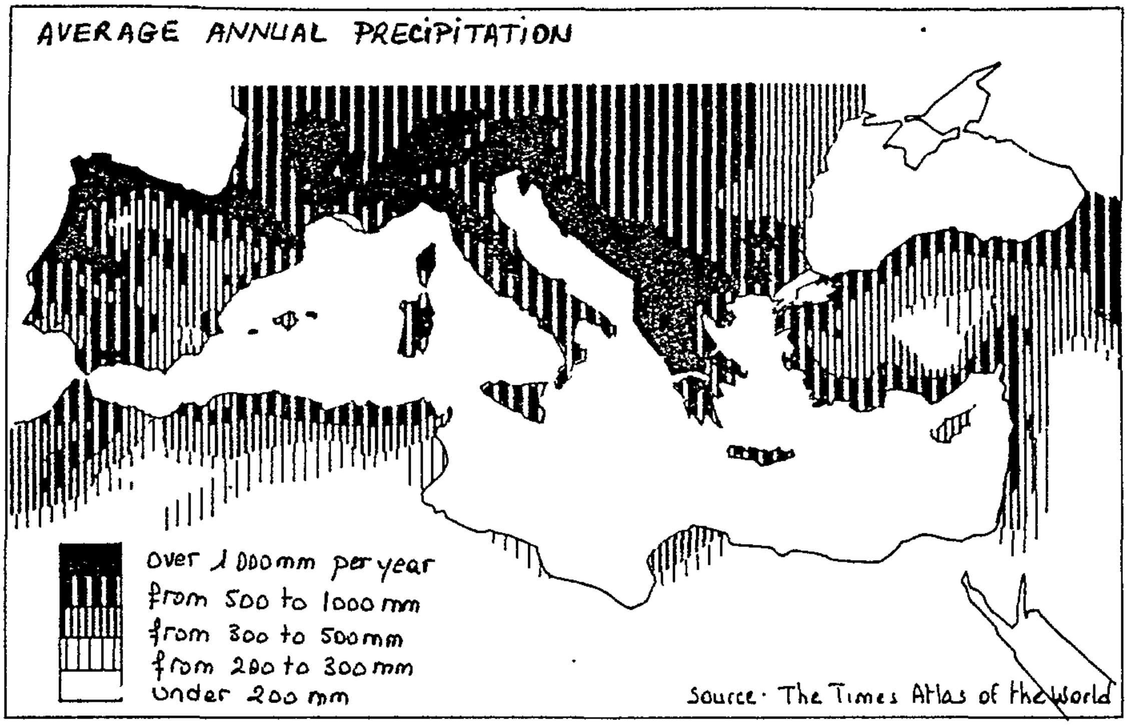
In a different connection, the climate may be changed, in limited areas, by the appearance of micro-climates. Thus urban climates are modified by gas emissions (domestic heating, automobile transport, industry), which cause the climate to heat up locally and change the distribution of rainfall in time and space.

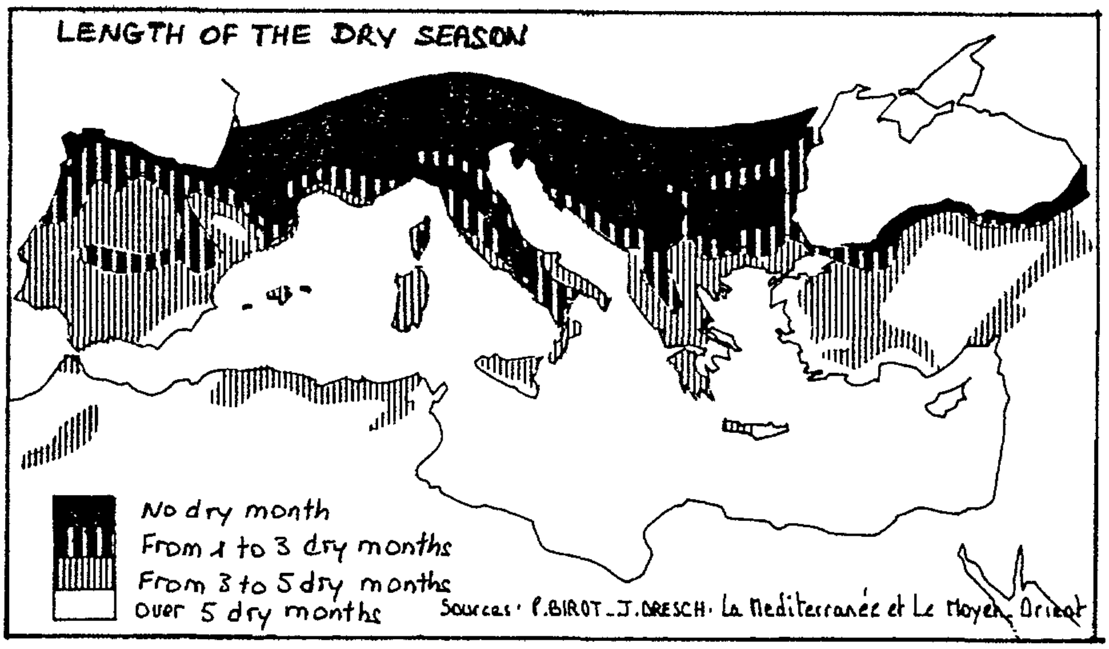
The concentration of air pollutants (NOx, SOx, CO, particulate matter, black smoke, etc.) in urban areas varies very widely, reflecting (at their highest level) specific, meteorological conditions that cumulate at emission points, related, for instance to traffic.

Generally speaking, maximum values are recorded in the Mediterranean under conditions of thermal inversion which often occur in summer : a mass of warm air, that cannot rise because it is blocked by a mass of stable cold air, lies over the city where the pollutants emitted concentrate. The effects of a rise in concentration levels do not involve only urban centres : under the effect of daily cycles (air exchanges at the end of the day when temperatures drop), pollutants in the atmosphere spread over surrounding areas (surburbs) where they contaminate the night air.

If the lack of rising air movement continues, the concentration of gases and particulate matter over the active city is such that all traffic has to be banned (Rome, 1986) as the health of the population may be at risk (combined with intense heat, Athens 1987).

Current knowledge about "environmental meteorology" is still very inadequate, and the Blue Plan can only stress the potential gravity of the occurrences according to the different scenarios.


AVERAGE ANNUAL PRECIPITATION
over 1 000mm per year
from 500 to 1000 mm
from 300 to 500mm
from 200 to 300mm
under 200 mm
Source · The Times Atlas of the World


LENGTH OF THE DRY SEASON
No dry month
From 1 to 3 dry months
From 3 to 5 dry months
over 5 dry months
Sources · P.BIROT - J.DRESCH · La Mediterranée et Le Moyen Orient

III. ECOSYSTEMS - WILDLIFE AND PLANT LIFE

The natural ecosystems of the Mediterranean basin are one of the permanent features of the region, even if human action has radically changed them over the centuries, causing their degradation or increasing artificiality.

Soil in the basin is usually Mediterranean ferruginous soil ("Terra Rossa", which originated primarily from climatic conditions : summer drought (iron oxide precipitation) and cold-season rain (decarbonation and leaching). Vegetation, particularly the former forest cover, affects the quality of the humus (evolved Mull type humus).

The alluvial plains and (or) coastal valleys and also the plateaux contain calcareous clay soil which is extremely fertile when rainfall is sufficient or irrigation possible. Azonic desert soil is also present in the south of the basin. Finally rendzinas on soft carbonated parent rock are found throughout the basin.

Unfortunately Mediterranean soils are sensitive to physical and chemical degradation, the climatic conditions specific to the region. As a result of their fragility with respect to the considerable degree of water erosion that has built up since remote antiquity, terrace farming has developed throughout the basin, wherever the relief is sharply uneven. Wind erosion is active in the southern and eastern part of the biogeographic region and causes the spread of desertification on sometimes overexploited marginal land. Finally, in the areas of the basin with a semi-arid climate, salinization, alkalization and the waterlogging of poorly drained irrigated districts cause soil infertility.

Thus Mediterranean soils are a resource whose trends will be examined in the scenarios in the light of demands made on them and the conservation measures taken. But from the outset these soils have certain permanent features which make them highly fragile.

The Mediterranean basin is one of the most original biogeographic regions in the world. Wildlife and plant life have distinct features as regards both their composition and associations.

Mediterranean plant life, with a wealth of some 25,000 species, is all the more remarkable since more than half of these are endemic (i.e. specific to the region). A number of plant associations and their accompanying wildlife are relicts, i.e. represent what remains of periods when ecological or climatic conditions were more favourable. Endemic or relict plant species are all the more sensitive to degration because once they have disappeared they cannot regenerate in the present climatic and geographic context, which did not exist when they first appeared.

The Mediterranean forest, typified especially by evergreen trees such as the holm oak (Quercus ilex) and cork oak (Quercus suber) (considerably fire resistant, which partly explains why they have spread), forms a transition belt. Going towards temperate environments (in latitude, altitude and inland location) deciduous trees mix with the holm oak. Towards low latitudes, green oaks are replaced by trees more resistant to drought (thuya) and cold at altitude (conifers, including three species of cedar).

This sclerophyllous forest, as well as the evergreen maquis or garrigue, does not exclude large pine-covered areas (Pinus halepensis or Pinus nigra).

THE BOTANICAL CONSERVATORY AT PORQUEROLLES AND THREATENED PLANT SPECIES

The aggressions of all kinds suffered by Mediterranean environments may have even more serious consequences on the impoverishment of genetic material in the Mediterranean basin, since the combined action of biogeographical climatic factors in this region has contributed to the creation or survival of specific plant species and communities which exist nowhere else.

According to a recent survey carried out by the Porquerolles Botanical Conservatory on the French Mediterranean region, at least 526 taxons (species, subspecies, and varieties) are threatened to varying degrees. Among them :

- 83 have regressed slightly over their natural area as a whole, and should be monitored ;
- 298 are at serious risk, as many populations have disappeared ;
- 137 are at the edge of extinction ;
- 85 have irrevocably disappeared from the French mainland Mediterranean region over the past 20 years. To this figure should be added some 30 species which have disappeared since the beginning of the century.

Furthermore, these threatened species, already numerous, are also scattered. Too often their natural area is confined to three or four sites covering barely ten square metres or so. Conventional administrative protection measures are often inapplicable or not applied. Faced with virtual powerlessness to control the factors causing species to regress, the idea came quite naturally to set up establishments called "gene banks" or "conservatories", which group together disappearing species and varieties.

However, considering the risk of genetic drift which can affect small populations, these establishments are only a contribution and cannot substitute for natural sites. The protection of natural sites is therefore vital and can only be envisaged with the support of all public or private bodies responsible for the management of natural areas.

Changes in plant life derived mainly from interactions between environments and species on the one hand, and human activities and needs on the other, rather than from climatic evolution over millenia.

Thus many plants were introduced into the Mediterranean during recent centuries, an area suited by its climate to tree crops. Some species are suited for human consumption (olive, fig, grenadine, orange, tomatoe, aubergine, maize, etc.), others to industry (eucalyptus, accacia, etc.), others to landscaping (bougainvillier, palm, etc.). These species, which originated in other parts of the world, have now become so well-adapted to the region it is easily forgotten that they were initially foreign to it.

In this way primary vegetation virtually everywhere has been replaced by regressive formations and secondary landscapes. The ecosystems of the region (both coastal and inland), which shelter animal populations and varied associated plant life whose survival depends on the stability of bio-topes, are particularly threatened (drainage or introduction of fish in wetlands, destruction of the maquis, fires or forest overexploitation, effects of pesticides and fertilizers, etc.).

A number of animal species have suffered from this development to the point of extinction or are in a critical situation : this is the case notably of certain anatidae, of large forest mammals such as the bear, lynx or some antilopes, the monk seal or large birds of prey (eagles, vultures). Excessive hunting has greatly contributed to the disappearance of birdlife throughout the Mediterranean region.

At the same time it is important to stress the very rich variety of hardy cultivated plants and domestic animals previously existing throughout the basin (bovine, ovine and even porcine species, cereals, alfa grass, fruit trees), at present very likely to disappear.

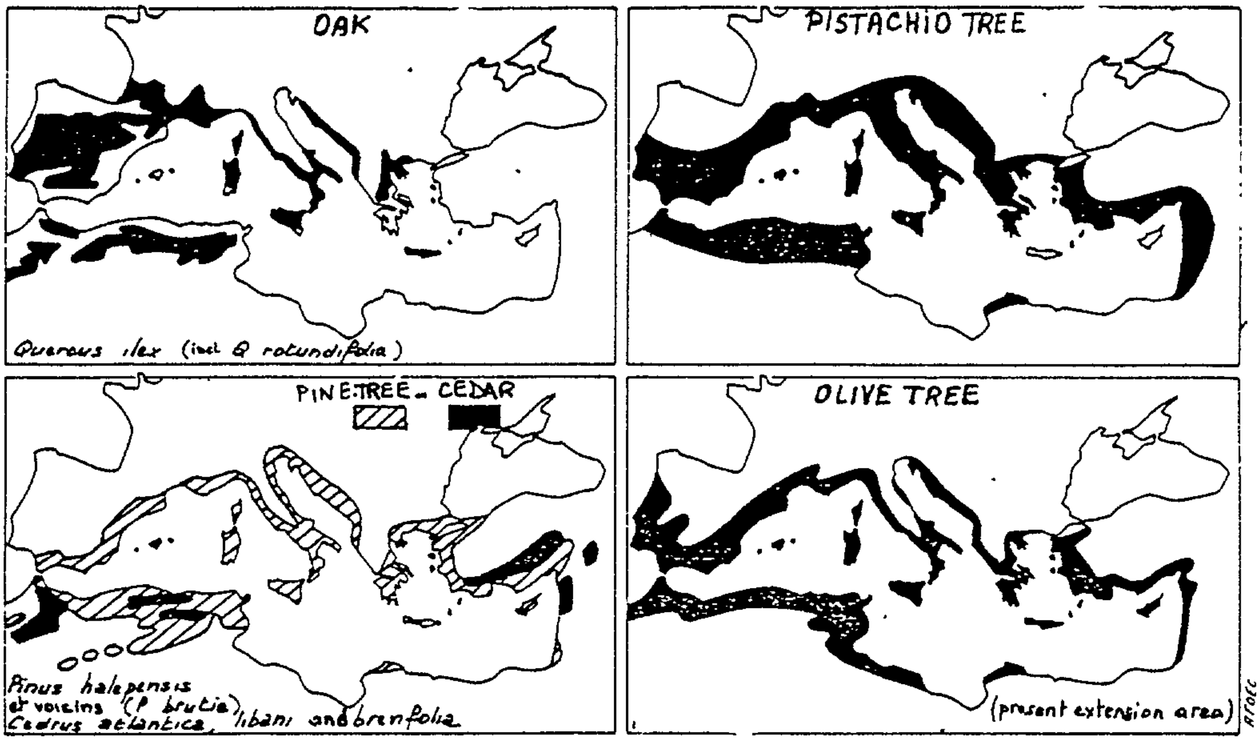
The Mediterranean marine fauna is very varied from the point of view of species (some 900 different species of fish), but it is not very plentiful. This is due to the fact that, on the one hand Mediterranean basin structures are very diverse (rocky or alluvial coasts, broad or very narrow continental shelf, compartmentalized basins etc.), which changes the ecological conditions of production ; and, on the other, the productivity of Mediterranean waters is poor (low level of organic matter, considerable average depth, limited surface area of continental shelves).

In the sea too, human pressures threaten some species such as the grouper or the swordfish, and especially the posidonia colonies and shallow coastal waters. Finally it should be recalled that the Mediterranean, and particularly its straits and narrow passages between the northern and southern shores, are major migration routes for land birdlife between Europe and Africa (Gilbraltar, Sardinia, Straits of Sicily, Crete, Cyprus, Dardanelles).

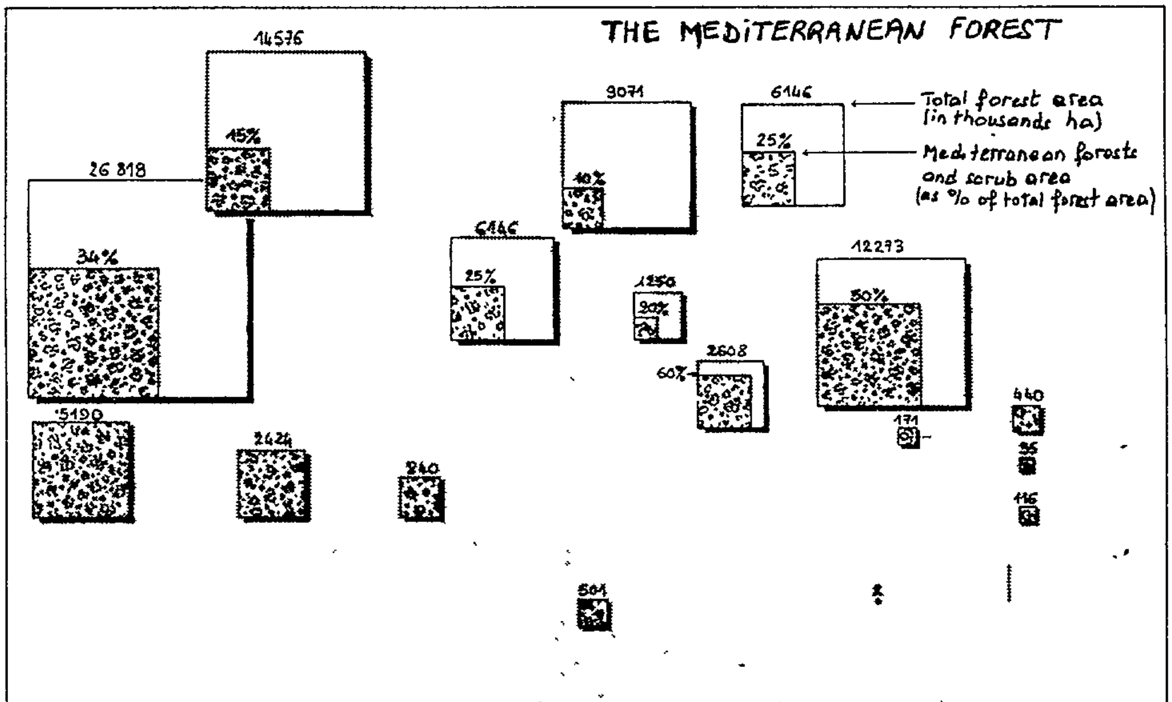
Since human activities continue to increase, the fragility of the environments (the underlying factor in their degradation or disappearance) may in 40 years' time lead to appreciable, even radical, changes, which should be taken into account when assessing the findings of the scenarios concerning these activities.

However, on the scale of the next 50 years, it can generally be considered that the composition of Mediterranean wildlife and plant life will evolve slowly even if there is an increase in the disappearance of species or the introduction of new ones.

An attempt will be made however in the scenarios to assess possible trends for soil erosion and forest cover.



Sources Société Botanique Française (1984), Plantes et Fleurs méditerranéennes (Nathan); P. Quézel (1985).



Sources L. Le HOUEROU, L'impact de l'homme et de ses animaux sur la forêt méditerranéenne (Forêt méditerranéenne, T II, 1980)
P. QUEZEL, Définition de la region méditerranéenne et origine de sa flore (Conservation des plantes dans l'aire méditerranéenne, Dordrecht 1985)

IV. SOCIO-CULTURAL DATA

Without attempting to define a "Mediterranean identity," about which much has been written, certain socio-cultural features can be pinpointed which are common to or largely shared by the populations of the coastal regions, despite significant differences deriving from their history, language, or religion. Thus, for thousands of years, from their origins to the contemporary period, Mediterranean civilizations have establish themselves in a number of urban sites. A true network of towns and villages was formed very early on and as Fernand Braudel noted, Mediterranean spatial organization centered around the town and the town gives it life. The current network, aside from a few exceptions, is the direct inheritance of 2000 to 3000 years ago, in particular the Roman empire. Mediterranean towns, all very old, bear the traces of successive civilizations, but the mark of history is still visible in their layout, sites or stones.

The inheritance of each period is reflected in the urban landscape by layers of new constructions on top of older ones, or by an expansion which for some towns did not extend beyond Mediaeval fortifications until the late eighteenth century.

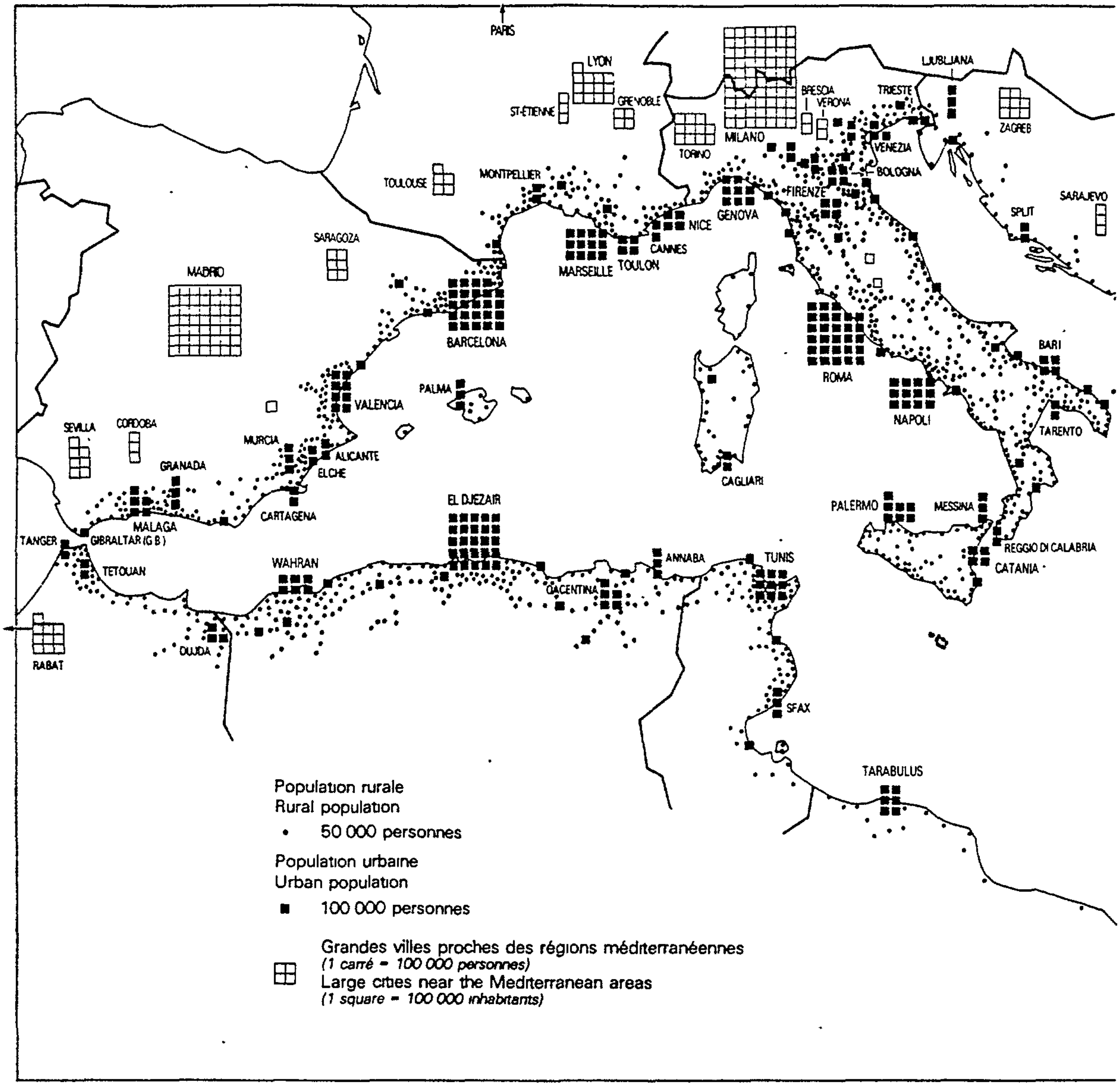
Towns grew through the increasing number of dwellings on the spot, reaching a huge residential density. Densities are higher in the Islamic towns south and east of the basin, and in the urban centres inherited directly from the Middle Ages. A relative slackening of the urban fabric, usually respecting a checker board layout, took place in the eighteenth century, but the creation of new urban areas, previously quite common, became infrequent. The old towns expanded but did not change site.

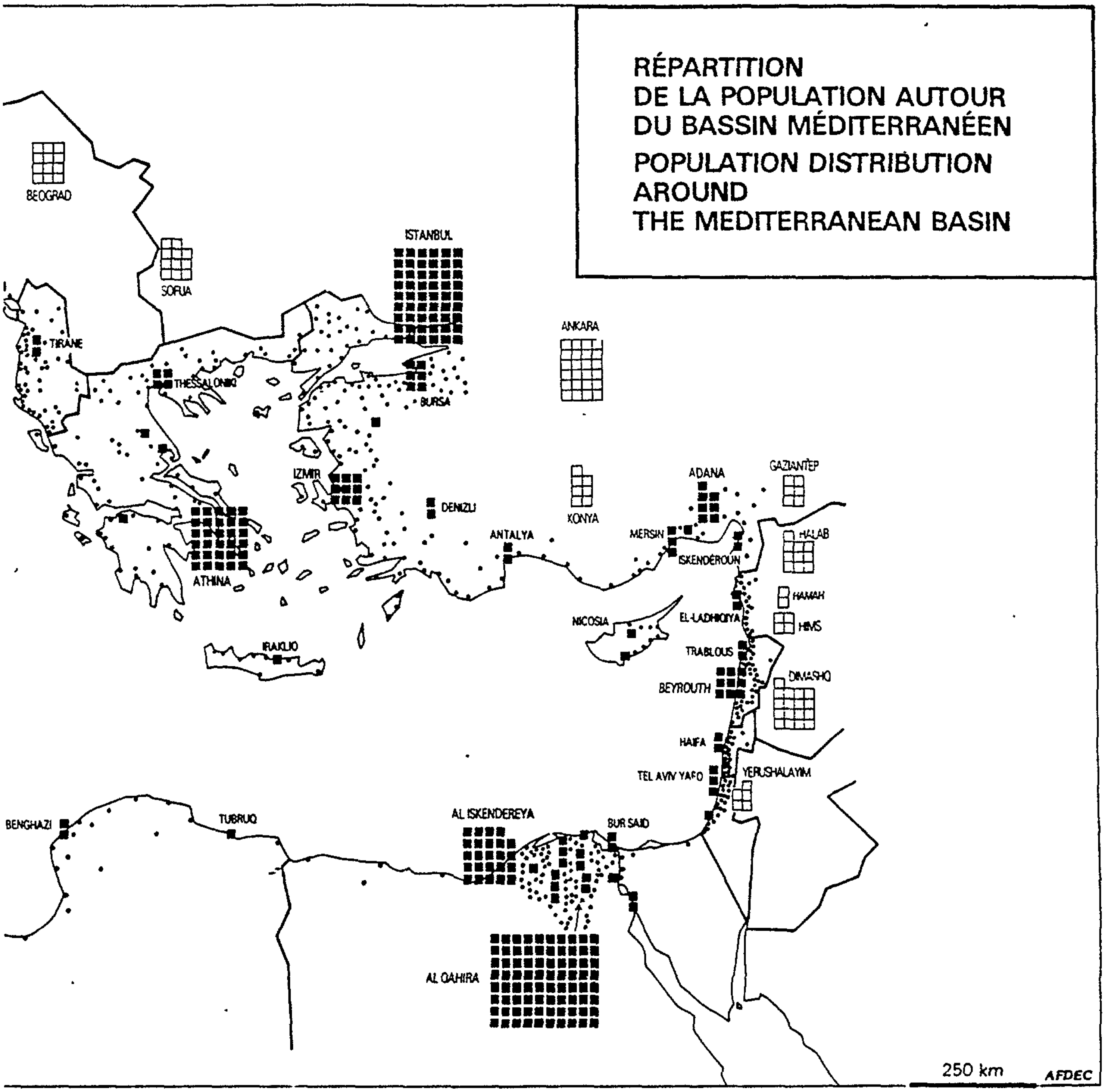
Human settlements in the Mediterranean, with their closely grouped houses, very concentrated and highly integrated, and their old districts gradually surrounded by modern areas, have specific features, despite the diversity of the civilizations they shelter. The problem of water supply continues to predominate. The town is often set in the countryside but rarely includes large green spaces. On the other hand, the traditional home is often planned around small irrigated gardens forming, as Claude Nugue observed microcosms in which forms of behaviour as regards water, plants, outside dryness and also the constructed environment are concentrated. The surface area absorbed by new buildings had only a low propensity to grow with rising incomes until quite recently when, unfortunately, there was a rapid spread, first in the north then increasingly in the south, of an American-style "peri-urbanization".

Detailed study of the dynamics of human settlements and habitat in the Mediterranean is vital, because inevitably fast urban development encounters very specific problems concerning human activities as a whole, affecting all other components of the environment.

On a twenty- to forty-year time scale however, it is considered that urbanization will develop on the basis of the existing network of urban sites, which will be taken as the basic data for land use, even if the trend toward uninterrupted spread ("oeccumenopolis" as Doxiadis termed it) is becoming increasingly strong, especially on the coast.

In addition, it is recognized that some socio-cultural data, such as the level of education or health, will evolve within the scenarios as a function of economic development and therefore cannot be considered as independent variables. Clearly the level of education is a fundamental vector -perhaps the most important


PARIS
LYON
ST-ETIENNE
GRENOBLE
MILANO
TORINO
BRESCIA
VERONA
TRIESTE
LJUBLJANA
ZAGREB
VENEZIA
BOLOGNA
TOULOUSE
MONTPELLIER
FIRENZE
GENOVA
NICE
CANNES
MARSEILLE
TOULON
SARAJEVO
SPLIT
SARAGOZA
MADRID
BARCELONA
ROMA
BARI
NAPOLI
TARENTO
PALMA
VALENCIA
SEVILLA
CORDOBA
MURCIA
ALICANTE
ELCHE
GRANADA
CARTAGENA
MALAGA
CAGLIARI
PALERMO
MESSINA
REGGIO DI CALABRIA
CATANIA
EL DJEZAIR
TANGER
GIBRALTAR (G B)
TETOUAN
WAHRAN
ANNABA
TUNIS
QACENTINA
OUJDA
RABAT
SFAX
TARABULUS
Population rurale
Rural population
50 000 personnes
Population urbaine
Urban population
100 000 personnes
Grandes villes proches des régions méditerranéennes
(1 carré = 100 000 personnes)
Large cities near the Mediterranean areas
(1 square = 100 000 inhabitants)


RÉPARTITION
DE LA POPULATION AUTOUR
DU BASSIN MÉDITERRANÉEN
POPULATION DISTRIBUTION
AROUND
THE MEDITERRANEAN BASIN
BEOGRAD
SOFIJA
ISTANBUL
TIRANE
THESSALONIKI
BURSA
ANKARA
IZMIR
DENIZLI
ATHINA
ANTALYA
KONYA
ADANA
GAZIANTEP
MERSIN
ISKENDEROUN
HALAB
HAMAH
HIMS
NICOSIA
EL-LADHIQIYA
TRABLOUS
BEYROUTH
DIMASHQ
IRAKLIO
HAIFA
TEL AVIV YAFO
YERUSHALAYIM
BENGHAZI
TUBRUQ
AL ISKENDEREYA
BUR SAID
AL QAHIRA
250 km
AFDEC

one- for both development (adaptation to change, responsibility for and mastery of technologies, spatial management, etc.) and the environment (teaching about daily life, living phenomena, functioning of systems, etc.). The same applies to the level of health, which will be taken into consideration especially because of its impact on population parameters, without being the subject of specialized prospective studies in the scenarios.

In the final analysis, in the Mediterranean as elsewhere, the evolution of interrelations between people and their environment will largely depend on their perception of the environment, and their behaviour towards it and towards the natural resources on which they depend.

The future depends to a large extent on the awareness of the population and officials of the importance of environmental problems, their poorly known relationships with types of development, the urgency of finding solutions for them, and of the continuity essential to all effort.

Changes in attitudes and behaviour have necessarily been taken into account in the Blue Plan prospective study, but mainly at the level of the major types of hypotheses forming part of the scenario construction. However, these variations can scarcely be quantified. At the same time it can be considered that a "common stock" of behaviour exists in the Mediterranean, with deep cultural or religious roots. These attitudes are usually related to realities and permanent features of the environment and they underlie basic economic traditions. Thus agriculture and farming practices have over the centuries made sparing use of land, soil, water, and the countryside. Land-tenure patterns differ from one country to another, but have common features. Food consumption depends on age-old traditions, always tinged with frugality. Attitudes as regards nature reflect the very old "anthropization" of nature, which Mediterranean people over the centuries have endeavoured to tame rather than to protect.

The contemporary cultural environment is destabilized by the massive intrusion of a rootless urban life style and the arrival of the communication and consumer society, either through the influence of tourists or the viewing of foreign audiovisual productions. The media carry issues which are virtually groundless in the local environment. They bombard local populations with references and models more related to the industrialized West than to the Mediterranean reality. A huge task of active instruction is required so that in the future adults and young people will understand the issues, risks, and also the renewal patterns which still provide the Mediterranean world with its values and individuality, even if new kinds of collective behaviour are added to the unchanging ones of the past.

Thus the major factors of the physical and human geographical context described above were not considered as variables in the Blue Plan scenarios. They evolve slowly compared to the series of changes the Mediterranean environment is undergoing, which will be highlighted in particular. However, there can be no question of underestimating the importance of these special characteristics and permanent features. On the contrary, they are considerable constraints which provide the framework for the various possible kinds of development. Among them, socio-cultural factors, attitudes, habits, and collective or individual behaviour are also levers and vectors which should enable Mediterranean populations to forge a future aimed at lasting development, attentive to the environment.

CHAPTER I.2

TIME SCALES AND GEOGRAPHICAL DELIMITATIONS

I. TIME SCALES AND SPANS

The prospective study focuses on what could be the future in a given period. The choice of this period depends on the speed of the changes studied. Even if at present the rate of change everywhere tends to accelerate, that of economic, social, human and environmental transformation varies greatly depending on the factors involved. The time spans chosen as "horizons" for the Blue Plan scenarios must be able to absorb the different lengths of change in a coherent fashion.

As regards the environment, it takes several hundred years to renew a forest, several decades to eliminate the most common forms of pollution from the soil or water, and only a few years to destroy a landscape with concrete. By 2025 the water of Mediterranean rivers would have been renewed one thousand times, that of lakes and shallow groundwater, one to a few dozen times, whereas the water of deep aquifers and glaciers will remain virtually unchanged. The abrupt nature of some disastrous phenomena should not disguise the deep truth, namely that most environmental features, with their linkages and cumulative mechanisms, evolve slowly, often insidiously, and that action intended to counteract degradation requires a considerable amount of time.

Thus soil erosion can be spectacular after a torrential storm, but more often it is a barely perceptible phenomena : two to three millimetres a year ; but in the twenty years between 1980 and 2000, this amounts to five centimetres of fertile soil lost, by 2025, more than ten centimetres. This is a substantial amount for thin soil layers and could, moreover, be multiplied by a factor of four for soil on slopes. At the same time, any effort to protect or rehabilitate soil will require continuous work over a very long period.

The case is similar for development. The "state" of the year 2000 is already determined by decisions adopted investments allocated, and regulations enacted over the past few years. But the range of possibilities opens broadly for a farther horizon and very divergent trends, fraught with consequence for many Mediterranean countries, can be envisaged for 2025. One example, among others, may be taken from the energy sector. It is likely that between 2000 and 2025, the oil-producing Mediterranean countries will have to stop their exports -source of foreign currency and investment for development- or even become importers following the depletion of their reserves and the increase in their domestic consumption.

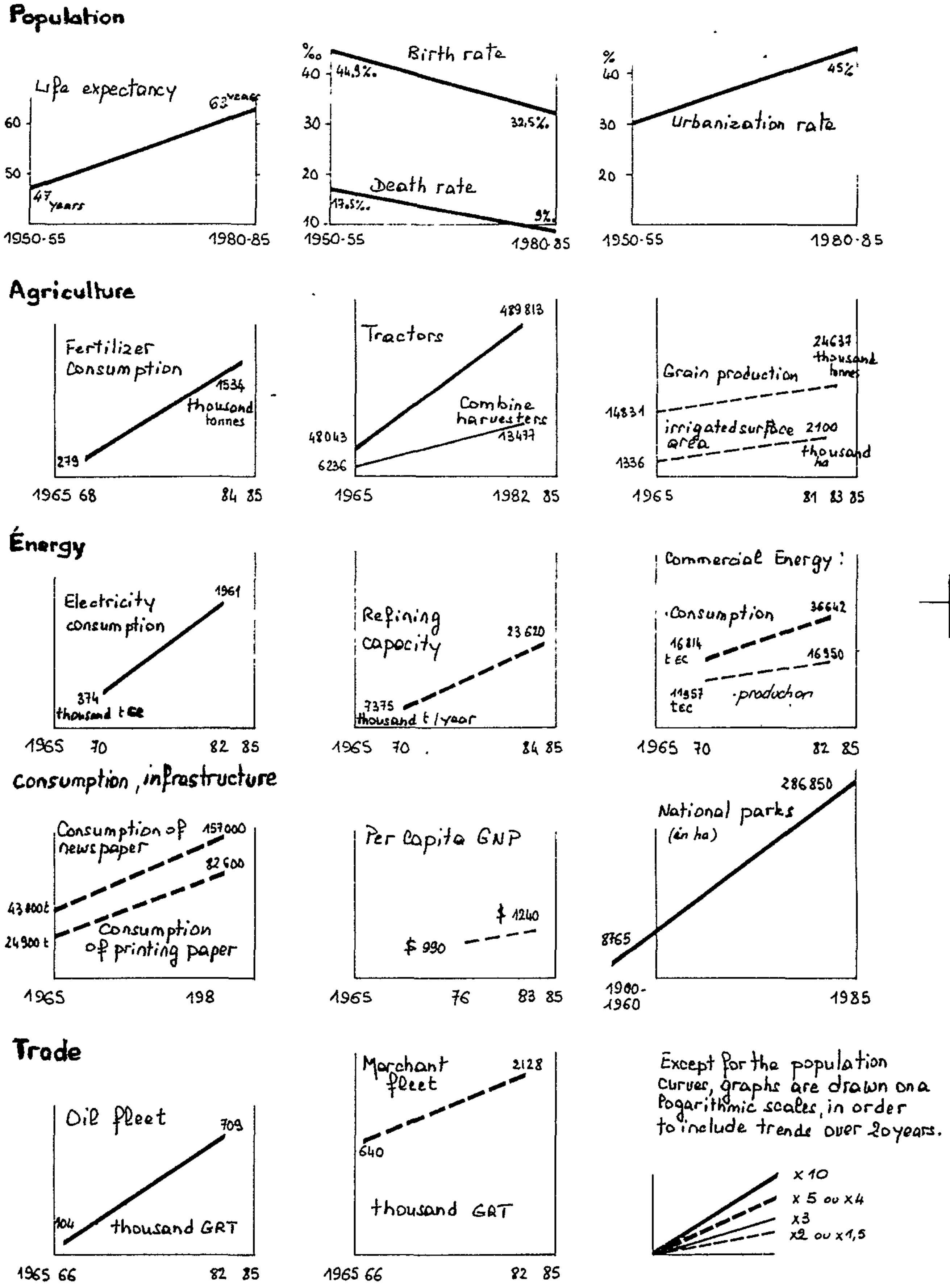
Technological evolution also requires time. The potential of production techniques and consumption structures for change -even transformation- is both considerable and unpredictable. The introduction of modern techniques for irrigation, the selection of high yield plant varieties or natural gas liquefaction illustrate this time dimension. What will happen in a few decades, with the use of biotechnology in agriculture, the spread of information technology, and the transformation of communication methods ?

An overly short-term view conceals these issues, and obscures the need to prepare now for the major choices to be made in the future.

Finally, trends in the social and cultural domains follow hidden paths, influenced by both the "long term" and fads. Attitudes and habits hold back the necessary transformation of perceptions and behaviour. Education and awareness-heightening require long-term action.

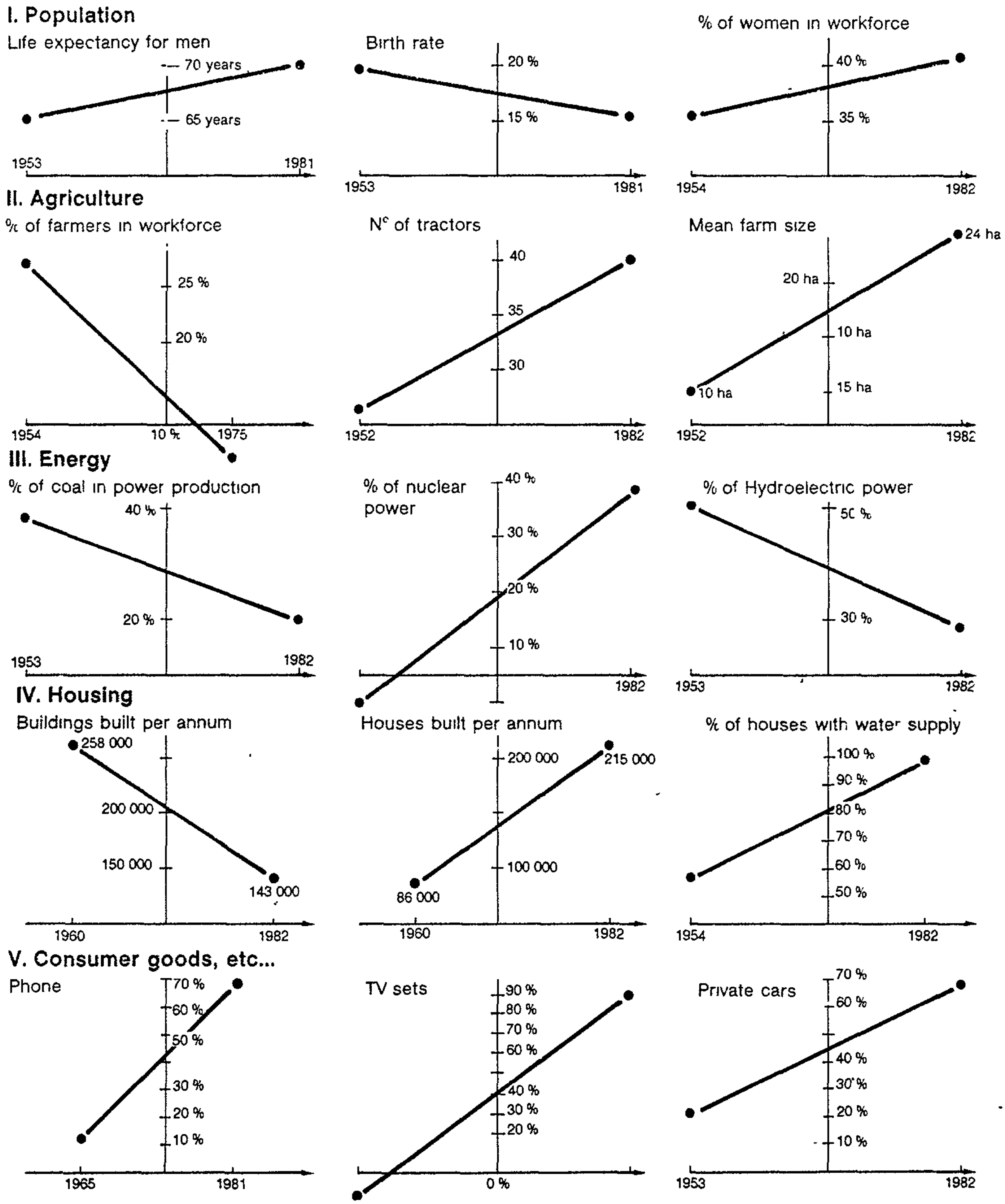
THINGS MAY CHANGE RADICALLY IN 20 TO 30 YEARS :

THE CASE OF TURKEY



Source : Blue Plan

THE CASE OF FRANCE



SOME TIME SCALES

"Renewal" of the Mediterranean Sea : around 80 years

The water flow in the Mediterranean is very complex, in addittion, the structure of the sea bed makes the basin a trap for sediment ; the total volume of the sea is about 3,754,000 cubic kilometres. The annual input from rivers and precipitation is low compared to the inflows and outflows through the strait of Gibraltar which bring about "a renewal" over a period of some 80 years.

The forest : between 25 and 200 years

In order to build up a stand or a successful plantation it takes :
- 15 to 25 years for poplar ;
- 50 years for walnut or Douglas pine ;
- 120 years for fir ;
- 200 years for oak.

Coastal urbanization : 25 years

Twenty-five years were enough for the dense or sprawling urbanization of most of the Languedoc and Provençal coasts in France, of the Costa Brava or the Balearic islands in Spain, or of Sicily in Italy, thus considerably changing the landscape, life-styles, and very nature of management problems. At the same time, 9 % of the French Mediterranean coast, i.e. 21,000 hectares covering 148 kilometres of coast, was bought by the state to protect part of the remaining natural areas (coastal conservatory).

Disappearance of the monk seal : 15 years

Formerly widespread in the Mediterrean between the Azores and the Black Sea, the monk seal (Monachus Monachus) would probably have disappeared by now without recent efforts not only to protect it but also to organize its survival. In 1987 there were only about 350 specimens left in the world, most of them near the coast of the Agean Sea.

Waste water treatment : 40 years

Sewage systems are a long-term problem. It will have take ten years for the percentage of the coastal population connected to the system (including tourists) to rise from 20 % to 36 % in France, and it will not reach 60 % until 1995. In Israel it took 25 years for treatment rates for the resident population to rise from 26 % (1960) to 61 % (in 1985), the proportion of recycled waste growing from 6 % to 36 % over the same period. In Turkey, investment programmes estimate 40 years for 54 % of the urban population to be equipped by 2025.

Thus, a relationship had to be established in the Blue Plan between, on the one hand, the time span of environmental change and the time needed to counteract them and, on the other, the length of time required for economic and social change, in an effort to examine a possible or desirable future. Incorporation of these time scales into the study meant chosing reference horizons. The Mediterranean countries chose the year 2000 as the intermediate horizon and the year 2025 as the long-term horizon, thus recognizing the significance of the quarter century between 2000 and 2025.

On the basis of the recent past, going back usually to 1970, it is possible, with the 2000 horizon, to envisage the continuation of trends already under way and decisions that may be taken between now and 2000 with a reasonable margin of certainty. A range of possible futures opens up as from the end of the 1990s. With the 2025 horizon, it is possible to take into consideration the time scales of ecological responses, technological development and innovation. This horizon, however, is more uncertain, as regards economic and social life and changes in attitude. The period covered by the Blue Plan prospective study goes well beyond the scope of physical planning or national development plans and programmes. But because of the slowness of ecological, economic, technological and societal responses, the interactions must be clearly understood now, and a future compatibility sought between necessary development and an environment whose specific features and fragility have been stressed.

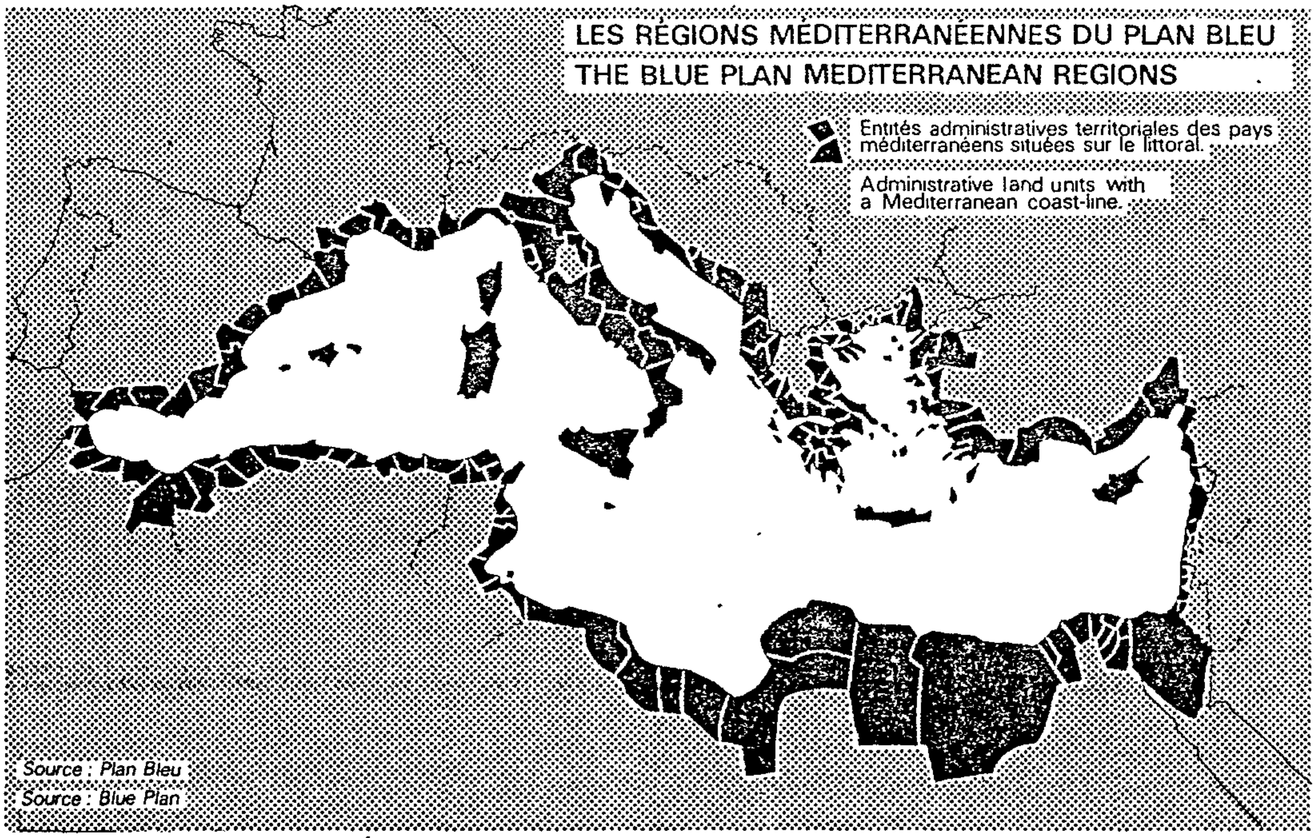
II. THE VARIABLE CONTOURS OF THE MEDITERRANEAN AREA

From the inception of the Blue Plan (Split intergovernmental meeting) it was agreed that the project "should cover the entire Mediterranean basin, namely the Mediterranean Sea, as defined in the Barcelona Convention, and the adjacent coastal zone where socio-economic activities are largely governed by their relations with the sea-board. These coastal zones might vary in territorial depth from one area to another, depending on the problems to be considered and the nature of the disciplines involved."

Since major socio-economic choices can only be made at the level of a whole country, and because continuous statistical series are usually available only at this level, the Blue Plan prospective exercise often takes into account the Mediterranean basin coastal countries as a whole, covering their entire national territory. This level is therefore broader than the "eco-regional" component of "Mediterranean regions" alone, or "coastal zones" alone. This level of study, determined by the national reality of economic situations, makes little difference to the analyses for most countries, especially those south and east of the basin whose most densely populated and economically important regions are those bordering the Mediterranean. For some countries, however, chiefly Spain, France, Yugoslavia, Turkey and Morocco, the relative importance of their Mediterranean regions in analyses should be borne in mind, which in addition varies considerably depending on the activity considered.

At the same time, an effort was made to place the Blue Plan studies at the most appropriate geographic level with regard to the problems tackled, in accordance with the wishes expressed at the outset.

In this respect, the global level, on the scale of entire countries, is very interesting even from the environmental viewpoint strictly speaking. Thus industrial pollution regulation and standard setting are necessarily carried out at the national level because of competition, or even at the level of several countries, as in the case, so important for the Mediterranean, of the European most



La définition administrative des régions littorales des pays méditerranéens, utilisée par le Plan Bleu, a principalement servi d'assise aux travaux prospectifs régionaux concernant les populations, l'urbanisation, le tourisme et les activités sur le littoral.
Les études portant sur l'environnement méditerranéen se sont appuyées sur une conception plus large de la notion de "région" administrative, ou bien sur la définition topographique et hydrographique du bassin versant.
The administrative definition of Mediterranean coastal regions, as presented here, provided the main bases for the Blue Plan regional prospective studies related to population, urbanization, tourism and coastal activities. The studies on the Mediterranean environment were based on a broader concept of the administrative Mediterranean "regions", or else on the topographic and hydrographic borders of the watershed.

environmental regulations which apply to Mediterranean regions are adopted at the national or international level.

The exercise comprises, however, other geographical levels. Thus for all matters relating to fresh water - including land-based pollution from rivers- the most suitable level of study is that of the hydrological basin : the impact of the Rhone or Po waters, for instance, may originate in non-Mediterranean regions. So watersheds were selected as the geographical context for the prospective study on water requirements and resources, a vital factor in relationships between the environment and development for the entire region, while nevertheless considering as "external" those areas of the watershed lying in countries which do not border the Mediterranean, especially as regards the Rhone and the Nile.

In fact, the concept of a "Mediterranean region" has for many years been the subject of debate among geographers, botanists, climatologists, economists or sociologists, and although many definitions exist, and are equally valid for a given topic, none of them can be used for all purposes. The idea of a coastal zone depends greatly on local topography, and its depth on the nature of the subject studied.

These conditions led to the choice of an operational definition to meet the practical needs of the Blue Plan scenarios. In each country all the administrative territorial units located on the coast were chosen as Mediterranean regions. These units form decentralized components of the executive authority (provinces, departments, governorates, etc.), for which statistical data are available, notably as regards population growth. Aside from the islands which were taken as a whole, the Mediterranean region thus considered forms a continuous coastal strip whose depth varies, but does not usually exceed 100 kilometres. This division is clearly a practical one, but it does not diverge too much from a frequently used biogeographical delimination, that of the area in which the olive tree grows.

Whatever the borders chosen for the study of different problems, the Blue Plan usually considers the Mediterranean basin as a whole and does not subdivide it into smaller geographical units. Contrasting economic conditions, however, often makes it necessary to distinguish what is happening on the southern and eastern shores from the situation on the northern shore. In this case Turkey forms a "hinge" between these two groups and may belong to either one depending on the matter under review.

Finally, a study at the overall level of the basin clearly cannot "go down" to the geographical levels of individual countries' coastal zones. For regions of very special importance, more detailed local or national prospective studies would doubtless be very valuable, particularly with a view to physical planning. These could use to advantage the methods followed and the general findings obtained at the level of the basin as a whole.

PART TWO :

THE SCENARIOS : CHOICE OF HYPOTHESES

CHAPTER II.1

WHY USE SCENARIOS ?

Since the main object of the Blue Plan is to study the relationships between certain kinds of development and the Mediterranean environment, the starting point had to be the choice of components of the "Mediterranean system" and more specifically :

. the main "components" of the environment
. the main "sectors" of economic activity.

The determining factor when making this choice was the importance of interactions between these elements : the impact of economic activity on the environmental component and feedback effects on development due to changes in these components (growing scarcity of resources, degradation of certain environments, etc.).

In addition, the most appropriate tool had to be identified to obtain the desired results by simulating a number of potential trends in the Mediterranean system. The "scenario method" seemed to be the most suitable.

I. THE RELEVANCE OF EXPLORING THE FUTURE

During the long period of relative economic stability in the world from 1950 to 1970, assumptions about future developments could be based on trends which seemed to be well established. This was the period, to some extent a good one, of forecasting.

In the last fifteen years, however, the world, and inter alia the Mediterranean basin, have embarked on a period of unrest and uncertainty. It would be even more useful to forecast the future, but this needs a sound basis -or in more technical terms "smooth statistical variations"- which is no longer available to decision-makers or officials. Should one then be resigned to inaction, shutting out creative imagination and just reacting to events as they occur ? Not necessarily, because there is still one certainty : that something will happen ...

By combining certain assumptions in a coherent way, a series of gradual "changes" can be defined which make it possible to explore the outcome of the hypotheses (termed an "if...then..." sequence). To construct an initial change sequence, a cautious starting point would be several well identified "major trends" whose potential repercussions can be anticipated. But this is not enough, the exercise has to be pursued further, as the last fifteen years have precisely shown that these trends often had to be revised. Hence the need to deviate from them in order to broaden the exploration as far as possible, without excluding events that are not easy to foresee (if only because of guessing the date on which they may occur), but not unlikely : hazards or "surprises" to which systems are usually all the more vulnerable because the event had been considered less likely, impossible, or even unthinkable.

The established hypotheses can be qualitatively very realistic but quantitatively arbitrary, without losing their relevance or the validity of the conclusions.

II. WHAT IS A SCENARIO ?

One of the main features of a scenario is the establishment of a link between the present and the future : in other words, a scenario must necessarily include a pathway between the present and the future. This path is not haphazard ; *it is constrained by two factors : the initial hypotheses and the rules of the game.*

A scenario rests basically on a set of hypotheses. Whether these hypotheses be "upstream" and general (focusing on international economic trends, population growth, or technological advances), or "downstream", more practically oriented or sectoral (concerning the choice of export crop or the trends in types of tourist, for instance, they must always be clearly explained and justified.

These fundamental hypotheses which make it possible to construct scenarios must respect a number of rules and must be :

. clear, in order to be understood by all ;
. probable, which does not exclude hazards ;
. consistent, both internally among themselves, and at all levels ;
. relevant, in terms of the desired objectives ; and finally
. adequate, i.e. a sufficiently large number to cover a wide range of possible futures, but not so many as to be redundant, or produce more combinations than can be handled.

Choosing these hypotheses is the first of the major difficulties in any scenario formulation exercise. Once chosen, *even if they are not recalled at every moment, they must always be kept in mind.*

On the basis of a clearly defined initial image, these main hypotheses make it possible to stage certain events (hence the term "scenario") according to a sequence subject to the rules of the game, an internal logic.

The basic difference between a scenario and a mere image of the future stems from this staging of events, in other words, the pathway. It is the only element that makes it possible to calculate the cost of required resources, length of implementation and the deadlines by which decisions must be taken.

The consistency fundamental in the choice of hypotheses must be maintained all along the pathway. Maintaining consistency throughout a scenario is therefore the second major difficulty in the exercise : consistency between sectors, between activities within a given sector, between activities and available resources, between activities and the supporting capacity of the environment, etc. Hence the paramount importance of the "feedback loops" : discontinueties, the "warning lights" in the scenarios, are essentially breaks in consistency.

Where should the path stop? Where should images be "frozen" in the scenario? Clearly at the selected horizons : in the case of the Blue Plan, the years 2000 and 2025, while admitting the necessarily arbitrary nature of these dates.

In brief, a scenario must necessarily comprise four components : an initial or starting image, a choice of hypotheses, a pathway, and an image of the final situation (with possible intermediate images), the whole linked by an internal logic, i.e. the rules of the game. The "images" are simplified pictures of reality or of the future. Some features of the final (or intermediate) images obtained by induction or the consistent extension of quantified findings are given for didactic purposes, or to facilitate comparison with the starting image.

III. HOW ARE SCENARIOS USED ?

Since scenarios work on the basis of mechanisms rather than figures, thus making it possible to compare hypotheses AND their outcome, they are one of the best decision-making tools for an uncertain future. But as with all tools, they have their limitations and it is important to know how to use them to provide a coherent framework for reflecting on the future, making it possible to understand the interactions between various issues. Moreover, the way to use the scenarios varies according to whether they concern :

. events which may happen, but over which influence can barely -or not at all- be exerted, within the context of both major trends and unexpected occurrences. Scenarios therefore in preparing to react for the best, avoiding "surprises" ;

. events on which influence can be exerted. The scenarios make it possible to examine several alternatives and compare their outcome (the choice of specific development/environment policies, for instance).

Finally, when assessing scenarios a posteriori, it is important to distinguish between those which proved incorrect because they were completely unrealistic (in this case the choice of hypothesis is usually at fault, possibly the rules of the game) and those which proved incorrect because ... they were correct. The energy sector offers a good example. Because most of the scenarios in the 1970s led to images of shortages, development failures and economic bankruptcy, many governments and economic agents had to and did take drastic measures to save energy and thus avoid the very pessimistic future that the scenarios had depicted. Were they then useless or unfruitful ?

When a number of scenarios are available, the first step is to assume a "position" within them. This position has to be regularly reviewed, as one may progress gradually from one scenario to another. A set of scenarios has to be regarded not only as a tool but also as "capital", which must be managed on a regular basis and kept up to date.

CHAPTER II.2

THE CHOICE OF THE ENVIRONMENTAL COMPONENTS

In order to define the "Mediterranean system" -subject of the scenarios- its various elements have first to be selected : the components of the environment and then the sectors of development activity.

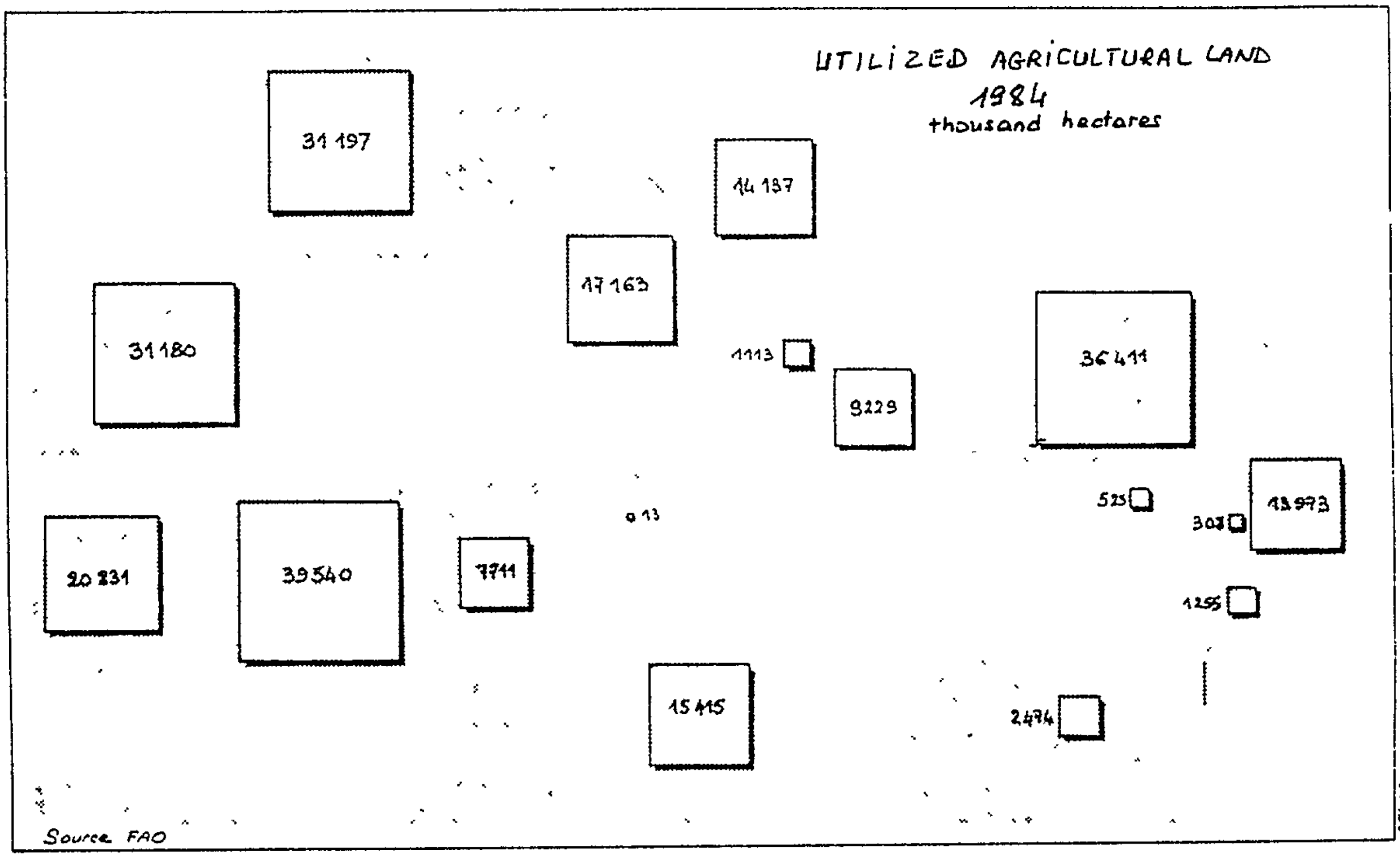
If the features of the Mediterranean region mentioned in Part I are considered as relatively stable, environmental "components", on the contrary, evolve faster, especially under the effect of economic and social development. They may be considered as "variables" in work focused on horizons 2000 and 2025.

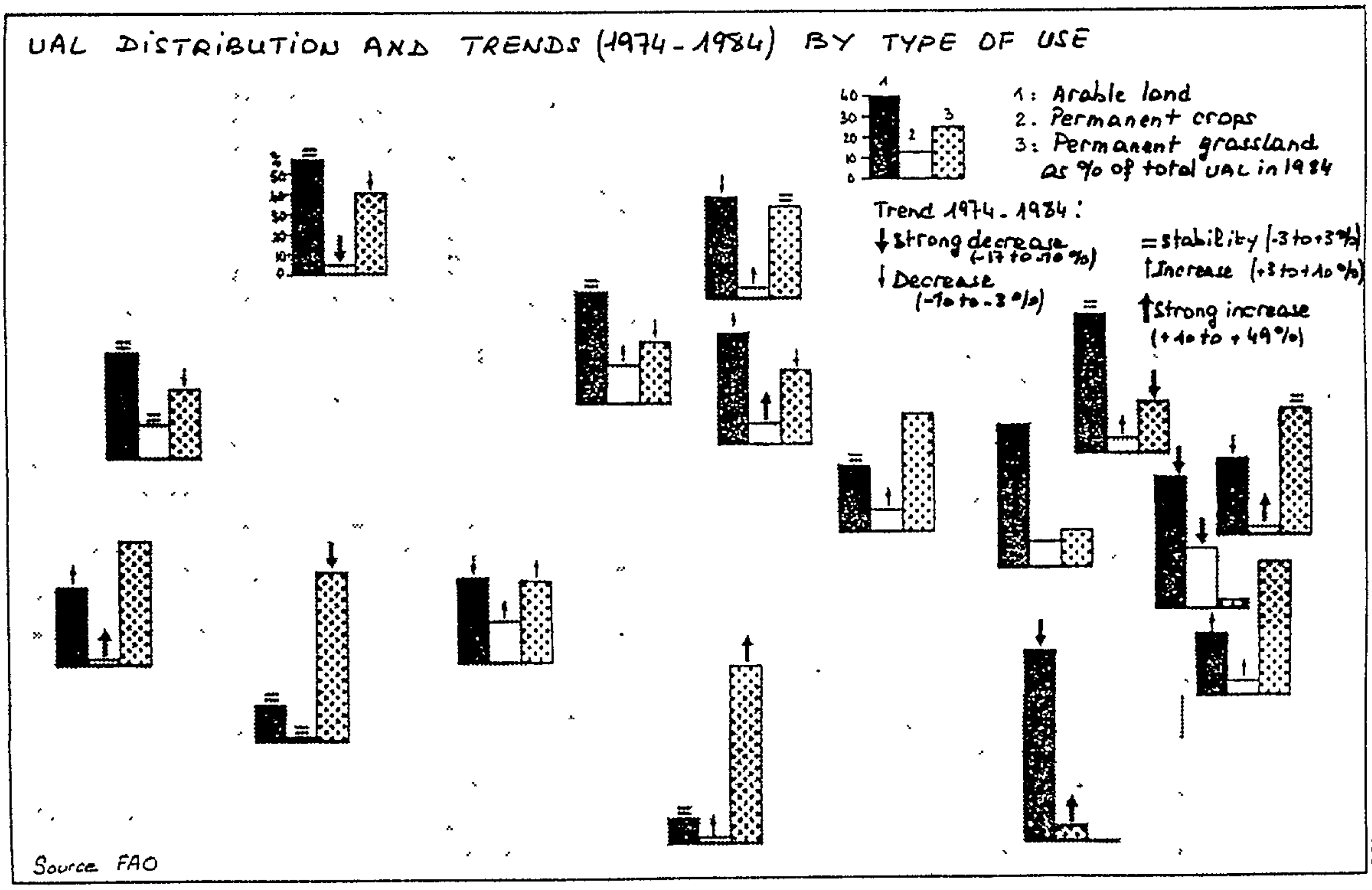
Within the Blue Plan perspective, it is important to choose the most significant and relevant environmental components as compared to the development activities which will affect them, in order to define and understand the dynamics of the system of relationships between the environment and development.

Five main subsystems or "components" of the overall Mediterranean environment system, related to its distinctive features, were selected :

- the soil
- inland water
- forests
- the coast
- the sea

Geographical extension plays a special role among the features of these environments. This spatial dimension enables them to provide a medium for various human activities.


UTILIZED AGRICULTURAL LAND
1984
thousand hectares
31 197
14 137
17 163
31 180
1113
9229
36 411
525
303
18 973
20 231
39 540
7711
0 13
1255
15 115
2474
Source FAO
AFDLC


UAL DISTRIBUTION AND TRENDS (1974-1984) BY TYPE OF USE
1: Arable land
2. Permanent crops
3: Permanent grassland
as % of total UAL in 1984
Trend 1974-1984:
Strong decrease (-17 to -10 %)
Decrease (-10 to -3 %)
= stability (-3 to +3 %)
Increase (+3 to +10 %)
Strong increase (+10 to +49 %)
Source FAO
AFDLC

I. <u>Soil</u>

The soil, depending on its features, fulfils two essential functions, the basis of many activities :

. In economic production : in this case, the chemical composition, structure and evolutive dynamics of the soil plays a crucial role. This production could be :
- agriculture, in broad terms (agriculture strictly speaking stock breeding and forests) and involves the surface layer in particular,
- industrial, involving both the surface layer (stone, clay, peats, etc.), and the subsoil (extraction or stocking activities), in which the soil itself only plays a transitory role.
In terms of surface area, agricultural production is by far the
most important (Figures II-1 and II-2).

. As a medium for man and his activities, starting with homes and urbanization, infrastructure (roads, airports, dams, etc.), industrial installations, etc. Although they cover a smaller surface area, these activities too often invade some of the most fertile land and make it sterile (the case of the expansion of Cairo into the Nile valley and delta).

Much Mediterranean land was almost entirely wooded until the current historical period. The conquest of agriculture led the disappearance of plant cover, though it also ensured, at least in the beginning, the protection or conservation of the soil. Then the major deforestation took place, the work of institutions or systems outside to the rural sector, whose objective was not agricultural merchant and military fleets, construction of towns, or energy for blast furnaces at the beginning of the industrial era and for crafts. There were many cases of overexploitation, with dramatic consequences during past centuries. Plato and Thucydides already regretted what was happening in Greece !

Each population increase led to the cultivation of marginal land, including on the slopes. As long as the feed load -men and beasts- was not too heavy, and farmers had the time and energy to look after their fields and their soil (for example, by bringing soil back up the slope when it had been carried down by runoff or building terraces), soil remained on the mountains. Local overpopulation, parcelling out, clearing for various purposes, overgrazing both on grassland and in forests, are at the origin of the degradation or disappearance of protective plant cover and the development of erosion from runoff on the farmed or grazed slopes, especially on the loose and crumbly soil in some Mediterranean regions (Italy, Morocco, etc.).

Water erosion is not the only threat to Mediterranean soil either. Two other agents can contribute to it :
- the wind, on the southern borders of the basin, but also to the east and in Spain, in flat areas or on gentle slopes ;
- salinization, developing on irrigated land. It is an underlying threat, which reccurs sooner or later in the case of poor management of irrigation and drainage networks.

The recent increase in populations to be fed, partly concentrated on the coast, led an intensification of soil exploitation. The mechanization of ploughing (deeper), the reduction of fallow land, the gaining of new land at the expenses grazing land (to the detriment of stock breeding, i.e. with a reduction in organic inputs), the

SOIL, WATER, EROSION

A few examples of the sediment load of Mediterranean watercourses are given below.

Tunisia. The Medjerdah, at 75 kilometres from its mouth, has average annual solid load of 21.5 million tonnes of sediment per year ; the average concentration of particles is 30g/l, which means that the level of erosion in the drainage basin is 1,020/km2/year.

Yugoslavia. In Yugoslavia, the direct damage caused by erosion has been estimated at more than 1.3% of the country's GNP per year. This is only part of the total loss.

Analyses made at the mouth of the Velika Morava show that in 24 hours, the river carries 1.312 million cubic metres of mud, containing 550 tonnes of nitrogen, 33 tonnes of phosphorous and 35 tonnes of potassium, equal to a 20 cm layer of fertile soil over an area of 50 ha.

Water erosion can also be assessed in the form of :

- loss of potentially productive topsoil ; loss of solid organic and mineral matter can also be considered as a loss of nutrients
- accumulation of sediment, depending on particle size, in low-lying areas (including in dam reservoirs and port zones)
- the instability of watercourse banks, associated with stronger and muddier floods
- inflow of suspended solid matter into the sea, one of the principal ways of introducing pollutants (organic, inorganic, heavy metals, particles, chemicals, etc.).

subsequent deterioration of soil structure, and changes in the soil's water balance also contribute to increasing the vulnerability of soil to degrading agents. In the Mediterranean basin, however, pedogenesis is virtually blocked (save a few areas of damp woodland), so soil lost is virtually gone forever.

Mediterranean land with its soil, long exploited and essential for the survival for the population, is a scarce and non-renewable resource. It has been chosen as the first "environmental component".

II. INLAND WATER

Inland water fills many functions :

. A biological function. Precipitation, vital for plant life and agriculture, is a spontaneous factor of production. Water is also an aquatic habitat.

. A raw material, essential for various purposes and exploited for :
- direct human consumption : drinking water is consumed in a minimal amount compared to other uses, but the necessary quality is currently at risk in many Mediterranean countries ;
- domestic use for households, mostly met by drinking water too ;
- a factor of agricultural production through irrigation, the basic method of intensifying and regulating agriculture in the Mediterranean basin ;
- a factor of industrial production, either as an intermediate product (for example as a solvent in manufacturing processes), or as a cooling agent (for most processes, notably for power stations) ;
- a factor in energy production, through hydro-electricity (without deterioration in quality).

. Various in-situ uses :
- as a medium, for river transport ;
- as a recreational environment ;
- as a carrying agent for evacuating wastewater. This irreplaceable function is supplemented by a self-filtering function (nowadays quite inadequate).

Figure II-3 summarizes the overall water balance in the Mediterranean basin.

At the regional level, water is a scarce resource and poorly distributed. The increase in functions and uses imply the possibility of conflict, both between the various human uses (including between exploitation and in situ use) and between these and the natural functions.

Table II-1 summarizes the situation of water supply and demand (on the basis of uses) in the Mediterranean watershed at the beginning of the 1980s. The first stage consists of quantifying physical water resources (columns b and c). These concern available resources, i.e. excluding rainwater but including spontaneous outflows from neighbouring countries. These resources are renewable. Resources deriving from the exploitation of reserves such as fossil water, considerable for most African countries, are therefore not included, neither are various non-conventional resources, such as the production of fresh water from the desalinization of sea water, etc. (The total excludes duplications due to spontaneous exchanges between neighbouring countries in the basin, in the order of 28 million m3/year). Not all these resources are necessarily accessible. The most available are the naturally stable flows of watercourses and groundwater, or flood flows regulated by existing installations (reservoirs) (column c, which has not been totalled as there is

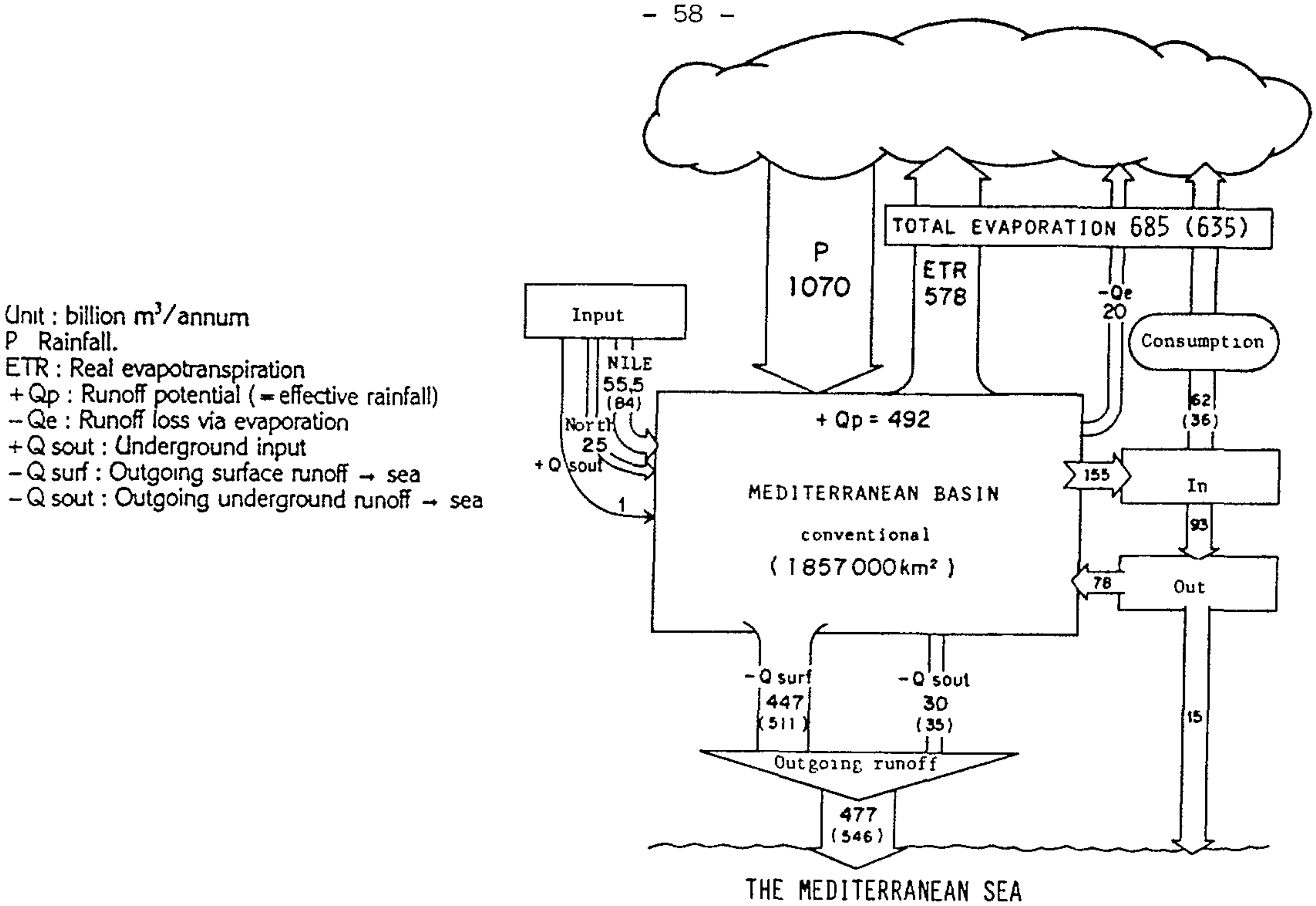


Figure II-1 Mediterranean basin water balance
(Current mean flow, figures in brackets = previous flow rates)

COUNTRY	(a) Estimated population (millions)	SUPPLY (resources) (b) total water resources Gm/year	SUPPLY (resources) (c) stable or stabilized resources Gm/year	DEMAND (d) water distributed (drawoffs) Gm/year	DEMAND (e) net consumption Gm/year	RATIO supply (f) exploitation index in relation to (b) d/b	RATIO demand (g) exploitation index in relation to (c) d/c
SPAIN	15,5	28,3	24,1	12,7	~ 6,9	45	53
FRANCE, MONACO	11,2	74	~ 30	12,7	2,2	17	33
ITALY	57,3	187	50	56,2	22	30	112
MALTA	0,37	0,03	0,03	0,023	0,02	77	77
YUGOSLAVIA	6,9	62	~ 12	1,5	0,3	2,5	< 12
ALBANIA	2,7	21,3	~ 7	0,2	0,04	1	< 3
GREECE	9,6	62,9	~ 10	6,9	3,6	11	< 70
TURKEY	11,0	77	~ 23	7,5	3,6	10	33
CYPRUS	0,6	0,9	0,4	0,54	0,3	60	135
SYRIA	1,0	4,4	~ 2,8	2,5	1,5	57	~ 90
LEBANON	3,1	4	3,3	0,6	0,4	15	18
ISRAEL	3,9	1,0	0,3	1,4	0,8	140	465
EGYPT	41,2	57,3	55,6	45	41	79	81
LIBYA	3	0,6	0,23	1,0	0,65	167	435
TUNISIA	6,3	3	2,9	~ 1,2	0,65	40	41
ALGERIA	14,6	13,2	~ 3,1	2,8	~ 1,4	21	90
MOROCCO	1,7	4,0	1,5	1,0	0,6	25	67
TOTAL	190	572	-	154	60		

Table II-1 WATER SUPPLY AND DEMAND IN THE MEDITERRANEAN DRAINAGE BASIN, 1980 some uncertainty as to this kind of installation). Gross drawoffs for all uses combined, which mobilize stable, regulated and also unstable flows of water, are equal to the volume of water allocated (column d). Part of this drawoff is not returned to the waters of the natural environment. Calculated according to general coefficients, this part represents the net volume of water consumed (column e).

Two ratios make it possible to compare supply and demand :
. the ratio of drawoffs to the total resources (d over b) ;
. the ratio of drawoffs to the stable flows (d over c).

It is worth noting that for the Mediterranean basin :

- the construction of dams has increased natural regular resources by at least 55 % (20 % of which from the Nile development alone) ;
- of the 154,000 million cubic metres drawn off per year, about 72 % (110,000 million m3) are used for irrigated agriculture, 10 % for the production of drinking water supplied to urban agglomerations (mainly for domestic use), and 16 % for industries not linked to the water supply, including power stations ;
- a large part of the water discharged into the Mediterranean (balance of theoretical resources minus net volumes consumed, column b - column e, i.e. 486,000 million m3/year) carries sewage, which greatly reduces its value as an available resource from the qualitative standpoint.

High exploitation rates in most countries imply low levels of future availability (20 % for Egypt for instance), even nil in extreme cases (Israel, Libya, and Malta, for example, where exploitation rates already exceed 100 %).

The volume of polluted water discharged into the sea on the one hand, and potential conflicts linked to growing demand to meet the needs of agricultural intensification and of urbanization (drinking water) on the other, have led to the choice of inland water as the second "environmental component".

III. THE FOREST

Having changed radically over the ages, the forest currently has the following functions :

. An ecological function : protection of land on slopes, stabilization of water flows, and conservation of plant and animal genetic resources by the protection of increasingly threatened habitats and ecological niches. This function is crucial in the Mediterranean region.

. An economic production function. Wood production compared to that of the temperate, northern, or tropical forest, is poor in quantity and quality, even if the often relict vegetation is of a remarkable genetic variety and wealth. Nevertheless, some species, such as the eucalyptus imported from Australia or pines from America, furthered the development of industrial plantations (especially for paper pulp). The noble species supply high quality wood for various crafted goods. The forest also provides local populations with other products (cork, resin, honey, seeds, etc.).

Aside from these products, the forest has two other uses which take advantage of its natural productivity in wood, grass and leaves :
- supplying fuelwood (from gathering, and also often poorly controlled felling) for domestic needs such as

cooking and heating and for the needs of local crafts ;
- providing grazing land, the forest, can, without detriment, feed a certain number of animals under conditions of access controlled so as to ensure the reproduction of grass, leaves and wood.
However, overexploitation for fuelwood or grazing,leads to the degradation, even disappearance of woodland, because the regeneration of overexploited species can no longer take place.

. A social function, for recreation, leisure and the landscape, a function that is not always well understood. In the north of the basin, the surface area of woodland is increasing in the Mediterranean regions because of abandonment of land previously under cultivation. Neglect of the forest encourages increasingly widespread fires (an average of 200,000 hectares of forest are destroyed each year by fires started criminally, accidentally or through negligence).

Damage to the forest threatens its ecological function. The serious turn taken by trends, though not involving all coastal states in the same way, was the reason for choosing the forest as the third "environmental component".

IV. THE COAST

The coast is the place where land, river and sea influences meet and interact, with many transitions and graduations stemming from the variety of geological mediums, soil, humidity and salinity conditions, geomorphologic processes, micro-climates, etc. As regards the Mediterranean basin, coastal environments are scarce and valuable, of great morphologic, biologic and geographic diversity.

For some decades, the cost has virtually become the most desirable area for the location of many activities. Hence a double set of broadening conflicts : conflicts between competing activities on the one hand, and between the activities and the environment on the other :

. Conflicts between competing activities such as :
- urbanization, either dense or sprawling, concentrated on the coast (encroachment by secondary residences)
- agriculture (traditional crops, market gardening, horticulture) ;
- fishing and aquaculture ;
- quarrying (sand, gravel, salt, etc.) ;
- industry, because of easy access to imported raw materials and outlets on domestic and/or foreign markets) ;
- energy (loading and unloading ports, refineries, thermal power stations) ;
- industry-port complexes ;
- commercial and fishing ports ;
- airports ;
- tourism, the most recent activity, but currently developing very strongly, and a big user of coastal areas (hotels, sports grounds, camp sites, marinas, etc.).
Most of these activities are mutually exclusive, or have not yet found good solutions for co-existence.

All these activities exert considerable qualitative and quantitative pressure on resources and the environment especially on land, inland water, and nearby forests, as well as the coastline and coastal seabed, with sometimes irreversible consequences :
- from the increasing water-resistance of soil to the definitive loss of agricultural land ;

- from the salinization of groundwater to the discharge of wastewater and chemicals;
- from deforestation to the stripping of age-old landscapes ;
- from the disturbance to the physical destruction of habitats, through variations in turbidity due to industrial waste or in temperature because of thermal power stations discharges into the sea, or through the disappearance of posidonia colonies (spawning grounds or nurseries, whose disappearance could upset all or part of a biological or food chain) ;
- from the disturbance of geomorphologic processes (the disappearance of beaches, for instance) to the mechanical destruction of organisms through overfishing or crushing in cooling-circuit turbines, etc.

As regards the coastline strictly speaking (Figures II-4 and Table II-2,) accretion coasts (beaches, dunes, marshes, lagoons, estuaries, deltas) depend on the inputs of land and sea sediment resulting from the effect of natural erosion in watersheds and rocky coasts, and on marine dynamics (waves and swell, currents). These sedimentary coasts are therefore very sensitive to any change in the system of interactions between these elements :
- dams and reservoirs, even far upstream, trap sediment and alter the flow of watercourses ;
- changes in plant cover in watersheds have an effect on sediment loads, which increase and silt up the coast ;
- sea-control works block or alter coastal erosion, but also disturb coastal currents and so accretion zones ;
- extraction of materials may reduce the volume of sediment, etc.

This leads inter alia to a destabilization of deltas and the erosion of beaches, together with silting up in other areas. This last phenomenon is a good example of a "feedback loop" in which economic activities may considerably degrade the environment (beaches), degradation that in the long term constrains or excludes these activities (seaside tourism).

A very different aspect of fears about the Mediterranean coastline is related to the possibility of a long-term rise in the sea level due to the heating up of the earth's atmosphere through the accumulation of industrial gases (in particular carbon gas producing a greenhouse effect).

The coast, likely to become an increasingly serious concern for the coastal countries, is an essential "environmental component" for the Blue Plan prospective study (it could even be considered "a system" by itself on account of its complexity).

V. THE SEA

The bonds between the Mediterranean Sea and the economic and social life of the coastal countries are both old and close. The Mediterranean, a place of contact and occasionally conflict, has gradually developed other functions :

. An economic production function : the sea is a source of food and mineral raw materials (oil exploration, inter alia, is a current activity) ;
. A medium for transport ;
. A social function : it is a preferred area for holidays and recreation ;
. A waste-reception function, based on its waste-assimilative capacity, wrongly considered as infinite.

The high seas are used by navies and yachts, the number of which is steadily rising.

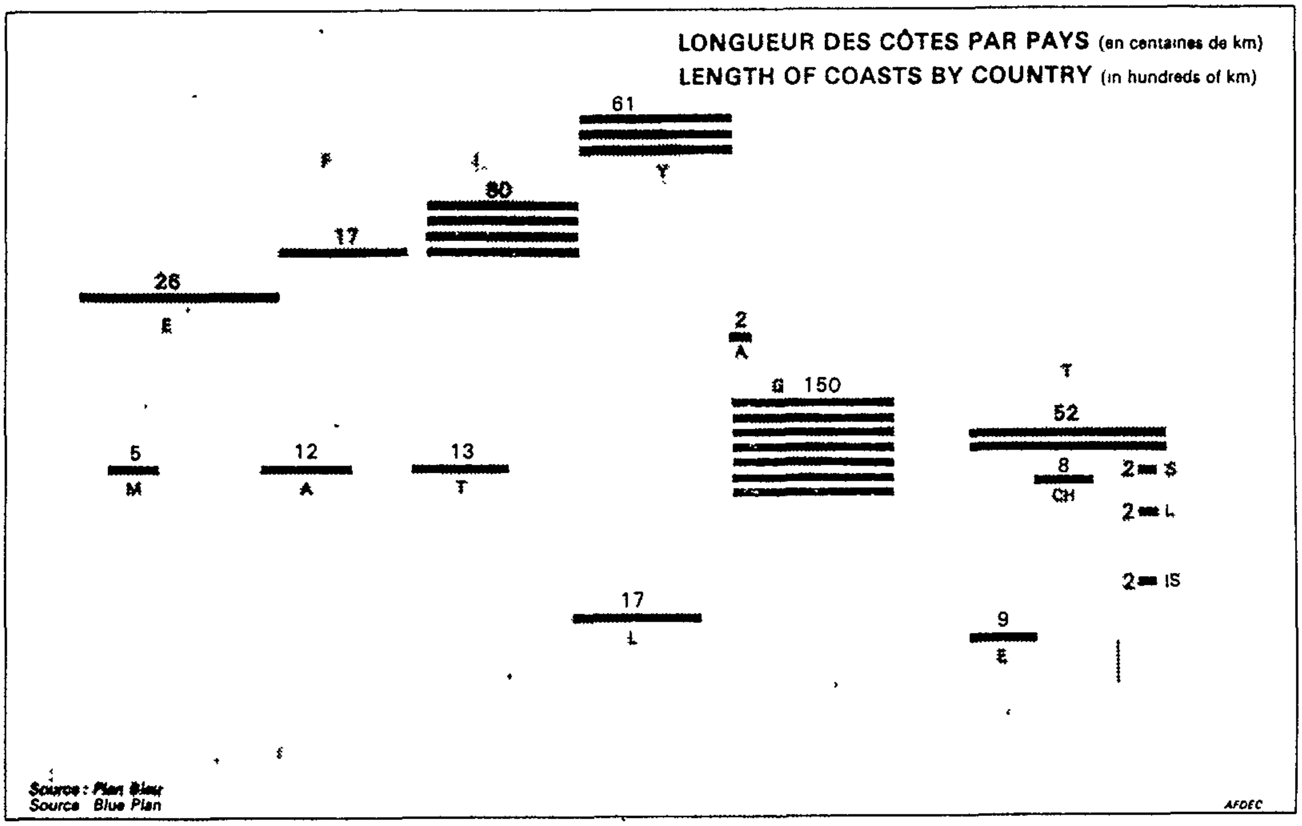


Figure II-14

Type of coast \ COUNTRY		SPAIN (1)	FRANCE	ITALY	MALTA	YUGOSLAVIA	ALBANIA	GREECE	TURKEY	CYPP 'S	SYRIA	LEBANON	ISRAEL	EGYPT	LIBYA	TUNISIA	ALGERIA	MOROCCO	TOTAL
Rocky coast	%	3	64	40	100	80	30	70	60	50	65	65	5	5	5	20	50	50	54 %
	km	80	1090	3181	180	4893	125	10500	3115	391	119	146	10	50	90	260	600	256	25086
Accretion coast	%	92	36	60	0	20	70	30	40	50	35	35	95	95	95	80	50	50	46 %
	km	2370	613	4772	0	1223	293	4500	2076	391	64	79	190	900	1680	1040	600	256	21047

(1) More than 5 % non-natural coast.

Figures may vary slightly depending on statistical source.
This table is made on official national documents.

Table II-2 DISTRIBUTION OF COASTS ACCORDING TO TYPE

The continental shelf is an area of recent activities such as oil prospection, or more traditional ones, such as fishing, especially on the narrow coastal fringe where fish stocks are concentrate, finding the water enriched by nearby land-based sources and conditions suited to reproduction.

The first two protocols to the Barcelona Convention (Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft, 1978, and the Protocol concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and other Harmful Substances in Cases of Emergency, 1978) deal with pollution and its consequences for the whole marine system, and are the first steps in Mediterranean co-operation.

A new protocol in preparation concerning offshore mining aims in particular at the hazards which could stem from activities on the continental shelf.

The worst pollution, however, is land based, related to everything that happens, and especially that will happen, around the Mediterranean.

This kind of pollution, subject of the protocol on the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, which came into effect in 1983, is to some extent at the beginning and end of the Blue Plan studies. It should be recalled that some of this pollution is atmospheric -roughly 50 % from some heavy metals, for example- but the mechanisms by which its spreads are rather poorly known ("aerial watersheds").

The sea has therefore been chosen as the fifth "environmental component" in the Blue Plan studies. Although both an "input variable" and a "output variable" it has not been the subject of special study since, as regards pollution at least, this is the responsibility of another part of the Mediterranean Action Plan : the MED POL programmes.

CHAPTER II.3

THE CHOICE OF THE ECONOMIC SECTORS

Only a few components or development sectors were selected to complete the "Mediterranean system". After due consideration it was decided to concentrate on five main sectors of activity, all important in their own way and components of what could be called the development "subsystem". They are :
- agriculture (or more specifically, food production) ;
- industry ;
- energy ;
- tourism ;
- transport.

I. AGRICULTURE

The importance of agriculture in the Mediterranean basin is greater than its share of the GDP -usually lower than 20 %- implies. On the one hand, it still provides employment for nearly half the labour force in the countries in the south and east of the basin. On the other, it uses 80 % to 85 % of developed water resources and a very large area of land, uses which will grow considerably in the countries in the south and east of the basin, sometimes in fierce competition with both urbanization and environmental conservation.

As a whole, Mediterranean agriculture is unlikely to generate surplus income. Its growth rates are usually lower than those of overall economic growth, and lower still than those of industrial growth ; the gap is widening between these two kinds of economic activity. On both sides of the basin (confining considerations on the northern side to the Mediterranean regions only), agriculture therefore seems to be a basic component of conflict and imbalance, these being so far heightened, rather than reduced by the economic environment.

Since population growth has been faster than progress in food production, many Mediterranean countries are no longer able to feed themselves, notably in the Maghreb and Egypt, whereas a few decades ago these countries balanced their trade with the sale of agricultural products (Morocco, for example, was a cereal exporter up to the beginning of the 1970s).

More or less extensive dry farming has probably reached maximal growth. Small farmers using traditional method produce yields often under ten quintals per hectare and marginal crops speed up soil degradation. Potential irrigation areas are few and rudimentary techniques (though occasionally ingenious) use water inefficiently, with significant losses from runoff or evaporation. The density of the rural population is an obstacle to modernization because of the splitting up of farms upon division of an inheritance, with no possibility of increasing the size of plots.

Necessary intensification is beset by other problems. Yields remain low despite modern production techniques, between 10 and 20 quintals per hectare, or even less (cereal crops in northern Morocco, Anatolia or the Syrian Djezireh, for instance), with the risk of pollution from fertilizers and pesticides, and the speeding up of desertification linked to the use of mechanical tools. For irrigation works (such as those in Syria, Turkey and Morocco) to be efficient and profitable they must be supplemented with work on plots, not always the case ; in addition, the erosion of upstream soil, often related to deforestation, threatens to silt up the dams in the medium or long term.

Finally, on the northern side, most of the markets for "Mediterranean" produce, such as durum wheat, wine, fruit and vegetables and olive oil are faced with an increasingly expensive crisis (substantial increase in payments from the EEC Agricultural Guidance and Guarantees Fund since 1981) and pose a problem in some regions.

How will Mediterranean agriculture respond to the formidable challenges of the coming decades ? What systems could meet a demand growing by 4-5 % per year ? What will be the impact on fragile soils and on water resources already much in demand ? What will be the possible long-term contribution of new biotechnologies ? How will all this affect development in the rural world ? These are all questions to be tackled in the scenarios.

II. INDUSTRY

For many years industrial development was synonymous with development (but does not this thinking still prevail ?) and was a necessary stage in it. In the Mediterranean basin, as elsewhere, the industrial sector, to varying extents depending on the country and strategy, has most often been given priority, unlike the agricultural sector, not only as regards investment, but also research and development programmes, the promotion of new technologies, assistance in innovating, regional development policies, "restructuration, rationalization and modernization" efforts, training expenditure, etc.

Since the end of the Second World War, industrial development in Mediterranean countries has on average been faster than in the world as a whole, and even spectacular in some cases (such as Spain, Yugoslavia, Turkey, Egypt, etc.), usually heavily dominated by public authorities, which radically transformed low productivity, agricultural economies, with rudimentary industrial development, within the span of a few decades.

Although industrial development in the countries to the south and east of the Mediterranean basin speeded up after 1970, whereas growth in the northern countries gradually slowed down and stagnated, even with recession in some sectors, major imbalances still exist between north and south : Spain, France and Italy still concentrate about 85 % of the basin's manufacturing industry, taking all countries into account, 70 % considering their Mediterranean regions alone.

Except for oil, natural gas and phosphates, the mining industry has not developed much in the Mediterranean basin, and is scarcely in a position to stimulate, or elicit, a true industrialization process.

The manufacturing industries of the countries in the south and east of the basin, closely related with the spatial distribution of the population, are located in or around the major cities, where it is easier for them to mobilize the necessary labour and find outlets for their production.

On the whole, however, Mediterranean countries have not generally been able to identify competitive market niches (as some newly industrialized countries have done), likely to ensure a world outlet for a number of manufactured products, enabling them to base their development on the increased growth of exports.

Industrial development in the Mediterranean is heavily concentrated in a few coastal areas : the regions of Barcelona, Valence and Fos-Marseilles, Taranto and Venice, Croatia, the Bay of Izmir, the Alexandrian coast, the coast of the Maghreb with Tunis, Algiers, etc. This coastal concentration of industry, a source of conflict with other economic activities, is particularly noticeable as regards refining and the major petrochemical complexes (in Sicily and Sardinia, near Marseilles, in Taragona, Porto Marghera, on the Libyan coast at Ras Lanuf, etc).

Industrial pollution has tended to follow trends in siting (strong growth of basic industries in the south and east) and in structure (more sophisticated industries in the north with greater risk of accidental pollution).

Bearing these factors in mind, what role will industry continue to play in the development of countries to the south and east of the basin, faced with considerable needs as regards manufactured goods, and how will the population's values and consumption models develop ? Will major installations continue to be located preferably on the coast, considering inter alia, limited water resources in the interior, a site which would exacerbate the problem of wastewater and related pollution hazards ? To what degree will existing technology be used to protect the environment ? How will the northern countries face up to the greater risk of accidental pollution linked to increasingly sophisticated industries ? What will be the importance of North-South or South-South co-operation ? All these questions are vital for the future of the Mediterranean countries and will be explored in the scenarios.

III. ENERGY

Energy, the prerequisite for all activities, the basic -and for many years inexpensive- ingredient of growth, has become one of the key items of economic balances since the beginning of the 1970s :

- often a major source of financing the exporting countries' development programmes (for instance, approximately 95 % of exports (in terms of value) for a country like Algeria, and 30 % of its 1983 budget at the time of the highest prices on the oil market) ;
- conversely a heavy constraint, cause of indebtedness and even a curb on the development of countries obliged to import it, with market fluctuations complicating further any medium-term planning in both cases.

In fact Mediterranean basin countries can be divided into two categories :

- importing countries on the northern side, as well as Turkey, Cyprus, Lebanon, Israel and Morocco, one of the least endowed countries as regards conventional energy resources and whose fuel imports account for some 30 % of total imports and 50 % of exports ;
- exporting countries, either comparatively small exporters like Syria or Tunisia, medium-sized, like Egypt, or large, like Algeria (oil and especially natural gas of which it is one of the biggest exporters in the world) and Libya (one of the major oil producers considering its reserves and resources).

The most industrialized countries in the Mediterranean basin usually resort to every source of energy : coal (domestic or imported), oil, natural gas (especially for the past two decades or so), and hydraulic, geothermal and nuclear energy (a recent development). The countries in the south and east of the basin developed their consumption of oil products in particular, which may obtain 90-95 % of their total energy consumption. This trend has only recently been affected by the breakthrough of natural gas, or by coal imports for electricity production, since most of these countries are virtually without any coal resources. Some countries which are currently oil exporters are likely to become importers during the coming decade, following the depletion of their deposits, a development with a tremendous social and economic impact.

As regards electricity production, a similar variety of sources exists in the north, along with the predominance of oil in the southern and eastern countries (with the exception of natural gas in Algeria). In north-western countries (France and Spain in particular), nuclear energy developed fast then recently slowed down ; in other countries the use of coal is increasingly considered. In the medium term, the pattern of electricity production is likely to change substantially in most countries.

The considerable growth of the population in Mediterranean cities during the last decades raises huge problems of power distribution and supply -electricty, fuel, motor fuel, etc.- especially as most other services depend in turn on the availability of energy. Urban energy consumption produces serious air-pollution problems (Rome, Athens, Cairo, Algeria, etc.), not to mention the socio-economic problems related to increasing traffic congestion.

On the other hand, in the countryside, population pressure is often exerted on increasingly scarce fuelwood resources for basic domestic needs such as cooking and heating, and local crafts. Fuelwood resources are increasingly likely to disappear altogether, contributing to desertification, soil erosion, etc.

From the environmental viewpoint, in addition to the problem of depletion of resources, energy has many aspects in common with industry, often sharing the same kind of chain from source to consumer : production, initial transformation and/or transport, possibly conversion, then distribution. Three aspects should be stressed with regard to the Mediterranean basin :

- heavy reliance on hydrocarbons, likely to continue in many countries ;
- importance of the sea for the transport of these hydrocarbons, not only to meet the needs of coastal countries, but also those of non-coastal countries (in northern Europe for instance), for which the Mediterranean is basically an international route ;
- the siting on the coast of a large number of often large-scale power plants, the source of various kinds of air or water pollution ;
- oil or natural gas loading or unloading terminals, and soon those for coal ; refineries (petrochemical complexes were mentioned along with industry) ; and thermal power stations. These installations often act as poles of development for other industrial activities, which also set up on the coast, and may lead to the establishment of true "power-industry- port" complexes.

How will the developing Mediterranean economies be able to face up to their transformation from exporter to importer of hydrocarbons ? What will be the role of new energy technologies, which have made considerable progress over the past couple of decades ? What will be the exact share of new sources of energy ? Can decentralized solar energy contribute to both solving the fuelwood crisis and meeting the energy needs of rural populations ? On what sources could the inevitable increase of electrical capacity be based, and where will they be located ? Will natural gas become the main energy resource in the Mediterranean and a pivot for trade between the northern and southern sides ? These are some of the questions which will be tackled in the scenarios.

IV. TOURISM

With more than 100 million international tourists, the Mediterranean basin is the most important tourist destination in the world (about one international tourist in three). It is an activity which concerns all the Mediterranean countries, and all count on its continued expansion, both international and domestic.

International tourism accounted for approximately 7 % of the Mediterranean countries' GDP on average, fluctuating from less than 1 % (Libya) to approximately 10 % for countries such as Italy and Spain, and in the order of 12-15 % for Malta, Cyprus and Israel. It covers between 10-20 % of imports for nearly half the countries. It also provides a large number jobs, though often seasonal. Seasonality also raises problems as to the timeliness and profitability of investments.

Modern tourism originated on the French and Italian coasts. Gradually spreading to all the basin countries, one of its basic and most dynamic components has been mass tourism in seaside resorts, naturally located on the coast, whose population may swell as much as tenfold in the high season.

Sometimes described as an "industry", tourism could in fact rather be compared to agriculture as regards its impact (positive and negative) on the environment, and its features, including an identical risk of overexploitation of its main resources (starting with its historical sites like Venice, the Acropolis or Luxor).

The water consumption of tourists has an even greater impact because it reaches its peak during the dry season when it is most scarce ; it then competes with the water needs of other users. The problem is particularly acute on the islands (Yugoslavian coast, Aegean Sea, Balearic Islands, Djerba, etc.), and its solution is a prerequisite for the anticipated development of island tourism. As regards coastal tourism, the lack of water may lead to cases of "social wasteland" (abandonment of arable land, as occurred in the region of Hammamet), and to a serious drop in the level of groundwater supplying the sector in drinking water, causing salination through permeation of seawater (around Barcelona at the end of the season for instance, in the Balearic Islands, on the Aegean coast of Turkey, etc.).

The surface area covered by tourist installations seems considerable because of their location (though in fact their importance is more qualitative than quantitative) and the infrastructure required. Forests are threatened by fire, largely because of too many visitors.

Wildlife and plant life can also become victims of tourist development : underwater fauna because of the growing popularity of skin diving and near-shore flora by the expansion of marinas or the increased number of open berths (the Mediterranean basin is the second most important area for nautical tourism in the world, after the Caribbean).

From the socio-cultural viewpoint, some of the largest markets of origin lie outside the Mediterranean basin. However, they are very important in the basin because of their holiday style and cultural influence. It is not always easy to achieve a balance between these two aspects of the tourist industry as regards relationships between populations : mixing and mutual enrichment of cultures, or likelihood of destabilization or modification of the cultural identity.

The sometimes "synergetic" combination of these effects has, moreover, led experts to introduce the concept of "saturation" or "load limit" for some very popular tourist areas. In fact the impact on fragile environments could be reduced by foresighted integrated planning and sound management practices.

Will world tourism continue to develop at the same rate as in recent decades, and will the Mediterranean still remain the number one destination of international tourism ? With the growing concentration on the coast, what lines will Mediterranean countries follow when organizing their tourist areas : either laissez-faire (as was usually the case for the "rivieras"), or goal-oriented (concerted and planned development as in the case of the Languedoc-Roussillon, where the environment was incorporated into plans from the outset) ? Will the quality of the environment become one of the chief tourist resources, and how will conflict over use of sites be solved ?

V. TRANSPORT

The transport sector is sometimes described as "derivative" to the extent that it reflects the level of activity of the other economic sectors, but both on land and at sea it has a direct link with the environment. In the Mediterranean basin land transport has long been hampered by the compartmentalization caused by the relief, and only recently have roads (with often expensive infrastructure on account of the relief) made it possible to open up the region. Conversely, conditions have long been particularly conducive to the development of maritime transport and the establishment of a dense port network, whose fate depended on economic trends over the centuries. It comprised peninsular or island ports of national or regional importance (like the Piraeus in the first case, and Barcelona Naples or Izmir in the second) ; deep-water ports playing an international role and able to serve a large hinterland (Genoa, Marseilles, Venice or Salonika, for instance) ; and poles of industry or "industry-ports complexes" (such as Taranto, Augusta, Fos-Marseilles, Alexandria, etc). With the opening of the Suez Canal, then the emergence of oil, the Mediterranean became a transit area used by ships of more than twenty nations. Finally, air transport furthered the development of international tourism in the region and the conclusion of major infrastructure work.

As regards its relationship with the environment, which naturally depends on the kind of transport considered, the transport sector resembles industry to some extent because of the use of machinery and energy consumption, although site-coverage is larger, due to its widespread infrastructure.

Historical towns and, worse still, many new cities, have been unable to adapt to modern transport, and to the virtually unchecked advance of the automobile. Many Mediterranean cities, whose expansion is sometimes blocked by the surrounding mountains or hills (Genoa, Algiers, etc.), are particularly affected : traffic congestion, with its serious economic consequences and, above all, air pollution, which occasionally exceeds the critical level, especially in areas with temperature inversion.

Road transport, often preferred because of its door-to-door facilities -further encouraged in the Mediterranean by roll-on roll-offs- is a major source of air pollution (nitrogen oxide, lead, poorly-burnt hydrocarbons) and water pollution (spills, used oil, products carried by runoff on water-proofed surfaces). Transport infrastructure, organized into more or less dense networks, covers a large surface area, roughly equal to that of a province in France for instance. In the Mediterranean regions, the motorway

	AGRICULTURE	INDUSTRY	ENERGY	TOURISM	TRANSPORT
AGRICULTURE	Inter-agricultural exchanges Seeds	Raw materials	Raw matérials/ ethanol waste	Products	(Land)
INDUSTRY	Industrial inputs : fertilizer mechanization	Inter-industrial exchanges	Infra-structure Installations	Infra-structure Installations	Infra-structure Installations/ stock
ENERGY	Motor fuel Fuel	Fuel Motor fuel	Consumption within sector	through transport	Motor fuel
TOURISM	M	A R	C	H E	S
TRANSPORT	Distribution Inputs Products	Supplies (incl. energy) Dissemination of products	Energy transport	Transport of persons and products	

Source : Blue Plan

Table II-3 SIMPLIFIED MATRIX OF INTERACTIONS BETWEEN THE MAIN ECONOMIC SECTORS

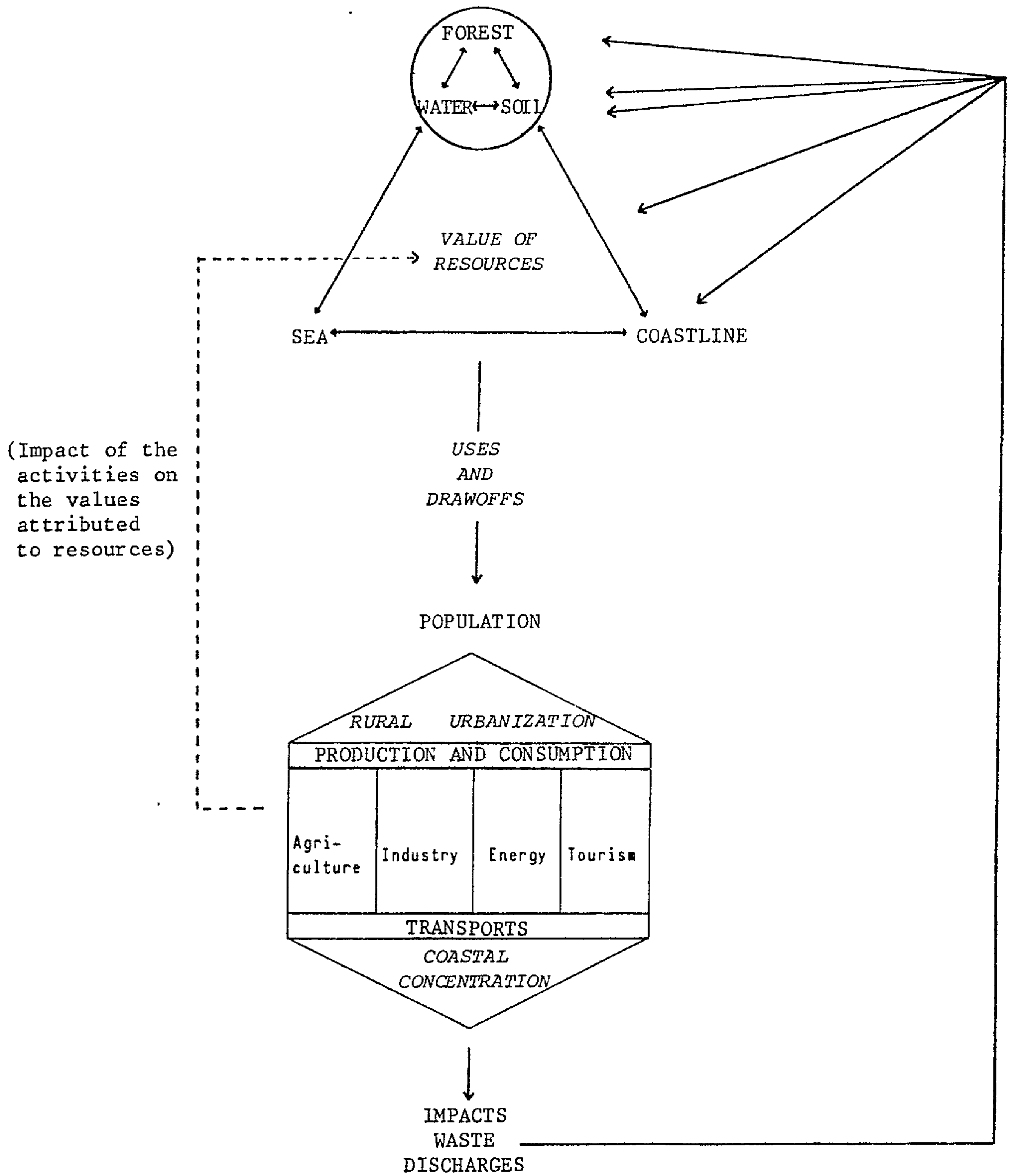


Figure II-5 Diagram of relationships between environmental components and development activities network is often developed at the expense of good agricultural land in the valleys, with large-scale civil engineering works which cause soil erosion or destroy the landscape.

Finally, while roads have undeniably brought men closer together by considerably reducing distances, they have also caused a number of disruptions, between people (two neighbouring villages separated by a motorway are no longer in touch), but especially among animals, by forming an impassable barrier, to the extent of breaking some ecological chains.

The transport of hydrocarbons by sea has a dual impact on the environment : pollution directly related to tankers, and pollution related to the specialized installations located on the coast, not many, but very large scale. The evolution of these impacts is closely linked to the future of hydrocarbons in the Mediterranean basin and throughout the world, and also to technological progress, such as the substitution of methane tankers by gas pipelines (for instance the trans-Mediterranean line between Algeria and Italy via Tunisia and Sicily.

How will be the various means of transport evolve ? Will the Mediterranean air transport networks extricate themselves from the predominance of major cities ? Will a thousand-seater aircraft be developed one day to offload crowds of tourists at airports specially built for their sole needs ? Will high-speed trains find their niche between the automobile and the aeroplane ? Will urban motor vehicles be electric tomorrow, to solve the problem of air pollution ? Is there room for new transport technologies ? These are many hypothesis for a limited number of scenarios.

VI. INTERRELATIONSHIPS

These economic sectors are not independent, as shown on the simplified matrix of their interactions (Table II-3). Industry supplies inputs for agriculture, such as fertilizers or machinery ; and agriculture provides industry with its raw materials. There would be no energy sector without transport, and no transport without energy.

Nor are the five main components of the environment independent of each other. Soil, water, and the forest form a schematic ecological system : the forest, for example, fixes the soil and retains water. If one of the components is degraded the other two are at risk. This ecological subsystem is itself related to what happens on the coast and in the sea. All the components of the environment are thus subject to dynamic interactions, which change with time under the effect of natural evolution, but now increasingly under the effect of human activity related to economic, social and cultural development. Nothing illustrates this system better than the increasing artificiality of the coast, which affects all the environments and the many relationships between them and man.

However, the complex relationships between the socio-economic parameters of development (growth, employment, infrastructure, etc.) and the environmental components must be explained in order to specify and interpret all meaningful interactions. The various components form environments. By attributing a value to all or part of these environments -currently an economic value in particular, but it could also be a religious, cultural or social value- man has transformed them into resources. By the use he makes of them, that is by his development activities, he modifies environments and resources through direct impact (drawoffs for example), or through waste, discharges, and so forth. In reality, the large number of environments, resources and human activities to be taken into consideration, bearing in mind that each activity can draw off or put back in several different environments, quickly leads to a very complex pattern. For the Blue Plan, however, it had to be simplified, the main point being to highlight and understand the relationship mechanisms of the most important "chains" or "feedback loops" for the environment, leading to a better understanding of the dynamics of the whole system.

Figure II-5 is an overall diagram of the main elements of the environment-development system in the Mediterranean basin. The scenarios will bring life to all these elements.

CHAPTER II.4

THE CHOICE OF THE "DIMENSIONS" AND TYPES OF SCENARIOS

Having specified what is meant by a scenario and defined the components chosen to represent the Mediterranean system, the next steps are :

- to identify the subjects on which the scenario hypotheses will focus,
- possibility to rank these hypotheses so that they contribute as effectively as possible to overall consistency.

Will the hypotheses focus on the environmental components ? The evolution of these components is in fact the "final product" of the analysis, and the hypotheses will concentrate on their behaviour or capacity, in the absence of more appropriate scientific knowledge on their possible evolution.

Will the hypotheses focus on sectors of activity ? In this case there is the possibility of lack of consistency and or redundancy, on the one hand because these sectors as already mentioned, are not independent of each other and, on the other, because they themselves depend on conditions further upstream and lie within a much broader context. In fact the hypotheses on the sectors will be "responses" -or the way agents adapt- to stimulii from this broader context.

The areas or topics on which the general hypotheses will focus, and which will act as variables, in broad terms, in the scenarios, are called "dimensions". The dimensions chosen must be both the most meaningful for the evolution of the Mediterranean system, and sufficiently open to lead to contrasting avenues for the future.

I. CHOICE OF THE MAIN DIMENSIONS

Since the main objectives of scenario formulation is to assess the effects of various development strategies on the Mediterranean environment, the first "dimension" chosen is the way in which this environment is taken into account by the various agents, governments, (central or local) public authorities, businesses, local populations, etc.

The impact of human activity on the environment is closely linked to the way in which these activities are distributed throughout the land, and this land is allocated among the various agents. The second "dimension" chosen is therefore spatial management.

Taking the environment and spatial management into account are in fact only two important aspects of national development strategies, which also aim at the organization of the various sectors of activity in terms of socio-economic objectives. Thus consideration of the environment and spatial management has to be positioned within the broader context of national development strategies, which are therefore the third "dimension".

Definition of the socio-economic objectives of development is itself influenced by demographic trends and the major population movements associated with migration and tourism. The starting point must therefore be hypotheses on demography, the level and structure of populations, and their movements (the fourth "dimension"), in order to define a range of development strategies.

METHODOLOGY : DIMENSIONS, HYPOTHESES AND SCENARIOS

The number of scenarios, i.e. possible combinations, grows very quickly. On the basis of five dimensions, two positions per dimension gives thirty two combinations ; three positions gives 243, etc. Most of these combinations are uninteresting, or even unrealistic. By limiting the exercise to a small number of well chosen combinations a sufficiently broad range of representative situations can be covered.

In the case of the Blue Plan scenarios, several hypotheses have been associated with the five dimensions. They are not necessarily independent of each other, which helps to maintain the consistency of these combinations. In addition, two positions seemed insufficient for some dimension, for which up to five different positions were considered in order to graduate better the scenarios.

Finally, when selecting combinations, preference was given, in addition to consistency, to diversity and contrast, inter alia when the logic of the combination of two hypotheses was not clear. In other words, black was often matched with black, or pink with pink, in order to increase the contrast.

The art of using the scenarios consists therefore, in the end, of judiciously mixing elements from one and the other, and of constructing composite and ... more probable scenarios, but with a less clear impact.

Can the process stop there ? The Mediterranean countries are not isolated from each other, or from the rest of the world, and they cannot formulate their national development strategies without taking into account the international economic context, which provides the last "dimension"

To summarize, five main "dimensions" were chosen in order to formulate the scenarios :
. *the international economic context,*
. the Mediterranean populations and their movements,
. nation development strategies,
. spatial management,
. consideration of the environment.

Various contrasting hypotheses, which seemed the most meaningful, were defined on the basis of these dimensions. Each of the five scenarios chosen was characterized by a certain combination of these main hypotheses. Moreover, the most important aspect in this first stage of "centering" was not so much the quantification of the hypotheses and possibly their indicators, as their formulation into a coherent and general set, able in turn to generate other downstream hypotheses, notably for the various sectors of activity.

A. THE INTERNATIONAL ECONOMIC CONTEXT

The Mediterranean countries, being very accessible to the rest of the world, are subject to many influences. While recognizing the importance of the political context, the influences chosen are primarily economic backed up naturally by technological ones. These influences are exerted by a few major agents, such as the United States, the Soviet Union, Japan, etc.

In the Mediterranean basin the major industrialized countries exert a special influence inter alia *on :*
. relationships among all the countries of the basin, which may lie either in a multilateral context (to the point of "collegiate" management) or a bilateral context (in which the economic or financial balance of power weighs more) ;
. commercial relations, permeated by either a free trade or protectionist bias, depending on the country or the circumstances, and often influenced by transnational corporations ;
. the growth rate of the countries as a whole, on account of the major industrialized countries' role of economic "locomotive"

The influence of the international economic context on the Mediterranean countries will be even greater since intra-Mediterranean economic relations are at a comparatively lower level.

Anticipated growth rates for the Mediterranean countries will partly depend on this international context, including many factors such as the price of oil and the possible trend of the energy market, the price of cereals and the movements of the agricultural market -these two markets affecting the Mediterranean producer and consumer countries in opposite ways- the commercial policies of the major industrialized or newly industrial countries, etc.

Some recent major trends should be borne in mind concerning the international context and relationships between industrialized and less developed countries, although strictly speaking they are not hypotheses that provide a basis for defining contrasting positions, used to distinguish between the scenarios :

. raw materials play a less important role in the world economy. The diminishing amount of material required for a given manufactured product, technological progress, the stabilizing effect of prices on substitution between products, and plentiful resources (contrary to the fears expressed in the first Club of Rome report in 1972) have all contributed to a comparative slackening of world demand and the slow erosion of prices (in 1986 raw material prices dropped to their lowest level ever compared to manufactured products ; the price of lead and copper, for example, were lower than in 1932) ;

. the industrialized countries are forced to undertake a thorough restructuring of their industry as will be seen later ; whole sectors, such as steel which seemed to be the very symbol of industry, have suffered long-term regression, while the service sector is experiencing strong growth. This has been reflected by weaker growth rates, the trend towards protectionism and structural problems of employment ;

. since trade is increasingly based on the transport of lighter weight, very diversified products, dynamic dispersal centres are appearing within the context of combined carriage. These centres are fairly distant from industrial production sites ; on the other hand, they are closely linked to decision-making poles in the tertiary sector, among which (in the Mediterranean too) port complexes continue to be a determining factor. Concentration around ports persists, to the advantage of a few large units likely to meet the requirements of complex management and distribution technologies ;

. finally, capital movements have been a major factor in the world economy. In 1986 for example, flows of floating capital stood at 170 thousand million dollars per day, i.e. twenty times higher than those of trade. The underlying influence of this "international economic complex" dimension, is considerable in all the scenarios.

B. MEDITERRANEAN POPULATIONS AND THEIR MOVEMENTS

The importance of the population issue in the Mediterranean basin dominated all thinking during scenario preparation, at the level of both the hypotheses (the population "dimension") and the findings (spatial distribution, impact, etc.). The dynamism of Mediterranean populations, characterized in the south and east by strong growth, means that in this region relationships between the population, development factors and the environment will be consistently changing both quantitatively and qualitatively. Starting from a still fairly modest basis, consumption as a whole will experience strong growth : consumption of food, water, energy, housing, transport, manufactured goods, etc. Wastewater and solid domestic waste will grow in line with consumption, and so should purification and conditioning facilities. Lack or inadequacy of these facilities could lead to the pollution of aquifers used for the water supply, the proliferation of parasites, even the spread of epidemics or deficiency diseases, all negative factors or curbs on development.

Hypotheses for the scenarios focused in the first place on the levels and age structure of Mediterranean populations, stemming from the interplay of birth and death factors, influenced in turn first by social underpinnings and behaviour, secondly, for some countries, by national population policies. Considering the slowness of demographic phenomena, the differences arising from the hypotheses are naturally a lot sharper for the farther 2025 horizon than for the year 2000, all the more so because many countries to the south and east of the basin will not yet have completed their demographic transition and will continue their population growth.

The second aspect of the population dimension on which hypotheses were based concerns the major phenomenon of urbanization (rates already over 50 % in most Mediterranean countries, in which the rural exodus is a dynamic factor) : trends in urbanization rates at the national and regional level, and also kinds of urbanization, starting with the distribution of urban population among different-sized cities (problem of the megalopolis or countermagnets, the optimal size of cities, etc.).

Both a cause and effect, urbanization permeates all development and aggravates relationships between development and the environment as mentioned above (inter alia, interactions with water resources), as well as site coverage and the degradation of these areas, encroachment on agricultural land or forest around cities, deterioration of the landscape, without mentioning social aspects which naturally go beyond the context of this report. (The importance of urbanization should not however overshadow the fact that rural overpopulation also has serious effects on the environment.)

"Coastal concentration" has similar effects, since it includes heavy urbanization, as well as industrial infrastructure (access to the sea and cooling methods), transport infrastructure (ports, railways, airports), and tourist activities (seasonal movements of the population).

The increasing mobility of populations, between countries, and between cities and the countryside or recreational areas, implies the systematic organization of urban and interurban transport, suited to comparatively contrasting hypotheses. On the other hand, the phenomenon of worker migration and employment are mostly perceived as results of various development options or strategies (migration phenomena are nevertheless the subject of hypotheses on emigration/immigration policies).

C. NATIONAL DEVELOPMENT

National development strategies are partly restricted by the international context through economic and technological relations and, depending on the country, by interdependence ties (import or export of foodstuffs, energy, raw materials, manufactured goods, etc.). Within these constraints, the strategies correspond to a more or less goal-oriented reaction on the part of national, regional or local communities to the challenge of social needs and objectives.

This "dimension" is no doubt the one which lends itself best to a variety of hypotheses, either at national or sectoral level, and to the diverse interplay of numerous agents. A number of hypotheses were chosen for the scenarios, as not all could be kept :

. type of development, i.e. the choice of "model",
. the main sectoral options, and in particular :
- agricultural strategies and the place of agriculture in development plans,
- types of industrialization, including the distribution in the economy of large companies (transnationals in particular) and small- and medium-sized firms in the formal or informal sector,
- energy choices, with the distribution among various possible sources of supply, and the role of electricity,
- strategies for developing tourism, including their economic effects,
- choices for the organization and possible co-ordination of the transport of goods and individuals,
. the intensity of intra-Mediterranean, North-South or South-South co-operation.

D. SPATIAL MANAGEMENT

Management of Mediterranean areas is set within the context of the management of the coastal countries national territories, with a set of physical planning regulations, including occasionally the definition of green spaces earmarked to be conserved and protected (for example in Israel in 1965, then in Cyprus, Tunisia, France, recently in Malta, Greece, etc).

Among the main hypotheses on spatial management which help to characterize the scenarios, a distinction should be made between :
. the extent to which space planning policies are goal-oriented (intentions and implementation),
. the nature of the desired objectives, such as controlling urban expansion, keeping up agricultural zones (especially around cities), desertification control, or achieving a better balance between :
- the "north" and "south" in some countries (even if the dividing line is not as horizontal as in the case of Italy),
- urban and rural areas
- the hinterland and the coast
. the kind of resources deployed.
These may include the planned construction of new towns, the development of medium-sized towns, the designation of areas to be developed as a priority, the prohibition of sprawling growth, large-scale reforestation.

Land tenure policies should also be mentioned, on which types of urban expansion, farming, industrial installations, tourist development policies, transport infrastructure and so forth all depend.

E. TAKING THE ENVIRONMENT INTO ACCOUNT

The most important hypothesis for the study as a whole, considering its environmental goals, concerns the greater or lesser degree of attention given to environmental protection and the management of natural resources, chiefly within the socio-economic decision-making process. Consideration may be given at various levels :
. that of the international community, gradually outlining a "universal or world discipline" ; protection of the ozone layer is a good example (Montreal Convention, 1987). People no longer feel concerned solely about their "close" environment, but also by collective hazards and issues, which reflects growing awareness ;
. that of the European Community, with enhanced co-operation among states (some seventy directives passed in Brussels over the past fifteen years or so), and the review of the treaties of Rome in 1987 (decisions no longer taken unanimously, but on a majority vote, and recognition of the environment as a subject of community legislation) ;
. that of states which, especially in the Mediterranean basin, enacted laws for the protection and conservation of the natural and cultural environment, in some cases since the beginning of the century (and in virtually all countries since 1960, strengthened since 1975 by special acts for coastal protection and the increasingly common obligation to undertake impact studies (in Greece and France since 1977, Israel since 1981, Algeria since 1983, etc.) ;
. that also of regional or local authorities, which have gained importance over the past twenty years (in different ways depending on the country) and now, directly involved, are increasingly and directly responsible.
The emergence of Mediterranean co-operation is also to be considered.

The environmental policies overed by the scenario hypotheses may be converted into standards and restrictions, regulations (the polluter pays principle), tax incentives or equalization, or the establishment of new institutions such as coastal conservation agencies, basin authorities, regional or intercommunity water and sanitation boards, forestry commissions, etc.).

Policies may be implemented through installations (sewage plants or ballast-water reception facilities), consideration of the environment in agricultural or industrial processes (clean technologies), or the development of new kinds of resource management (recycling, for instance).

Their level of efficiency, and application methods and schedules in particular (anticipated and ... real), are in fact as important as the kind of policy : hypotheses on the effective application of the Mediterranean Action Plan Protocols, especially the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources, will provide the opportunity to distinguish among scenarios and a means of envisaging the consequences of possible delays in protocol application.

The fact that two of the five main dimensions for all the scenarios are spatial management and consideration of the environment clearly indicates that they are not regarded as mere outcomes of the economic hypotheses, but are virtually on par with them. The policies associated with them are true factors of development, particularly in the alternative scenarios.

II. KINDS OF SCENARIOS

The choice of hypotheses focuseing on the "dimensions" and their coherent combination around a few main themes, such as strong economic growth, with some consideration given to environmental protection, or economic growth based on international co-operation with a concern for resource conservation, led to identifing two kinds of scenario :

. trend scenarios,
. alternative scenarios.

Trend scenarios describe evolutionary processes that do not diverge radically from trends observed hitherto*.

Alternative scenarios, on the contrary, describe evolutionary processes which deviate from the trends observed up to now, and are characterized by a more goal-oriented approach on the part of Mediterranean governments at both the domestic and the international level.

These scenarios, logically developed throughout the period under review (forty years), clearly underestimate the adaptation capacity of the socio-economic system. In reality, the likelihood of an impasse here or there would lead from one scenario to another, although experience shows that trends are only modified after being identified, i.e. when it already is already too late. Exploration of the scenarios up to the end of the period without changing the initial trends makes it possible to assess the reaction capacity of the system and to identify the kinds of options that facilitate adaptation, in other words to delimit the "range of possibilities".

* This is less a matter of statistically established trends -although the scenarios indirectly depend on them- than of policies or strategies, atmosphere of co-operation, etc.

A. TREND SCENARIOS

The economic engine of the trend scenarios is the expansion of an international market still characterized by American-Japanese economic and technological predominance. The dynamism of the American economy would enable the United States inter alia to maintain a long-lasting lead over Europe in high technology. In this context, whether from a political, economic, cultural or other viewpoint, Europe does not manage to assert itself as much as it would like. Similarly in the Mediterranean, individual countries in both the north and south adapt more or less well to the joint United States-East Asia predominance.

In these circumstances, it seemed that three trend scenarios should be identified, their differences depending on how far the above pattern was developed. The reference trend scenario T-1, the continuation of current trends, lies between two diverging scenarios. In the worse trend scenario T-2 international economic growth remains weak, especially because the dominant partners in the world economy are unable to co-ordinate their polititial, financial and macroeconomic policies. Consequently, the problem of Third World debt remains acute. Conversely, in the moderate trend scenario T-3, a better co-ordination of economic policies between the European Community, the United States and Japan makes it possible to achieve comparatively stable economic growth.

As regards the environment, the three trend scenarios lead to an adjustment of government efforts depending on economic possibilities, greater in the moderate trend scenario T-3 than in the worse trend scenario T-2. In all cases, it should be considered that the strongest economic and technological partners may also press for the adoption of certain environmental standards, a handicap for various national economies.

Only the two extreme scenarios -the worse trend T-2 and the moderate trend T-3- were considered for some aspects of the exercise, the reference trend scenario then being an intermediate or average situation between the two.

B. THE ALTERNATIVE SCENARIOS

The main feature of the two alternative scenarios is the greater influence of the Mediterranean countries, facilitated by the existence of a multipolar world structure in which Western Europe, the United States, Japan and perhaps one or two other countries or groups of countries assert themselves. In particular, political Europe is more visible, although playing a different role in each scenarios.

The two alternative scenarios differ essentially by the kind of relations established among the Mediterranean basin countries, namely :

- for reference alternative scenario A-1, a "Mediterranean" concept of relations among coastal countries, the countries of the European Community and other Mediterranean countries, whether heavily industrialized or industrializing, striving to forge together a region of harmonious development with the optimal opening up of exchanges, and agreement on migratory flows. In the reference alternative scenario, A-1, Mediterranean exchanges flows mostly north to south, since the European Community has a certain spillover role.
- for the "integration" alternative scenario A-2, a more "regional" concept of these relations with economic co-operation involving preferably groups of countries, for example the countries of the enlarged European Community, the Maghreb countries, the Arab East, etc., with maximal opening up of exchanges and migration within these groups, while maintaining certain barriers between the groups, as countries wish to

protect themselves to some extent from international influences. In the A-2 scenario, the role of the European Community is less predominant and coastal countries that are not members of the European Community manage to establish comparatively well-integrated subgroups.

A certain degree of Mediterranean autonomy exists in both cases, weaker in the integration alternative scenario A-2, but perhaps more effective initially in terms of growth in the reference alternative scenario A-1 because of the economic and technological importance of Europe.

Development strategies in the alternative scenarios may be termed "self-reliant", understood here as the search for complementarity between the development of a "modern" sector, patterned on that of the advanced industrialized nations, and the development of small- and medium- sized businesses in the formal and informal sector within urban societies. This is perhaps easier in the integration alternative scenario A-2 - since integration allows for better planning and larger markets- than in the reference alternative scenario A-1 (this requires good understanding of two sectors and their dynamics).

However, the self-reliance concept also implies reduced dependence, food or otherwise, including by the gradual adaption of behaviour and life-styles, whether at the level of individual or of collective consumption. The two alternative scenarios therefore assume a greater mobilization of Mediterranean resources, within the context of a more goal-oriented "production geography" and a more determined struggle against waste or degradation of resources -areas in which innovation has a major role to play- and the long-term growth in intra-Mediterranean exchanges.

In the alternative scenarios, physical planning and environment policies are better incorporated into decision-making processes and development plans. For example, preference is given systematically to low pollution manufacturing processes, biological processes, water-saving irrigation methods, or solutions that are more "systemic" than mechanical.

CHAPTER II.5

POPULATION HYPOTHESES

Population trends are the most important data on the Mediterranean basin.

I. THE MEDITERRANEAN COUNTRIES IN THE WORLD POPULATION

During the past decades, the world population experienced unprecedented growth rates. This demographic upsurge stemmed basically from natural population movements in the less developed regions. In the second half of the 1960s, for example (maximal growth period, except for Africa), these regions had an annual growth rate of 2-3 %, whereas the most developed regions had a rate of less than one, falling continuously since the 1950s post-war baby-boom. The graphs in Figure II-6 illustrate recent trends of various population indicators and their projections up to 2025 for the world and for the Mediterranean countries, according to the average variant of the latest United Nations population projections.

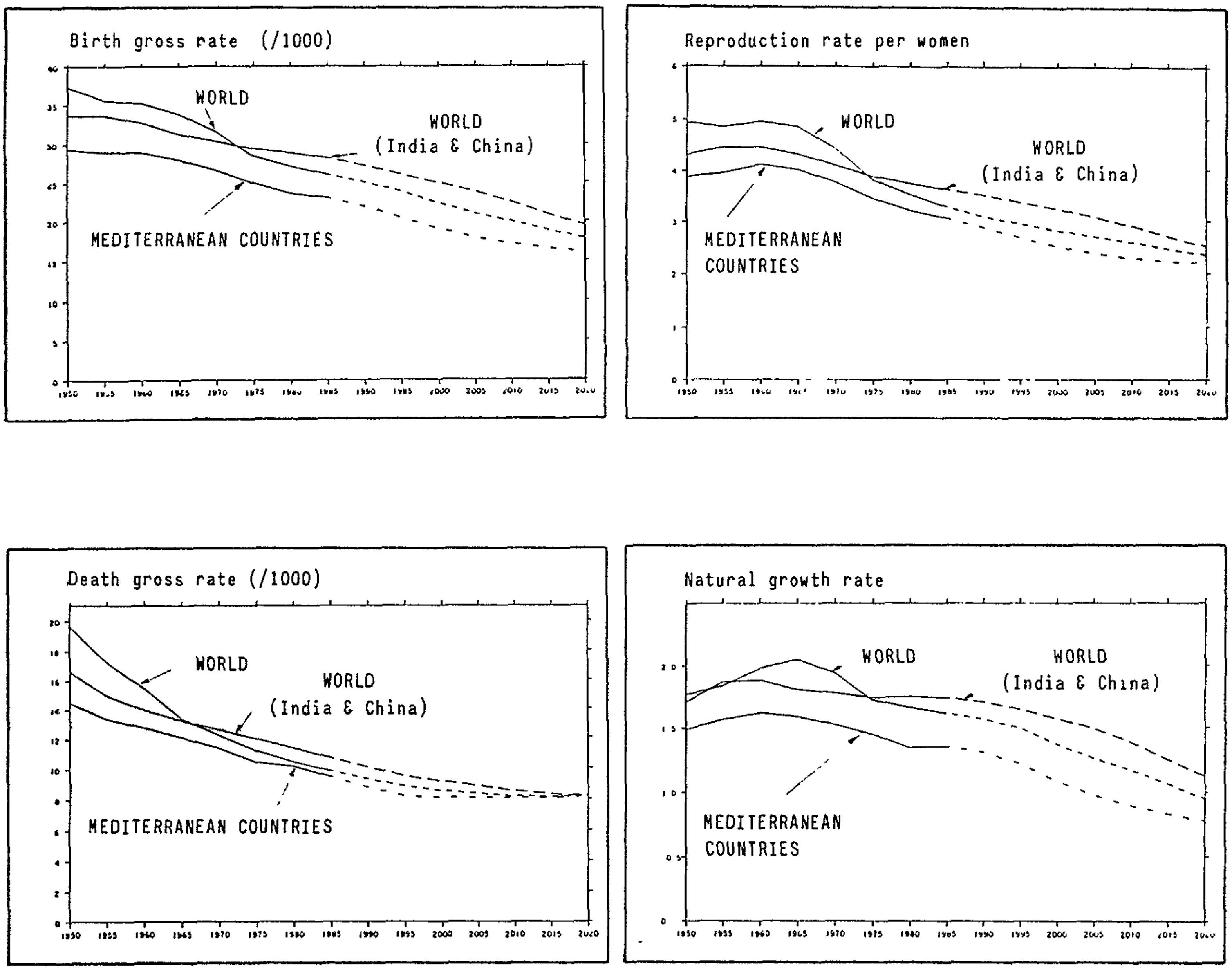
Declining fertility often goes along with the appearance of new generations with a better education and higher standard of living.

Technical and sanitary progress has, in addition, contributed significantly to prolonging the life span. It took more than a century and a half for average life expectancy to rise from 30 to 60 years in Europe, and less than half a century in the less developed countries.

Demographic transition -or the change from a traditional pattern of demographic balance, with high death and fertility rates, to a modern pattern of demographic balance, with low death and fertility rates- is generally over in the most developed regions, and is slowly taking place in the less developed regions over recent decades. Thus, in many cases, the less developed countries will reach their highest growth rates in the second half of the twentieth century, whereas the most developed regions will experience a decline, sometimes even severe, in fertility during the same period.

Table II-4 helps to place the Mediterranean in this context : it gives population figures in 1950, 1980, and 1985, forecasts for 2000 and 2025 (United Nations mean variant), and growth rates during the corresponding periods for the whole world, the most developed countries, the less developed countries, and the Mediterranean countries as a whole. Dependency ratios are also given for the five different years under review (proportion of the population from 0 to 14 years old and over 65 as compared to the population of working age, between 15 and 64).

Finally, it should be recalled that with the United Nations mean variant, world population as a whole would only reach the "stationary" stage of about 12,000 million in the second half of the next century, and would then fluctuate around this level.



Source : United Nations. Formulation : Blue Plan

Figure II-6 World demographic indicators

Region	Population (thousands)					Annual average growth rate (%)				Dependency ratio 0-14 + 65 + / 15-64				
	1950	1980	1985	2000	2025	1950/1980	1980/1985	1985/2000	2000/2025	1950	1980	1985	2000	2025
Whole world	2.515.652	4.449.568	4.836.646	6.121.813	8.205.764	1,92	1,68	1,58	1,18	0,66	0,70	0,65	0,59	0,53
More developed regions	831.857	1.136.668	117.381	1.276.647	1.396.476	1,05	0,65	0,56	0,36	0,55	0,53	0,50	0,52	0,59
Less developed regions	1.683.796	3.312.899	3.662.835	4.845.166	6.809.289	2,28	2,03	1,88	1,37	0,72	0,77	0,70	0,61	0,51
Mediterranean countries	211.943	332.659	355.591	433.484	547.097	1,51	1,34	1,33	0,94	0,60	0,67	0,63	0,59	0,51
Share of Mediterranean countries in world pop. (%)	8,4	7,5	7,4	7,1	6,7	-	-	-	-	-	-	-	-	-

Source : United Nations. Formulation : Blue Plan

Table II-4 WORLD AND MEDITERRANEAN POPULATION TRENDS

II. POPULATION OF THE MEDITERRANEAN BASIN

Rather than applying the United Nations distinction between more developed and less developed countries to the Mediterranean basin, study of the demographic features of the eighteen coastal countries led to the identification of three "demographic" groupings helping to present the findings of the evaluations and population projections, namely :

Region A : Spain, France, Greece, Italy, Yugoslavia ;
Region B : Algeria, Egypt, Libya, Morocco, Syria, Tunisia, Turkey ;
Region C : Albania, Cyprus, Israel, Lebanon, Malta, Monaco.

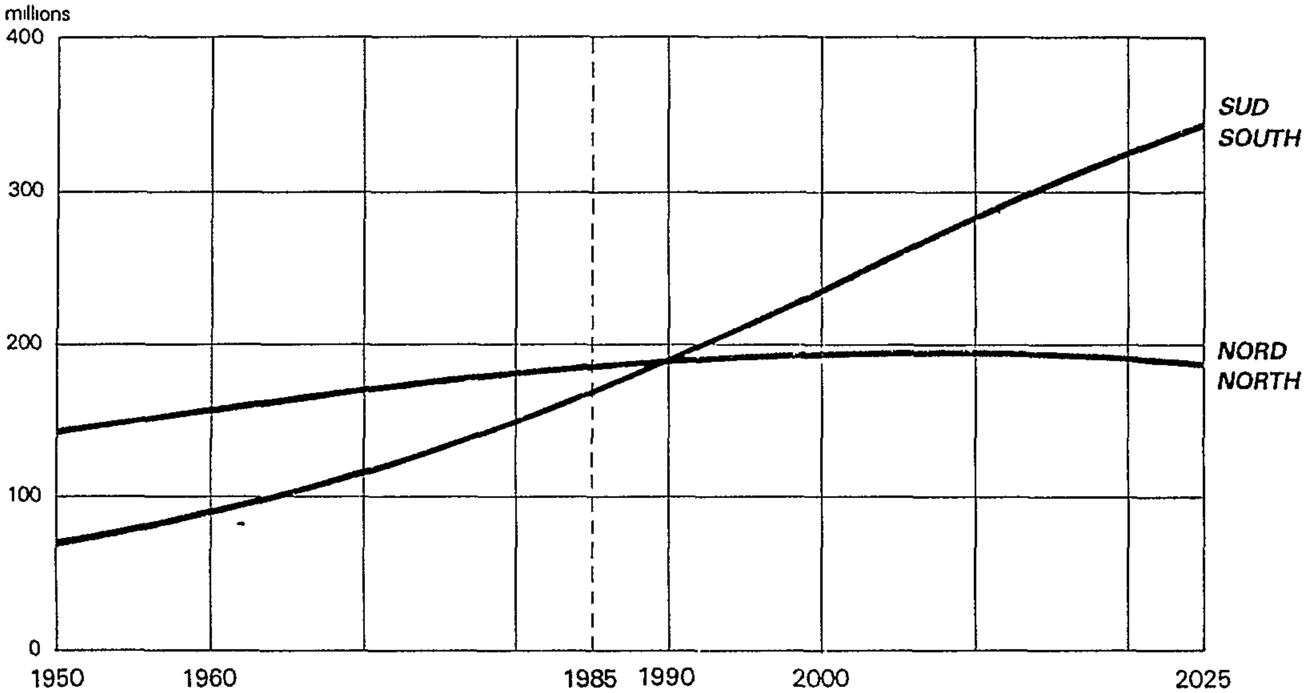
The population of these three groups are given in Table II-5 for 1950, 1980, 1985, 2000 and 2025 (projections were based on the United Nations mean variant for 1984 estimates and projections).

As a whole, the population of the Mediterranean basin increased by 68 % in thirty-five years from 1950 to 1985, i.e. an annual average growth rate of 1.5 %. The real rate peaked towards the end of the 1960s. It slowly declined since, lower than that for the world as a whole, 1.9 %, but should remain comparatively high, in the region of 1.3 %, between 1985 and 2000, and around 0.9 % between 2000 and 2025.

This trend varies according to the three regions. The countries in region A have had distinctly lower growth rates than those in regions B and C : 0.8 % compared to 2.5 % and 2.3 % respectively between 1950 and 1985. In 2025, region A will have no more than 36 % of the total population of the basin, compared to 66 % in 1950 and 52 % in 1985. Conversely, in 2025 region B alone would comprise nearly 60 % of the entire Mediterranean basin population, i.e. twice its current number, and nearly five times more than in 1950.

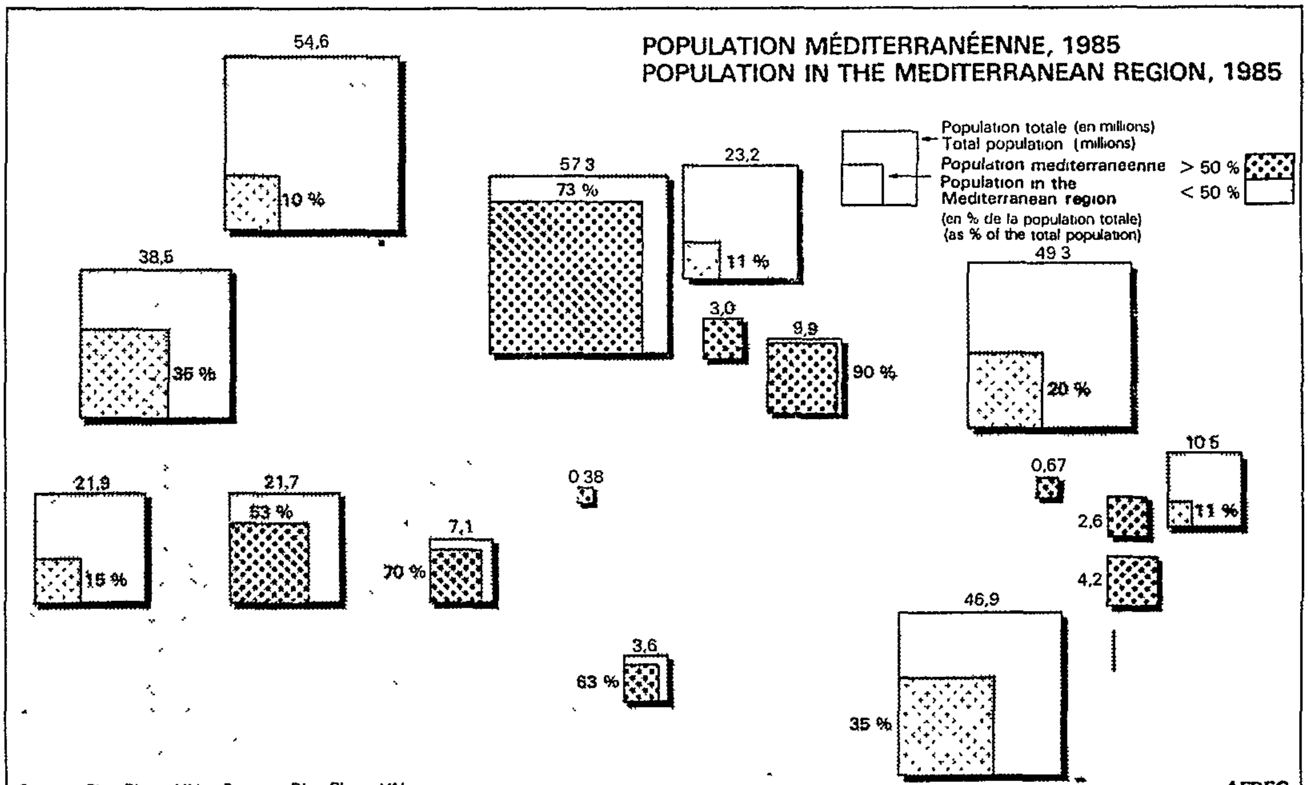
POPULATION DES PAYS MÉDITERRANÉENS
Évolution 1950-1985 ; scénario moyen 1985-2025

POPULATION IN THE MEDITERRANEAN COUNTRIES
Evolution trends 1950-1985 ; average scenario 1985-2025



Source Plan Bleu - UN
Source Blue Plan - UN

Le rythme d'accroissement de la population de l'ensemble des pays méditerranéens semble s'atténuer à partir de l'an 2000 La population des pays du Sud dépasse celle des pays du Nord à partir de 1990
The rate of population growth of the Mediterranean countries as a whole seems to level off from the year 2000 The population of the southern countries exceeds that of the northern countries as from 1990



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Regions	Population (millions)					Growth factor (1980=1)			
	1950	1980	1985	2000	2025	1980	1985	2000	2025
Total Mediterranean countries	212	333	356	433	547	1.00	1.07	1.03	1.64
of which									
Region A	140	180	185	194	199	1.00	1.03	1.08	1.11
Region B	67	142	161	226	329	1.00	1.13	1.59	2.32
Region C	5	10	11	14	19	1.00	1.10	1.40	1.90

Sources : United Nations, Blue Plan

Table II-5 TREND OF THE TOTAL POPULATION OF THE COUNTRIES OF THE MEDITERRANEAN BASIN
(United Nations mean variant)

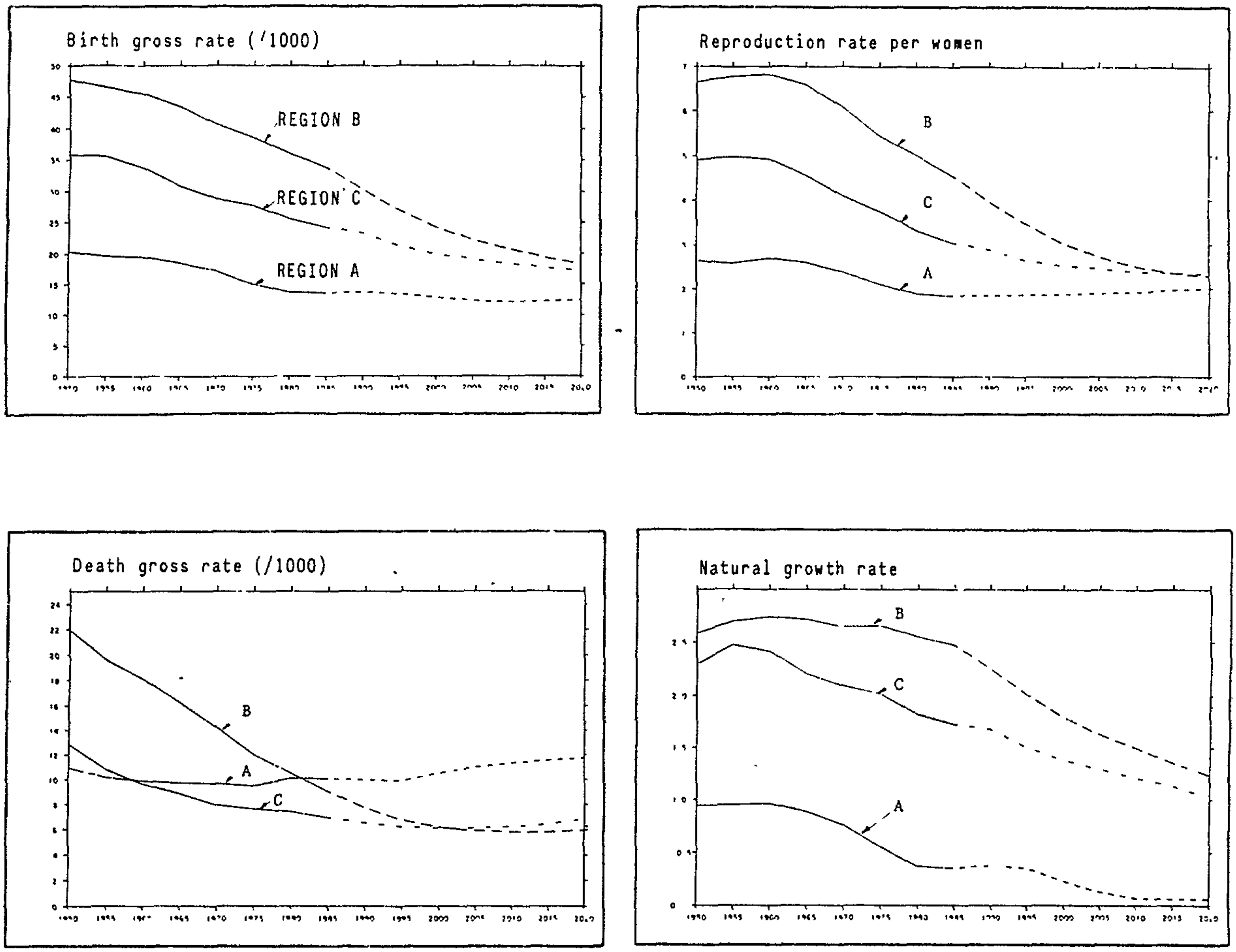
Fertility and mortality trends

Current fertility and mortality levels and trends are very different in countries to the north of the Mediterranean basin and in those to the south and east.

During the period 1960 to 1985, fertility plummeted in group A (Figure II-7), starting for most of these countries from the mid-1960s and stemming, on the one hand, from the decline in the marriage index and, on the other, from the voluntary reduction in the number of children per family.

During the 1974-1985 period, the fertility rate in France, Italy and Spain continued to fall, with variations according to the country, finally to reach levels below the replacement threshold (2.1 children per woman of childbearing age). The same situation as in Italy, where the estimated fertility indicator fell very early on, reaching the extremely low level of 1.42 children per woman in 1985, is now observed in Spain (1.71 in 1983), both countries having started with comparatively high rates of 2.4 to 2.9 children per woman. Greece, which long had a surprising stable fertility rate (2.1 to 2.3) has now reached a level insufficient for long-term replacement. Finally, Yugoslavia has joined the other industrialized countries. In France, however, a very slight recovery has been observed recently compared to the lowest ever recorded in 1983 (1.79).

For the countries in the south and east of the basin, the decline in fertility is more or less general and affects all the countries, even those where signs of stabilization were observed (Algeria, Libya, Morocco and Syria). The extent of the decrease varies from one country to another, but it seems that for some of these countries the downturn in the estimated fertility indicator has accelerated since the 1970s. In Morocco, for example, the indicator fell from 7.2 children per woman to 5.7 in twenty years (the crude birth rate dropping from 4.61 % to 3.86 %).



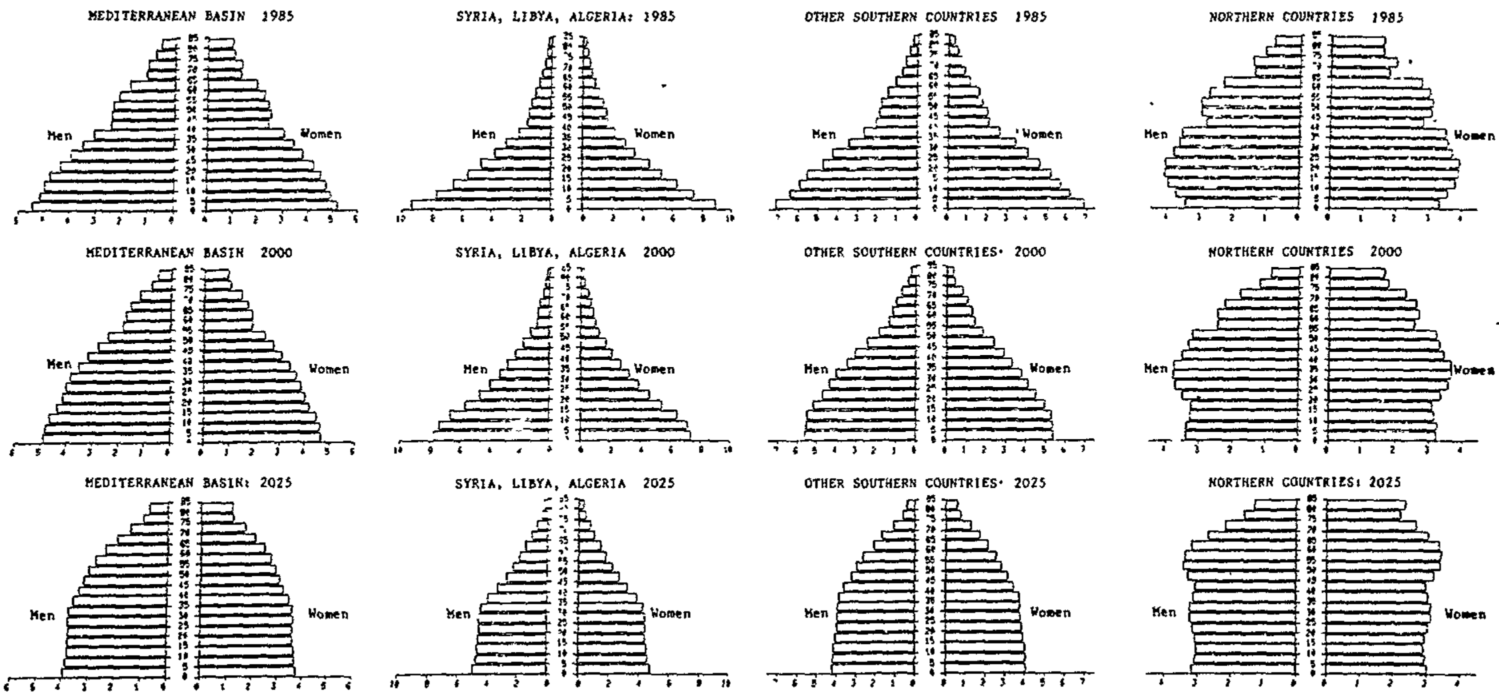
Source : United Nations. Formulation : Blue Plan

Figure II-7 Demographic indicators by major Mediterranean region

COUNTRY	SCENARIO T1	SCENARIO T2	SCENARIO T3	SCENARIO A1	SCENARIO A2
REGION A SPAIN FRANCE ITALY GREECE YUGOSLAVIA	F	F	M	M	H
REGION C MONACO MALTA ALBANIA CYPRUS LEBANON ISRAEL	M	M	M	M	M M M M M M
REGION B TURKEY SYRIA EGYPT LIBYA TUNISIA ALGERIA MOROCCO	M	H	M	F	F

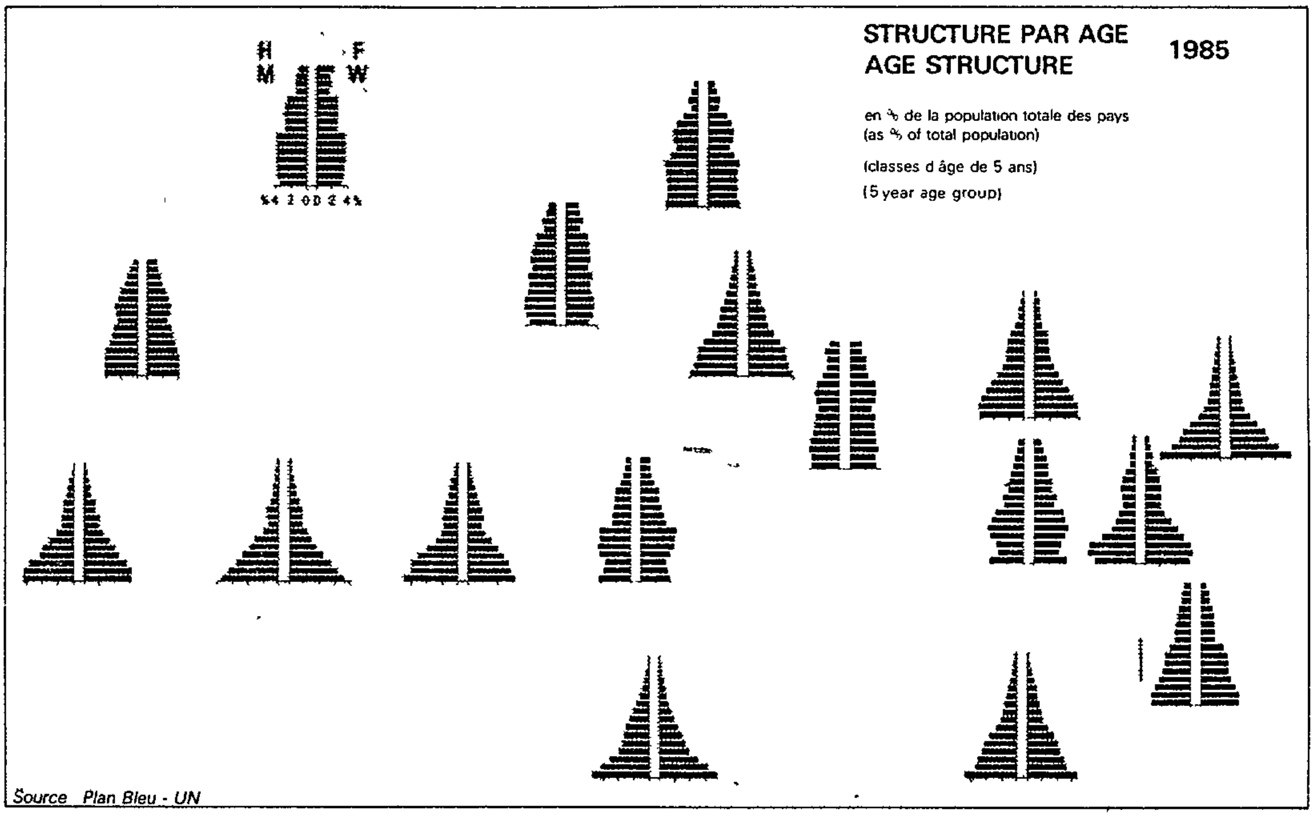
L : Low ; H : High ; M : Medium
Source Blue Plan

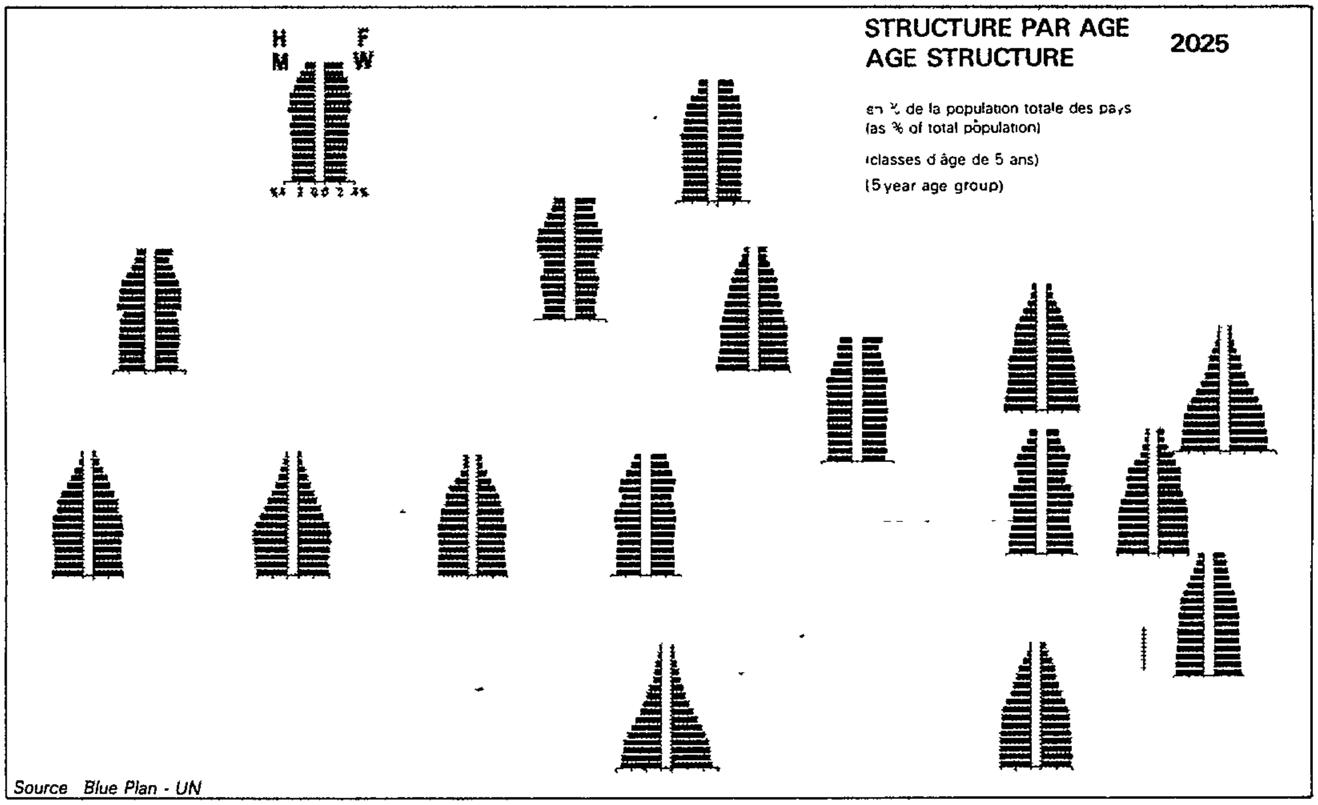
Table II-6 FERTILITY HYPOTHESES OF THE UNITED NATIONS POPULATION DIVISION IN THE FIVE MEDITERRANEAN SCENARIOS



Source : United Nations. Formulation : Blue Plan

Figure II-8 Trends of the various kinds of population pyramide in the Mediterranean





En 2025, la structure par âge des populations des pays du Sud se rapproche de celle des pays du Nord
In 2025 the age structure of the populations in the southern countries becomes similar to that of the northern countries

The countries in group B have three points in common :
. they have all entered into a phase of declining fertility ;
. their estimated fertility indicator remains very high, usually more than five children per woman ;
. a major difference remains between fertility in urban and in rural areas.

In Egypt, for example, the estimated fertility indicator in 1976 was calculated at 5.52 for the country as a whole, but at 3.89 for Cairo and Alexandria.

In the group C countries, decline in fertility has been uneven and irregular. Cyprus has a fertility rate similar to that of Greece, whereas Malta's has been falling since the 1950s. In Israel, the drop is noticeable but the rate remains high (3.85 in 1960, 3.14 in 1980).

There was a general drop in mortality throughout the Mediterranean countries between 1950 and 1980. An increase of 7 to 12 years in average life expectancy has been recorded in the countries to the north of the basin, and of 9 to 18 years in the other countries. Major regional discrepancies exist, however, between general mortality and that of infants and children, as well as between sexes and between urban and rural areas. Urban concentration, with possibly substandard living and hygiene conditions, may sometimes leads to higher mortality, despite a larger number of doctors and hospitals.

The downswing in mortality means the increasing coexistence of several generations, with many consequences for economic and social planning.

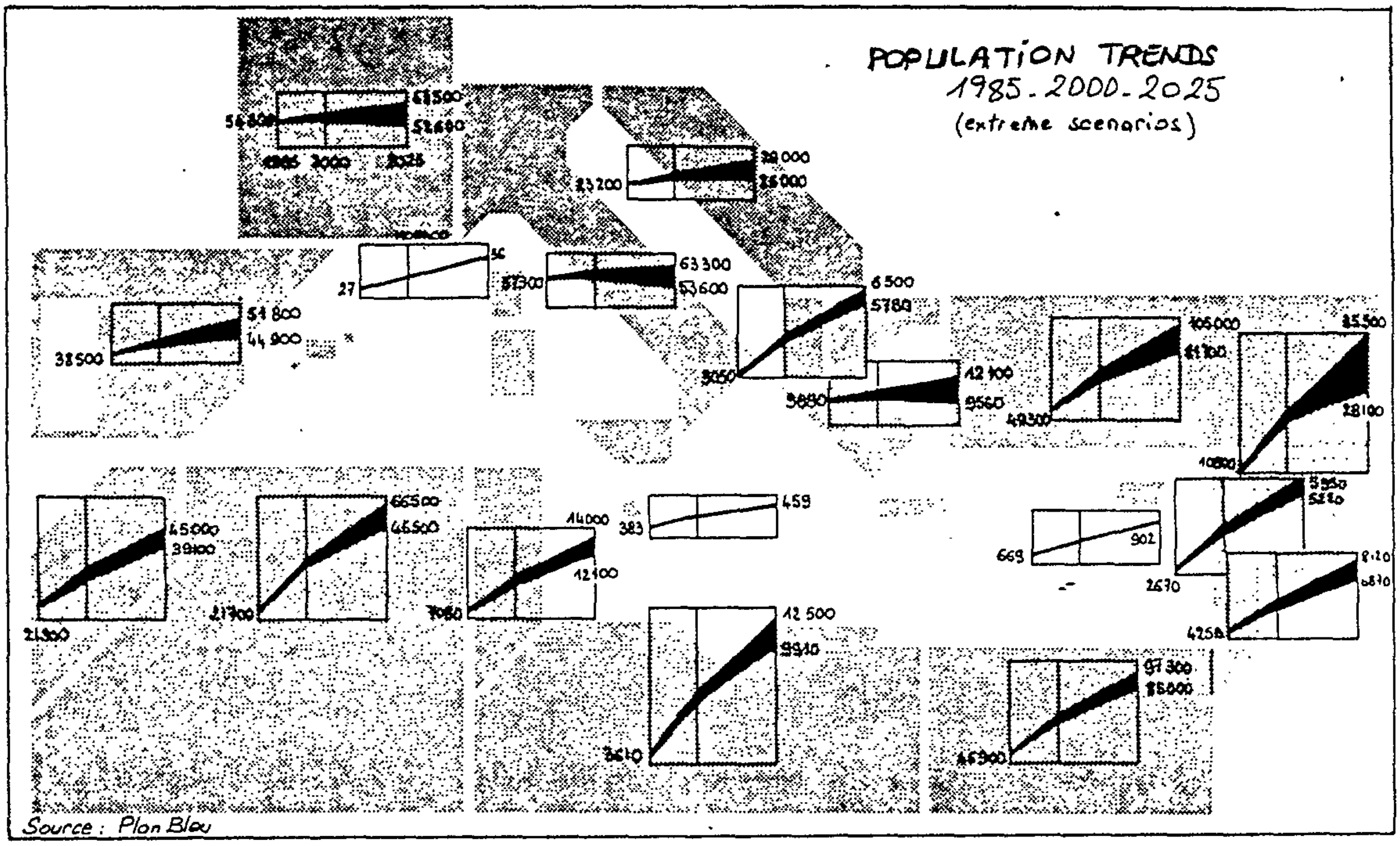
International migration

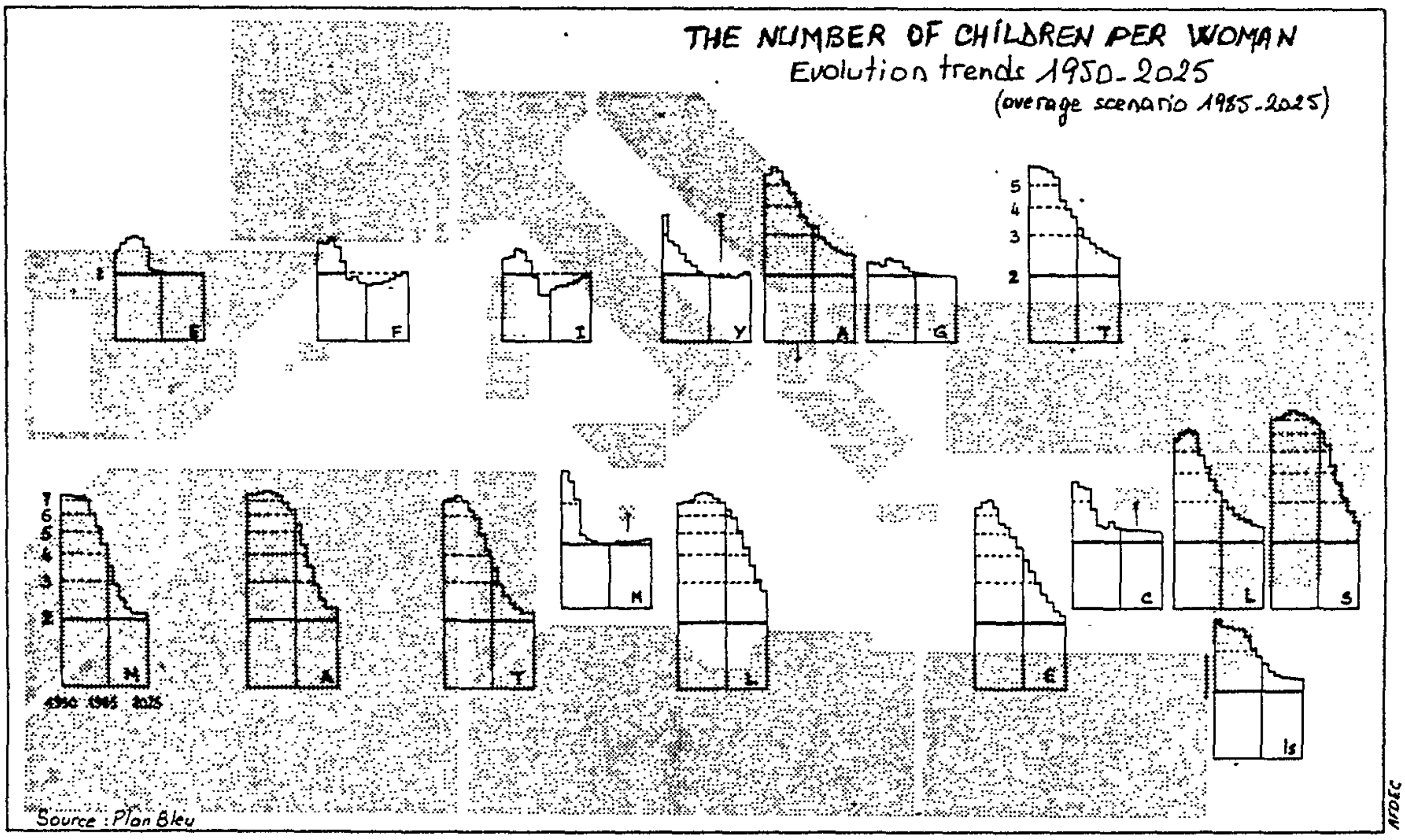
International migration is the third element, after the fertility and mortality, for assessing the population prospects of the Mediterranean basin countries. The subject is so complex it has to be confined to a few considerations, identifying the elements needed to construct the scenarios.

Since the 1960s, a considerable proportion of the poorly skilled manual workers in the countries of north-west Europe have been immigrants from other areas of the Mediterranean region. In these areas, agriculture was the main source of income and employment ; most industrial activities were still incipient. Thus is a little over half the foreign population in the EEC member states is currently of Mediterranean origin).

Changes in economic structures has brought about a reversal of the migration situation in some of the southern European countries (Spain, Italy and Greece), which are now receiving immigrants, especially nationals from the countries on the southern side of the basin. In addition, trends in socio-economic differences between the north and south, and the fresh dynamism of small- and medium-sized businesses brought about by the enlargement of the European Community, imply that recourse to clandestine workers will continue. This involves moreover a rather skilled labour force, whose educational level is constantly improving, than manual workers.

On the other hand, the part played by the Arabian-Persian Gulf countries and Libya up to 1986 in receiving foreign labour has been threatened by cyclical variations in oil prices.


POPULATION TRENDS
1985-2000-2025
(extreme scenarios)
Source : Plan Bleu


THE NUMBER OF CHILDREN PER WOMAN
Evolution trends 1950-2025
(average scenario 1985-2025)
Source : Plan Bleu

A table showing the foreign population legally resident in the Mediterranean countries at the beginning of the 1980s, by country and by major region, is given as an annex.

Migration flows are now subject to controls, on the part of both the country of origin and the host country. New regulations on international migration are being organized through bilateral agreements. But the interests of the countries of origin and the host countries no longer coincide with the migrants' wishes and the persistence of clandestine migration indicates the limitations these measures. Immigration and the employment of labour follow more the laws of the market than administrative regulations.

Migration is therefore a very complex dynamic process. Recent experience of immigration in Europe or that to the Arabian-Persian Gulf and Libya does not seem to provide models on which an assessment of future prospects could be based. Neither current economic and socio-cultural conditions nor the existing geopolitical context help to predict migration flows in the coming decades. It seems in fact that a new phase has begun in the history of migration, one which will be characterized by the possible social integration of the majority of foreign populations ; this does not exclude the fact that economic needs or the attitudes of some social groups may generate new South-North or South-South migrations.

III. THE CHOICE OF BASIC HYPOTHESES FOR THE SCENARIOS

The United Nations population forecasts used to establish the Mediterranean basin population hypotheses for the scenarios are based on :

- a single mortality hypothesis, called the trend hypothesis : an increase of 2.5 years in life expectancy every five years up to 62.5 years, then a sliding scale of increases until a more or less stable level of 79 years (75 years for men and 82.5 years for women) ;
- three fertility hypotheses, termed respectively average, high and low : fertility would fall fairly fast in the less developed countries, and would end by rising sooner or later in the most developed countries, until it fluctuates around "replacement" levels, i.e. crude reproduction rate equal to one. The United Nations forecast discounts the possibility of unexpected eventualities such as war, famine, epidemics, etc. ; prior events however leave their mark on the population pyramids.

The consistency of these population hypotheses with the conceptual framework of the Blue Plan scenarios was checked, and the fertility variants are given in Table II-6.

This overall pattern reflects inter alia the assumed relationships between demographic reactions and the economic conditions or development strategies of the various Mediterranean societies for each scenario.

In the worse trend scenario T-2, for example, persistence of the fertility decline in the countries to the north of the basin, and the slowdown of this decline in the countries to the south and east, were linked to slow economic growth. Conversely, in the integration alternative scenario A-2, a recovery of fertility was assumed in the north, together with an acceleration of the fertility decline in the south and east through the combined effects of education, mobility and modernization, with a long-term convergence of all the Mediterranean countries towards the replacement threshold. Although somewhat arbitrary, it seemed interesting to explore in at least one scenario the hypothesis of a recovery of fertility in the north (the possibility of other reversals was not considered).

Country	Population	SCENARIO T1			SCENARIO T2			SCENARIO T3			SCENARIO A1			SCENARIO A2		
	1980	1985	2000	2025	1985	2000	2025	1985	2000	2025	1985	2000	2025	1985	2000	2025
SPAIN	37.400	38.500	41.900	44.900	38.500	41.900	44.900	38.500	42.200	46.000	38.500	42.200	46.000	38.500	43.900	51.800
FRANCE	53.700	54.600	55.200	52.600	54.600	55.200	52.600	54.600	57.200	58.400	54.600	57.200	58.400	54.600	58.300	63.500
ITALY	57.100	57.300	57.800	53.600	57.300	57.800	53.600	57.300	58.6 0	57.200	57.300	58.600	57.200	57.300	60.500	63.300
GREECE	9.640	9.880	10.100	9.560	9.880	10.100	9.560	9.880	10.400	10.800	9.880	10.400	10.800	9.880	10.800	12.100
YUGOSLAVIA	22.300	23.200	24.700	25.000	23.200	24.700	25.000	23.200	25.200	26.800	23.200	25.200	26.800	23.200	25.800	29.000
TOTAL REGION A*	180.000	183.000	190.000	186.000	183.000	190.000	186.000	183.000	194.000	199.000	183.000	194.000	199.000	183.000	199.000	220.000
MONACO	26	27	30	36	27	30	36	27	30	36	27	30	36	27	30	36
MALTA	369	383	418	459	383	418	459	383	418	459	383	418	459	383	418	459
ALBANIA	2.730	3.050	4.100	5.780	3.050	4.100	5.780	3.050	4.100	5.780	3.050	4.100	5.770	3.080	4.260	6.500
CYPRUS	629	669	762	902	669	762	902	669	762	902	669	762	902	669	762	902
LEBANON	2.670	2.670	3.620	5.220	2.670	3.620	5.220	2.670	3.620	5.220	2.670	3.620	5.220	3.770	3.830	5.950
ISRAEL	3.880	4.250	5.300	6.870	4.250	5.300	6.870	4.250	5.300	6.870	4.250	5.300	6.870	4.350	5.720	8.120
TOTAL REGION C*	10.300	11.000	14.200	19.300	11.000	14.200	19.300	11.000	14.200	19.300	11.000	14.200	19.300	11.300	15.000	22.000
TURKEY	44.500	49.300	65.400	91.900	49.600	68.600	105.000	49.300	65.400	91.900	48.800	62.300	81.700	48.800	62.300	81.700
SYRIA	8.800	10.500	17.000	31.800	10.500	18.300	35.500	10.500	17.000	31.800	10.500	17.000	28.100	10.500	17.000	28.100
EGYPT	41.500	46.900	63.900	90.400	47.100	65.700	97.300	46.900	63.900	90.400	46.800	62.200	85.000	46.800	62.200	85.000
LIBYA	2.970	3.610	6.080	11.100	3.620	6.240	17.500	3.610	6.080	11.100	3.600	5.920	9.910	3.600	5.920	9.910
TUNISIA	6.390	7.080	9.430	12.900	7.130	9.830	14.000	7.080	9.430	12.900	7.050	9.060	12.100	7.050	9.060	12.100
ALGERIA	18.700	21.700	33.400	50.600	21.800	34.700	56.500	21.700	33.400	50.600	21.600	32.200	46.500	21.600	32.200	46.400
MOROCCO	19.400	21.900	29.500	40.100	22.200	31.400	45.000	21.900	29.500	40.100	21.900	28.900	39.100	21.900	28.900	39.100
TOTAL REGION B*	142.000	161.000	226.000	329.000	162.000	235.000	366.000	161.000	226.000	329.000	160.000	218.000	302.000	160.000	218.000	302.000
Total Mediterrane countries	333.000	356.000	430.000	533.000	356.000	439.000	571.000	356.000	433.000	547.000	355.000	426.000	521.000	355.000	432.000	544.000

* Addition based on non-rounded figures (3 significant figures)

Table II-7 POPULATION IN THE FIVE MEDITERRANEAN SCENARIOS

OUTLOOK FOR 2000 IN ALGERIA

The assumptions for 2000 imply :
. an annual average demographic growth rate of 3.19 %,
. a total population of 34 500 000.

Population growth could however differ according to the major geographic regions, depending on national planning and regional development objectives, even if their outcome is not entirely up to expectations.

Population growth would be higher in the high plateaux and the south, inland areas less affected by the lower averages assumed by the population policy, but which would nevertheless settle their population in place through investment reflecting its preferred options.

Aside from the northern area, outside the capital, where the final demographic growth rate (reached between 2000 and 2025) is the same as that of the total population on account of a return and/or a decline of population living in the north.

The priority location of productive investment and major infrastructure in the high plateaux and the south should bring about the definitive redeployment of a population of about 1,500,000 to these areas

On the basis of these initial objectives (horizon 2000), the effect of their materialization was estimates for 2025. In 2025, the total population would reach 57.5 million, and the national urbanization rate would be 80.6 %

Urban population growth, althoug declining in correpondence with the overall population trend, would maintain different rates in the various regions, in accordance with the objectives of achieving regional balance and rational distribution throughout the country.

The urban population in the south and the high plateaux would grow at a rate of 2.3 % compared to 1.73 % in the northern wilayats representing a complete reversal of current population trends in the country, the desired objective.

(Source : Algerian national scenarios)

Regions	1950	1980	1985	2000	2025
Region A					
15-24 years	17.33	15.71	15.89	13.38	12.12
55-64 years	8.55	9.12	10.92	10.48	13.46
ratio	2.04	1.72	1.46	1.28	0.90
Region B					
15-24 years	19.56	20.11	20.19	19.69	16.42
55-64 years	9.89	6.66	6.69	5.93	9.03
ratio	1.98	3.02	3.02	3.32	1.82
Region C					
15-24 years	18.30	19.05	19.10	17.51	15.05
55-64 years	6.12	6.17	6.45	6.57	10.04
ratio	2.99	3.09	2.96	2.67	1.50

To facilitate comparison between the three groups of countries, potential flows of entries into working life have been assimilated into the 15-24 age-group, and potential withdrawals flows into the 55-65 age-group. The average age of entry into or withdrawal from working life varies from one country to another. This difference is explained on the one hand by the lengthening of studies and, on the other, by the postponement or advancement of definitive withdrawals from working life.

Table II-8 TREND OF FLOWS OF POTENTIAL ENTRIES (15-24) AND WITHDRAWALS (55-64) ON THE LABOUR MARKET IN THE MEDITERRANEAN COUNTRIES BY REGION AND ACCORDING TO THE T-3 SCENARIO FOR 1985-2025
(as % of the total population)

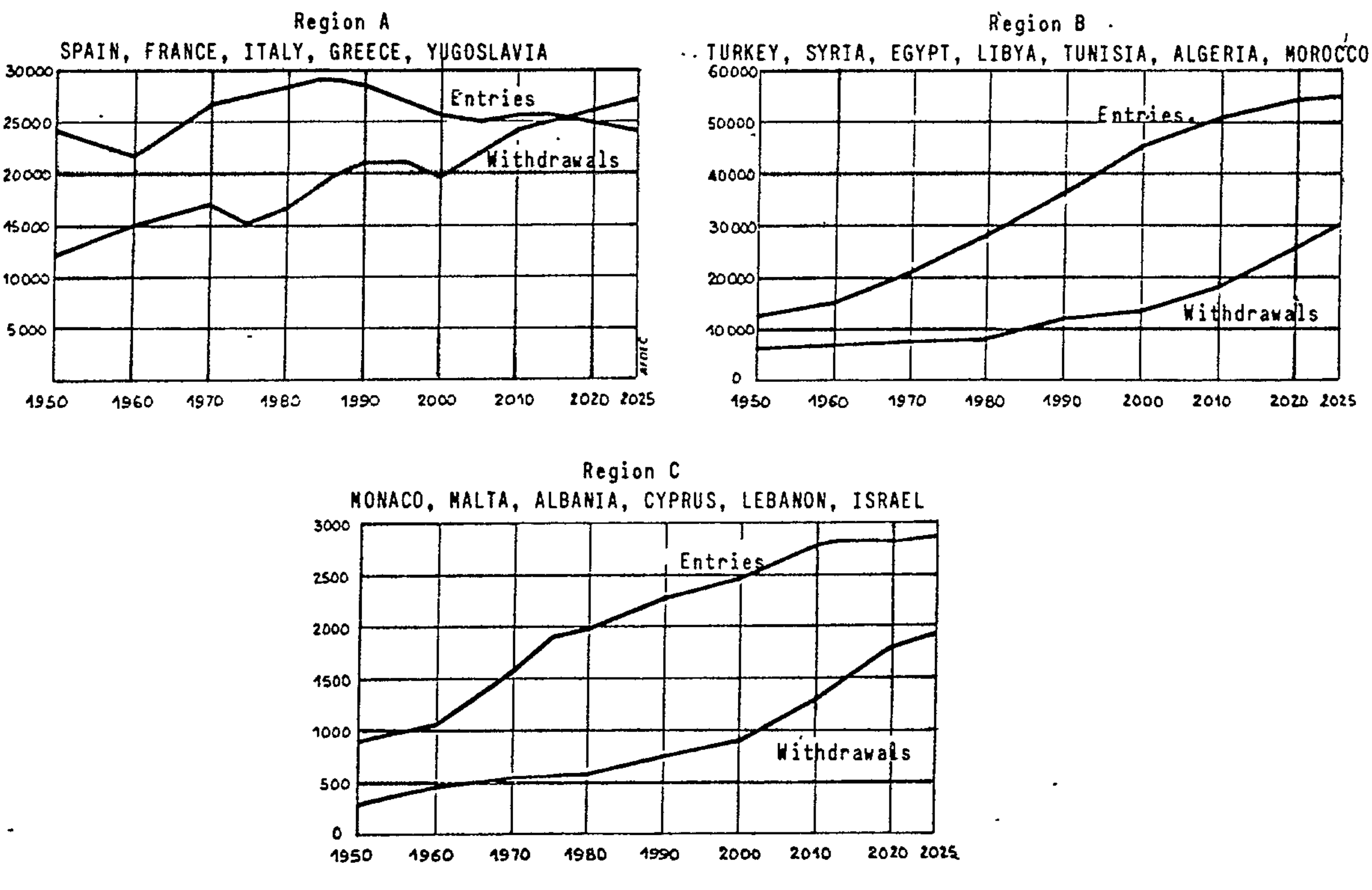


Figure II-9 Entries and withdrawals on the labour market

The Mediterranean population figures chosen for the five scenarios in 1980 (base year), 1985, 2000 and 2025 are given in Table II-7. For the Mediterranean basin as a whole, the difference between the two extreme population hypotheses was 50 million people in 2025 (with a maximum deviation of 34 million for group A, and 64 million for group B). If the United Nations projection used had been combined (non-weighted) with socio-economic conditions (by amalgamating either all the weakest forecasts or all the strongest ones), the gap in 2025 would have been double that obtained. This gap of 50 million or so in 2025 is virtually equivalent to the current population of Egypt, or all three Maghreb countries.

The population pyramids associated with these estimates (Figure II-8) indicate significant discrepancies from one group of countries to another. Thus in the north of the Mediterranean, the 0 to 14 year age-group drops from 21.9 % in 1985 to 18.2 % in 2025, whereas it rises from 28.2 % to 46.1 % for the Syria-Algeria-Libya subgroup, where fertility is virtually the highest in the basin. The situation will be the reverse for the respective adult populations, and the average age will remain higher in the northern countries than in the southern and eastern countries. Socio-economic problems will therefore be very different depending on the country and the scenarios.

IV. <u>ENTRIES AND WITHDRAWALS FROM THE LABOUR MARKET</u>

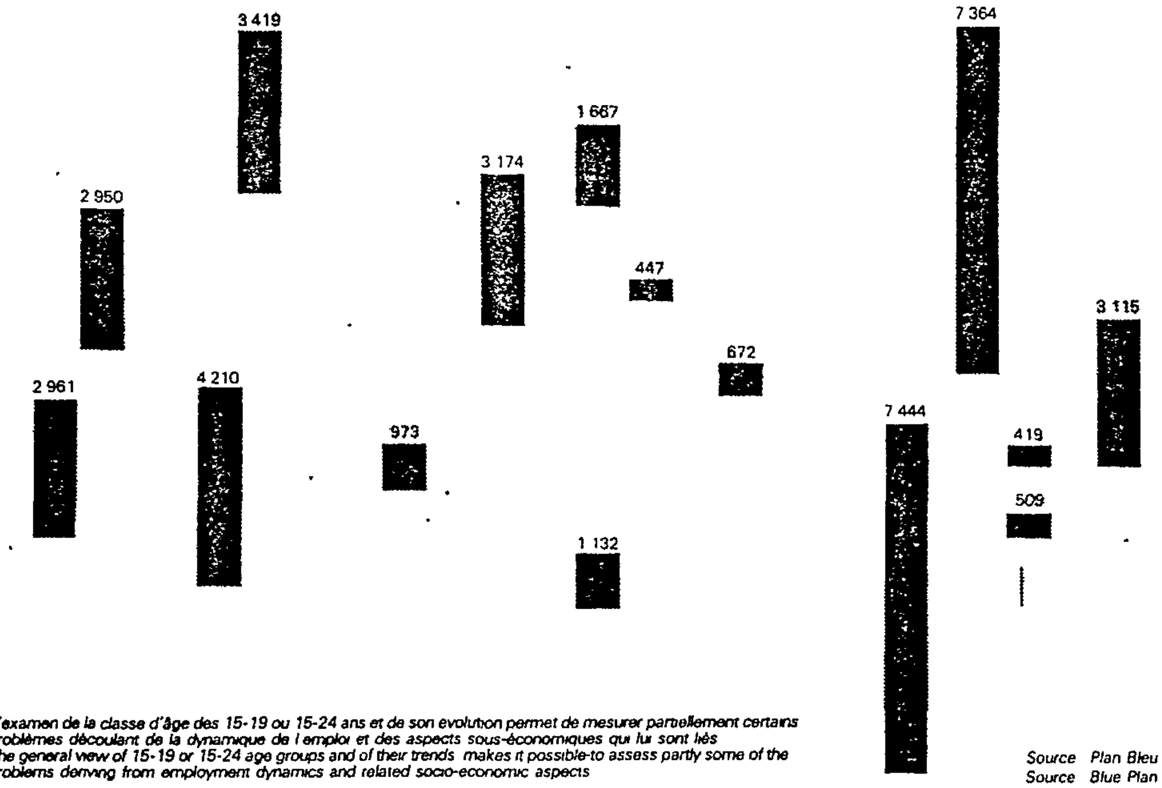
The Blue Plan studies did not concentrate on the labour market or on employment. At this stage it will simply be stressed that the composition of the population by age clearly plays a vital role in the labour markets, although real activity rates are a lot more uncertain than foreseeable populations trends to the horizons 2000 and 2025. The potential intake (15 to 24 year age-group), and withdrawals (55 to 64 year age-group) differ from one country to another, and from one region to another, as illustrated in the Table II-8 and Figure II-9 for the moderate trend scenario T-3.

Throughout the period 1985-2025, growth of the labour force would continue to slow down and workers would be increasingly older in region A, the countries in the north of the basin, where fertility is low. At the beginning of next century, the number of workers would even start to dwindle in France and Italy, reflecting a significant shortage of young adults on the labour market. However, the entry of women into the labour force should continue and could partly offset the shortfall.

In the countries in the south and east of the basin, with comparatively high fertility, potential intake would expand faster than withdrawals, and the gap would continue to widen until it peaks towards 2000. In other words, demand pressure is likely to exacerbate employment problems and influence the direction of socio-economic development strategies ; nevertheless various adaptation strategies seem feasible.

These changes linked to demographic structures would clearly be more adverse in the worse trend scenario T-2 than in the alternative scenarios.

POPULATION ÂGÉE DE 15 À 19 ANS EN 2025 (en milliers) - Scénario moyen.
POPULATION AGED 15-19 IN 2025 (in thousands) - Average scenario.



L'examen de la classe d'âge des 15-19 ou 15-24 ans et de son evolution permet de mesurer partiellement certains problèmes découlant de la dynamique de l'emploi et des aspects sous-économiques qui lui sont liés
The general view of 15-19 or 15-24 age groups and of their trends makes it possible to assess partly some of the problems deriving from employment dynamics and related socio-economic aspects

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CHAPTER II.6

ECONOMIC HYPOTHESES

The general hypotheses on growth and trade define the international context of the scenarios and fix the trends of production structures.

I. CONTEXT AND CONSTRAINTS OF GROWTH

Disregarding short- and medium-term fluctuations, work was based on an annual average growth rate of 2.5 % for the United States of America, sustained over the fourty-year period from 1985 to 2025, which reflects long-standing trends. The growth rate for Japan would be 3.75 % per year for the fifteen-year period from 1985 to 2000, and 3.3 % after 2000. These hypotheses are valid for all the scenarios, justified in an exercise whose application is strictly confined to the Mediterranean area. (The choice of several growth rates for the United States and Japan would have increased the number of scenarios and in the end obfuscated the exercise.)

On the other hand, the growth rate for the European Community, important for all the Mediterranean countries, varies according to the scenario from 2.1 % to 2.8 % per year from now to 2000, and from 3 % to 3.4 % per year beyond that date (see Table II-9). This growth assumes a general recovery of international economic activity during the 1990s (justified further on), without however counting on thān Japan or European Community returning to their growth levels of the 1960s. The European Community may in fact experience two opposing trends. It can be imagined on the one hand that the nature of growth will be different and rates lower because the economies are mature, reflected for instance in shorter working hours and more free time for leisure. The trend towards smaller numbers of workers arriving on the labour market, even a decline of the population, heads in the same direction, and production structures would mirror this new face of growth, characterized by low rates. On the other hand, however, the Single European Act and the huge internal market in 1992 would provide a fresh stimulus to growth. Even if the economic and technological predominance of the United States and Japan persists, it can be assumed that the European Community will experience higher rates (particularly in the alternative scenarios) at the beginning of the next century, especially as economic growth may make up for the sluggishness of the 1970-1985 period. Table II-9 reflects these considerations.

	1985 - 2000					2000 - 2025				
U.S.A.	←		2.5							→
Japan	←		3.75			←		3.3		→
Scenarios	T-1	T-2	T-3	A-1	A-2	T-1	T-2	T-3	A-1	A-2
E E C	2.3	2.1	2.7	2.8	2.8	3.0	3.0	3.3	3.4	3.3

Talbe II-9 GROWTH RATES SELECTED FOR THE MAIN INDUSTRIALIZED COUNTRIES
(% per annum)

The effects of these hypotheses on the growth of Mediterranean countries depends heavily on trade conditions. Major trends since 1970 in fact correlate the economic activity of the Mediterranean countries with the international economic situation, and three factors in particular : the oil situation, the trend towards participation in the world market and, finally, the debt burden.

The price of oil is determined by the balance of supply and demand on the world market, strongly influenced by United States demand. The price rises during the 1970s had a strong impact on growth in producer countries and, conversely, the slack demand which lowered prices over the past few years considerably curtails investment projects. The influence of the oil market is felt indirectly in other countries to the south and east of the Mediterranean basin, notably Egypt, Lebanon and Syria, through financial flows : public transfers and private remittances (migrant of workers), and revenue from oil pipelines.

In the oil-importing countries in the north of the basin, the impact of oil prices on their economies has dwindled due to falling prices and energy-saving efforts. The oil bill of the importing countries in the south and east was also lower, although they benefited less from the drop in prices because their exports include other primary products whose prices tailed off either before or at the same time as those of oil (the case of phosphates in Morocco).

In countries in the south and east of the basin, the trend towards participation in the world market firstappeared during the period of expansion in the 1970s. The policy followed at that time focused not only on diversification of commodity exports, but also on promotion of industrial projects geared to processing them for the world market (aluminium, iron and steel). With the weak economic situation in the 1980s, this policy received increased support from international finance institutions in the context of the trade-deficit adjustment policies required of debtor countries.

Indebtedness itself, often associated with strong growth in the 1970s, contributed to the trend towards participation in the world market. The two phenomena are in fact related : thanks to world prices for raw materials, some exporting countries benefited from growth over and above world rates, and sought to maintain it during the price reversal by borrowing from banks ; as from 1981, however, money was more scarce and interest rates soared on the money market. So from then on indebtedness must be considered as one of the international market's chief "drive belts" for the debtor countries' economies (see Table II-10).

At the end of 1985, the outstanding debt of the Mediterranean countries amounted to 156,000 million dollars, i.e. approximately 16 % of the total debt of developing countries. Debt servicing burden (amortization and interest) in 1984, a fairly good year for exports, exceeded 30 % of export revenue for Turkey and Yugoslavia in the north and for Morocco, Algeria and Egypt in the south, and approached this amount for Greece and Tunisia. Debt this high is likely to shackle the growth of countries in the south and east of the basin, whose exports are more vulnerable to commodity price fluctuations than the countries in the north, some of which benefit in addition from the backing of the powerful financial centres of the European Community.

	Outstanding medium-term debt		Debt service
	$ 1,000 million end 1985	% GDP	% of exports in 1985
Southern Europe			
Greece	18.5	36.5	28.8
Malta	0.1	11.8	1.6
Turkey	22.0	42.8	32.1
Yugoslavia	20.0	46.0	34.3
Southern and Eastern Mediterranean			
Algeria	19.7	32.9	35.5
Egypt	30.9	67.9	47.6
Israel	21.9	82.5	21.7
Lebanon	0.5*	...	10.0
Morocco	13.7	88.0	41.8
Tunisia	5.7	58.7	29.6
Syria	2.6*	16.1*	14.3
Total	155.6		

* End 1984.
Source : For 1985, "Lettre du CEPII n°66, October 1987".
For 1984, UNCTAD Statistics, 1986 supplement.

Table II-10 MEDITERRANEAN COUNTRIES DEBT, 1985
(nominal dollars 1,000 million and percentages)

II. GROWTH IN MEDITERRANEAN COUNTRIES

Once the growth rates of the major industrialized regions were fixed, a study was made of past links between national growth rates and those of the European Community through "coupled elasticities" (or the ratio between the growth rate of a given country and that of the EEC) and in order to choose the growth rates for each of the Mediterranean countries. As these elasticities are comparatively stable, growth rates for each country were chosen on the basis of observed elasticities, and weighted by a country analysis. The figures given in the tables below may therefore be considered as fairly consistent sets.

A. COUNTRIES IN THE SOUTH AND EAST OF THE BASIN

Because of the circumstances mentioned above, southern and eastern coastal countries cannot experience strong growth from 1985 to 2000 in the trend scenarios. This stems directly from their linkage with an international economy which itself lacks dynamism. For these countries as a whole, annual growth rates are around 3.1 % in the reference trend scenario T-1, a little lower in the worst trend scenario T-2, and rise to 4.3 % in the moderate trend scenario T-3. Average per capita GDP growth varies between 0 % and 2.1 % per year for these scenarios, to the extent that in some countries the per capita GDP would be lower in 2000 than it was in 1985 in adverse circumstances. Conversely, the very fact of accepting a certain "decoupling"

Country	1980		1985*		T-1		T-2		T-3		A-1		A-2	
	GDP	80/60	GDP	85/80	GDP	2000/85	GDP	2000/85	GDP	2000/85	GDP	2000/85	GDP	2000/85
SPAIN	110,2	5,7	117.97	1.4	199	3.5	180.6	2.9	217.2	4.1	222.25	4.3	222.25	4.3
FRANCE	398.8	4.6	421.67	1.1	640.8	2.8	622.3	2.6	696.9	3.4	709,2	3.5	709.2	3.5
ITALY	230.2	4.1	241.03	0,9	342,1	2.4	332.1	2.2	364.2	2.8	387.6	3.2	387.6	3.2
YUGOSLAVIA	37.28	5.8	38.33	0.7	59,67	3.0	56,83	2.6	63.64	3.4	68,65	3.9	68.65	3.9
GREECE	22.94	6.3	24.48	1.3	42.41	3.7	38.18	3.0	45.82	4.3	49.02	4.7	49.02	4.7
TURKEY	41.76	5.3	52.75	4.8	82.3	3.0	73.54	2.2	82.61	3.0	90.45	3.7	90.45	3.7
SYRIA	7.38	7.7	8.76	3.5	12.57	2.4	12.09	2.1	13.59	2.9	14.07	3.2	14.38	3.3
LEBANON	2,42	5,6	2,42	0.0	4.02	3.4	4.02	3.4	4.02	3.4	4.02	3.4	4.02	3.4
ISRAEL	13.06	6.9	13.06	0.0	27.1	5.0	27.1	5.0	28.62	5.4	30.9	5.9	30,9	5.9
EGYPT	20.31	6.40	29.08	7,4	36.82	1.6	35.63	1,4	40.1	2.2	44.25	2.8	49.45	3,6
LIBYA	18.37	17.9	14.12	-5.1	28.95	4.9	27.84	4,6	52.59	9.2	56.84	9.7	56,84	9.7
TUNISIA	5,04	6,4	6.15	4.1	9.01	2.6	8.67	2.3	9.93	3.2	11.39	4.2	12,89	4.8
ALGERIA*	13,87	3,7	17.42	4.7	22.82	1.8	20.61	1.1	24.76	2.4	27.60	3.1	36.80	5.1
MOROCCO	12,97	6.8	14,72	2.6	22,75	2,9	20.24	2,1	24.3	3.4	25.86	3.8	26,77	4,1

* Provisional estimate for 1985

Figure II-10,b GDP in 2000 (1985 US dollars 1,000 million) and growth rates for the period 1985-2000 (%)

Country	T-1		T-2		T-3		A-1		A-2	
	GDP	2025/2000	GDP	2025/2000	GDP	2025/2000	GDP	2025/2000	GDP	2025/2000
SPAIN	500,7	3.8	414.6	3.4	598.8	4.1	631.8	4.3	613	4.1
FRANCE	1464	3.4	1422	3.4	1728	3.7	1809	3.8	1760	3.7
ITALY	798,8	3.4	775.4	3.4	925.3	3.8	1014	3.9	985.8	3.8
YUGOSLAVIA	153,8	3.9	146,5	3.9	179.7	4.2	220.1	4.8	213.4	4.6
GREECE	114,2	4,0	93.33	3.6	136.1	4.4	150.3	4.6	145.5	4.4
TURKEY	215,2	3,9	161.6	3,2	237.8	4.3	294.9	4.8	311.8	5.1
SYRIA	35,02	4,2	33.68	4.2	42.86	4.7	49.02	5.1	60.25	5.9
LEBANON	12,18	4,5	12.18	4.5	13,58	5.0	14.08	5.1	17.33	6.0
ISRAEL	70.42	3.9	64.1	3.5	78.15	4.1	112.9	5.3	135.5	6.1
EGYPT	91.04	3.7	88.1	3.7	107.8	4.0	135	4.6	180.5	5,3
LIBYA	69.4	3.6	57,57	2.9	203.4	5.6	215	5.2	215	5.5
TUNISIA	25.51	4.2	23.14	4.0	29.02	4.4	37.93	4,9	55.19	6.2
ALGERIA**	58.49	3.8	49,9	3.6	70.64	4.3	82.90	4.5	101.36	4.1
MOROCCO	59.45	3.9	48.05	3,5	69,8	4.3	85.46	4.9	105.3	5,6

** GDP at factor cost

Figure II-10,c GDP in 2025 (1975 US dollars 1,000 million) and growth rates for the period 2000-2025 (%)

from the international economy in the alternative scenarios provides the opportunity of introducing higher rates, with annual average per capita GDP growth in the order of 3 % (2.9 % and 3.4 % respectively).

From 2000 to 2025 all rates rise, reaching an average level of 3.8 % per year in the reference trend scenario and 5 % or more in the alternative scenarios over the 25-year period.

These rates (Figure II-10) may seem low compared to 1960-1980 growth (7 % per year), but they stem from ECC-coupled elasticities (according to the method described above) of 1.4 to 1.9, flanking the figure of 1.5 observed from 1960 to 1980.

In correlation, per capita GDP growth rates remain low, population constraints adding in this case to those of the economy. They would be in the region of 2.2 % per year on average in the reference trend scenario T-1, and about 3 % in the alternative scenarios.

B. COUNTRIES IN THE NORTH OF THE BASIN

In the north, a distinction is made for France and Italy, too closely integrated to the European Community to have a growth rate noticeably diverging from that assumed for the Community as a whole (the growth rate for Italy may in fact be underestimated because insufficient allowance may have been made for the so called "underground economy").

Spain, Yugoslavia, Greece and Turkey make a rather heterogeneous group, in which ratios between standards of living varied from one to three in 1980. However, they all experienced much higher growth rates than those of the European Community from 1960 to 1980, and some of them suffered from the 1980-1986 recession. Their development over the period 1985-2000 will therefore follow rather closely the hypotheses made on Community growth and cohesion, whether they are members or not. The growth elasticity for these countries as a group should therefore rise from the worst trend scenario T-2 (1.3) to the moderate trend scenario T-3 (1.5). No difference was introduced for this period in the two alternative scenarios.

Beyond 2000, the countries to the north of the basin benefit from a larger market and slightly faster European Community growth (3.4 % compared to 3.3 %) in reference alternative scenario A-1. These features make the A-1 scenario the most propitious for the northern coastal countries.

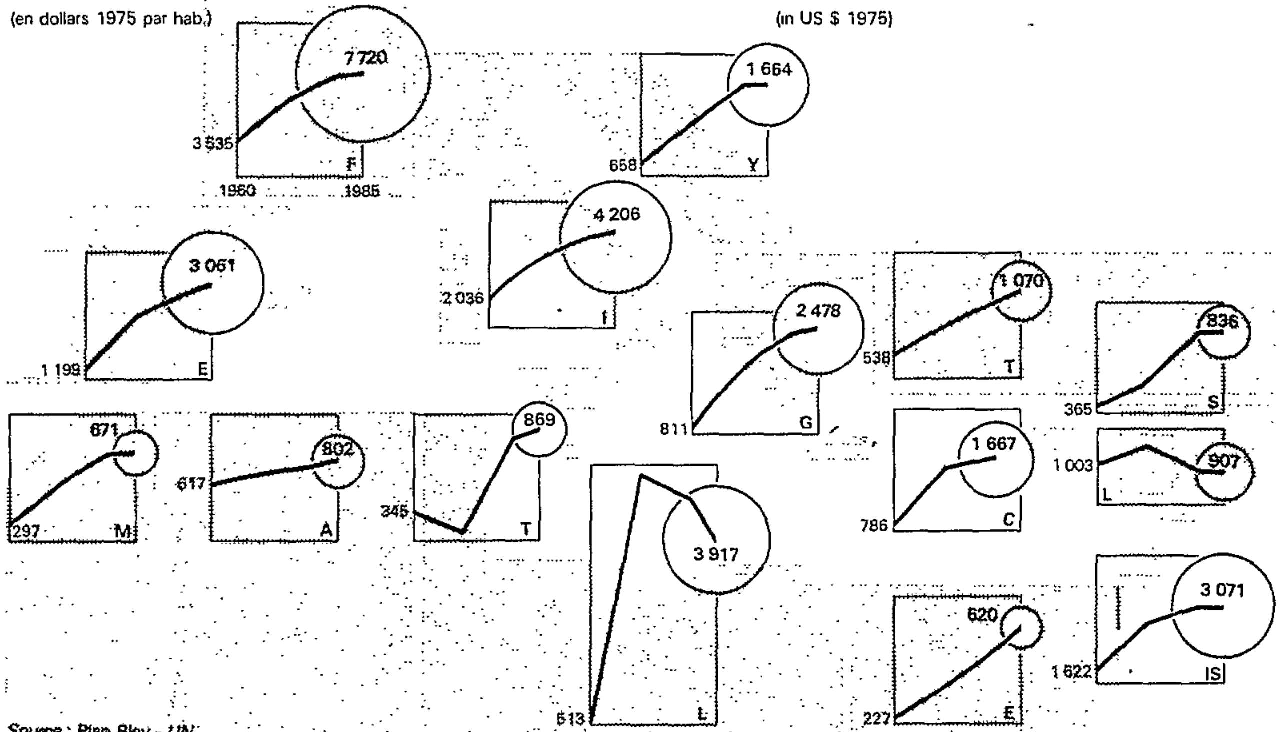
C. FINAL COMMENTS ON GROWTH RATES

It is interesting to compare the assumed growth rates of Mediterranean countries by way of a table (II-11) giving the GDP multipliers from 1980 to 2025. It can be observed that the GDP of the countries in the south and east of the basin would grow nearly fourfold during the period 1980 to 2025 in the reference trend scenario T-1 and the worst trend scenario T-2, sevenfold in the moderate trend scenario T-3, and eight-to ninefold in the two alternative scenarios. This can be compared to the multipliers obtained for the countries in the north of the basin over the same period, which never exceed five.

On the other hand, comparisons between per capita GDP reflect the very different population growth patterns in the two groups of countries.

PRODUIT INTÉRIEUR BRUT PAR HABITANT
Évolution 1960-1985
(en dollars 1975 par hab.)

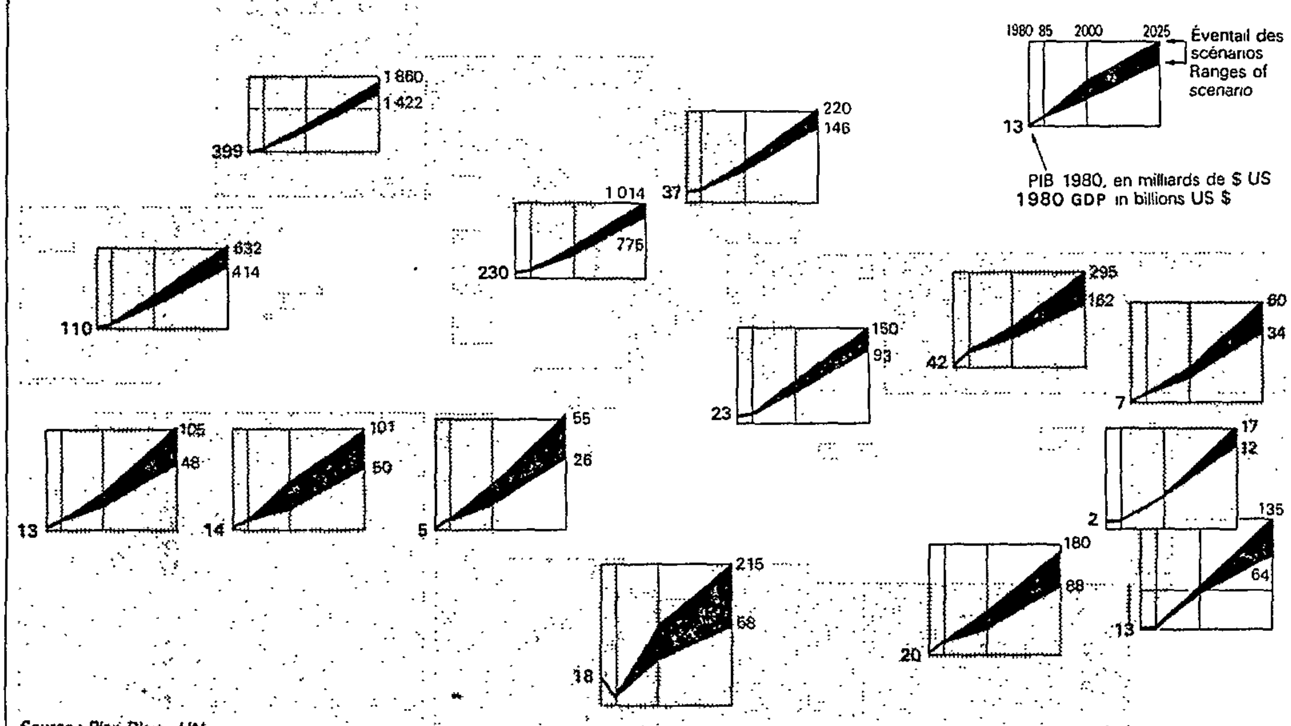
GROSS DOMESTIC PRODUCT PER CAPITA
Evolution trends, 1960-1985
(in US $ 1975)



Source : Plan Bleu - UN
Source : Blue Plan - UN
AFDEC

PRODUIT INTÉRIEUR BRUT
Scénarios d'évolution 1980-2025

GROSS DOMESTIC PRODUCT
Extreme scenarios, 1980-2025



Source : Plan Bleu - UN
Source : Blue Plan - UN
AFDEC

Considering that per capita standards of living vary in according to productivity levels, growth of production would be obtained in very different ways in the two groups, with productivity rising on average more slowly in the south and east, but with a faster growing labor force (which corresponds to the economic laws of resource allocation).

COUNTRY	T-1	T-2	T-3	A-1	A-2
SPAIN	3.8	3.1	4.4	4.7	4.0
FRANCE	3.8	3.6	4.0	4.2	3.7
ITALY	3.7	3.6	4.0	4.4	3.9
YUGOSLAVIA	3.7	3.5	4.0	4.9	4.4
GREECE	5.0	4.1	5.3	5.9	5.0
TURKEY	2.5	1.6	2.8	3.8	4.0
SYRIA	1.3	1.1	1.6	2.1	2.6
LEBANON	2.6	2.6	2.9	3.0	3.2
ISRAEL	3.0	2.8	3.4	4.9	5.0
EGYPT	2.1	1.9	2.4	3.3	4.3
LIBYA	1.0	0.7	3.0	3.5	3.5
TUNISIA	2.5	2.1	2.9	4.0	5.8
ALGERIA	1.6	1.2	1.9	2.4	2.9
MOROCCO	2.2	1.6	2.6	3.3	4.0

Source : Blue Plan

Table II-11 PER CAPITA GDP MULTIPLIERS ACCORDING TO VARIOUS SCENARIOS BETWEEN 1980 AND 2025 (45 years)

To conclude on a word of caution, it should be stressed that the figures for individual countries are given only as an indication and had to be defined fairly early on in the exercise. They are naturally less stable than collective averages, on which a number of observations have been made. Nevertheless, they proved useful for sectoral analyses, despite their somewhat arbitrary nature, and made it possible to cover a fairly wide range of economic growth possibilities.

(Finally, as regards Turkey, it can be linked with the northern countries for some parameters and with the less industrialized countries in the south and east of the basin for others, population growth for instance. This ambiguity reoccurs throughout the report. In this chapter Turkey was often included among the northern countries.)

III. MONETARY AND FINANCIAL CONSTRAINTS

In order to compare growth hypotheses to economic policies, the balance of trade was taken as an indicator. This balance is in turn one of the key components of the broader balance of payments, which also includes :

- the balance of services, which is positive for Morocco, Tunisia and Egypt (reference year 1983), because of income from tourism -an indication of the importance of tourism for these countries- and also of the "adjustment policies" adopted ;
- the balance of the capital account, adversely affected by payments of interest on debt and of dividends on foreign investment. It is negative for all the indebted countries in the Mediterranean basin, and deteriorates each year for most of them ;

SPAIN IN EUROPE AND THE MEDITERRANEAN

The integration of Spain into Europe presents the problem of the future role of Spain in the European productive system, and also the broader issue of relationships between Europe and the Mediterranean.

In this context, the role of Spain could develop in a very different way : it could become a pole of traditional industry, recovering the kinds of production in which the north European countries had lost the struggle for competitivity, especially as regards the Third World. On the other hand, it could become host to advanced industrial activities no longer responding to the technical and economic location criteria which, in the past, justified the concentration of new industrial developments in the north of Europe.

In the first extreme hypothesis, Spain would be "a developing country" among advanced industrialized countries, a situation which characterized the Italian Mezzogiorno during the past twenty years without any identifiable progress being observed in attempts to reduce the per capita income gap.

In the second extreme hypothesis, Spain would be a new "pole of innovation" among the advanced industrialized countries, similar to California in the United States.

Clearly the most likely future is somewhere between these two extreme situations, and the existence of "two Spains" could even lead to the co-existence of the two industrialization models envisaged.

*

In fact, when studying major trends, many sociological and economic studies reached the conclusion that there are two Spains : an urbanized and industrial Spain, turned towards Europe, with a high standard of living (Catalonia, Basque country, Madrid and other north-eastern regions), and agricultural, Mediterranean and considerably poorer Spain. Major internal migration flows have been recorded, especially in the post-war period.

In 1955, 3.5 % of the population lived in Madrid, Catalonia, Valencia and the Basque country ; in 1975, 4.6 %. In terms of value added, the activities of these regions represented 48.5 % in 1955 and 56 % in 1975. Among these richest regions there is also the greatest desire for autonomy, strengthened by clearly different languages and cultures (Basque and Catalan).

Source : Spanish national scenarios

- the balance of private transfers, which includes amounts deposited by immigrants or remitted by emigrants. In 1983, Egypt had the biggest positive balance (but Libya's was negative).

Balances of payments were virtually all negative in 1983 for the countries in the south and east of the Mediterranean basin, even taking into account official development assistance.

As regards the industrialized countries on the northern side, the balance of services is positive for all countries (except for Yugoslavia), because of major contracts for capital goods and income from banking services and telecommunications, which boost the positive balance derived from tourism. Conversely, capital account balances are negative for all countries, either because of countries' indebtedness (France, Yugoslavia and Turkey) or the outflow of dividends from foreign firms in Europe exceeding the inflow of dividends from national firms established abroad. A low dollar stimulates European investment in North America, but Japanese investment in Europe could take up the slack and keep the balance negative.

What can be deducted from this short analysis of medium-term development prospects, especially in the trend scenarios ? The world-wide expansion of services could be considered a challenge similar to that of technology for the industrialized countries, which will have to be as efficient in the services as in the high technology industries if they wish to keep a positive trade balance.

What is the situation in the countries in the east and south of the Mediterranean, this time including Turkey ? The difficulties of the major oil-exporting countries (Mediterranean and Arabian-Persian Gulf) stemming from falling prices and the weak dollar should stressed first of all. The deterioration of their trade balance obliges them to reverse policies fairly abruptly, with an impact on other items of the national budget : cancellation of major civil works underway to relieve the service account, repatriation of immigrant workers, reduction of assistance granted to other countries, and lowering of the GDP growth rate.

The misfortunes of the major oil-exporters have a serious impact on the balance of payments of other countries in the south and east of the Mediterranean basin, especially because of the repatriation of their emigrant workers (private transfers, not to mention the social problems caused by the return and integration of these workers, as in Egypt or Tunisia for instance).

Faced with these trends (the severest being those depicted in worst trend scenario T-2), the scenarios implicitly assume that countries will resort to economic recovery policies such as :
- improvement of the balance of tourism through investment in this sector, with the risk of a more or less haphazard development in the hands of national or international investors and inadequate (even virtually non-existent) protection of particularly desirable coastal areas ;
- obtention from the industrialized countries of increased official development assistance or, along similar lines, of debt relief (slow orientation of the international community towards long-term. debt rescheduling). To stay consistent with the trend scenario hypotheses, however, it was assumed that the debt burden would remain comparatively heavy (depending on the scenarios) and offical assistance moderate up to 2000 ;
- all-out efforts would be made to restore the trade balance, while sacrificing a minimum of growth. However, to understand better the interplay between economic, social and environmental constraints, a distinction should be made between opportunities in the industrial and in the agricultural sectors.

1) Industrial potential and constraints. Considering the necessarily reduced and selective contribution of foreign investors (the case of the trend scenarios) two assumptions are made about the financing of industrial promotion. The first is the possibility of releasing considerable resources from domestic savings - hence austerity measures in both rural and urban sectors ; the second is the ability to set up industries that are competitive on the world market, therefore the quick mastery of industrial processes. If possible, efforts should also be made to ensure a domestic market for their output. Clearly this option does not leave much margin, but it is not impractical if the social structure can bear the rigorous constraints, as illustrated moreover by the efforts of various Mediterranean countries (and some east-Asian countries with high levels of growth and domestic savings, although they benefited from an opening of the American market).

2) Agricultural potential and constraints. The difficulty for agriculture in the countries in the south and east of the Mediterranean basin is to reconcile the internationalization of trade with a policy of employment and the long-term management of scarce resources. In fact, this trade pattern would lead to persistence of an international division of labour involving the export of fruit and vegetables and the imports of food staples (cereals, meat, milk products, oil-seed products and sugar). In 1980 for instance, the cereal shortfall in the southern Mediterranean countries was equal to between 90 % and 100 % of agricultural trade, and that of foodstuffs between 56 % and 100 %. For non-food agricultural products, the shortfall exceeded 75 % in the Maghreb (including Libya), but was virtually nil for Egypt because of substantial cotton exports. Aside from this, agriculture and food deficits are in fact considerable.

Massive imports of cereals and other food staples dumped on international markets because of competition between industrialized countries to offload their food surpluses, would dramatically undermine traditional agriculture in the countries to the south of the basin in a very short time, stimulating the exodus of migrants from the country, who would be unable to find jobs quickly enough in the cities. In these circumstances, the proliferation of shanty towns can be expected around major urban centres and coastal cities, with their social and environmental consequences, whose impact has been simulated in the trend scenarios.

Moreover, is there not a paradox in the fact that the southern countries export market-garden produce (early fruit and vegetables, citrus fruit, grapes etc.), taking advantage of the seasonal or climatic complementarity with the countries in the north of the basin ? In the final analysis, is this not the export, in the form of fruit and vegetables, of ... water, a scarce resource which, largely subsidized, is thus not sold at its real cost ?

IV. PRODUCTION STRUCTURES

The mechanisms governing the structures of the economy are very different in the industrialized countries and in the developing countries. In the countries in the north of the basin, although growth has a considerable impact, technological change alters the business environment just as radically, introducing new complexity and increased mobility in henceforth world-wide markets. In the developing countries, the changes in the domestic market plays a part, notably the improvement of food consumption (as propounded in Engles laws, which already governed the food consumption patterns of industrialized countries in the distant past). Aside from trade, however, income distribution is also an important factor, which justifies its inclusion in the alternative scenarios.

A. COUNTRIES IN THE NORTH OF THE BASIN

Any long-term projection is based on a view of the economy. The basic phenomenon since the mid-1970s has been the downswing of the developed economies, including those on the northern side of the Mediterranean. Is this a lasting phenomenon ? If so, for how long and for what reason ? Many people see it as the outcome of a series of events which shook the world economy, starting with the breakdown of the Bretton Woods monetary system, followed by the oil shocks, exaggerated fluctuations on the money and financial markets, and the waves of inflation and deflation throughout the world. Certainly these disruptions had an impact on growth, in the same way as the current disequilibria in the North American economy will affect growth in the coming years. Nonetheless these explanations are incomplete. The crux of the matter lies in the interrelated imbalances stemming from a demand which is saturated in some major sectors and dynamic in others, combined with technological change and social rigidities, especially in the European economies :

- saturation, as indicated by the regression of some sectors (steel and coal, for instance) and the sluggish growth of other markets, automobile in particular, offset, however, by strong demand in service sectors, such as health, tourism or communications (as described in the sectoral analysis) ;
- technological change, centering on the electronic revolution, with its many elements - informatics, robotics, telematics, mass-audience television, etc. ;
- social rigidities, starting with the institutions and economic agents whose behaviour determines the supply of and demand for products, which evolve more slowly than technology strictly speaking. This drag, always evident in the past, is felt today because electronic products affect information, a factor which permeates most of the production, sale and purchase processes in the economy. It is not surprising therefore that the adaptation of institutions and behaviour, both of businesses and of consumers, is constantly lagging behind technological developments (with an apparent contradiction between the speed of technical change at the microeconomic level in the strong-growth sectors, and the slow down of "technical progress" at the macroeconomic level).

Thus it is a matter of "structural disequilibria" because former fast-growth sectors, such as electromechanics, one to big compared to demand, whereas potential growth sectors are not large enough. Even if these sectors take off, their relative insignificance in production prevents them from pulling the economy as a whole. International upheavals, whether related or not to these structural disequilibria, hamper adjustment, particularly by slowing down investment, hence technological change. The solution to the crisis, aside from the reabsorption of distortions in the international economy, must therefore await the slow, reciprocal adaptation of the structures of demand and supply. This is a major process because it depends not only, as mentioned above, on technological development generally speaking, but also on the institutions and behaviour governing supply and demand. In practice, and for the scenarios, it was assumed that these radical social changes would be producing results during the 1990s (perhaps too optimistic ?).

The countries on the northern side of the basin, France and Italy in the lead, are involved in these problems which affect trends in their production structures. Overall, the most important hypothesis is the stagnation of agricultural production, in terms of volume, throughout the period up to 2025. As regards industry, multipliers around four times the 1980 level are advanced, with major differences depending on the sector. As for the services, growth in terms of volume is meaningless, but even taking into account the blurred border between products and services, the latter have advanced considerably in terms of value, as this sector will, in the long run, represent between 70 % and 80 % of the GDP (considering the priority given to environmental problems, the service sector has not been examin further as would have been the

Branch of industry	1980 Mult	1980 %MVA	1980 %EMP	2000 Mult	2000 %MVA	2000 %EMP	2025 Mult	2025 %MVA	2025 %EMP
Agro-food	1	15.1	10.2	1.5	13.2	9.4	3.1	11.4	7.9
Heavy	1	28.5	22.2	1.5	26.1	20.0	3.3	23.4	18.4
Light	1	21.1	30.3	1.6	20.3	27.3	3.5	18.3	23.1
Machinery	1	35.3	37.3	1.9	40.4	43.3	5.4	46.9	50.6
Sector	1	100.0	100.0	1.7	100.0	100.0	4.1	100.0	100.0

Table II-12. FRANCE-ITALY : MANUFACTURING STRUCTURE, (T-1 scenario) 1980, 2000 and 2025

Branch of industry	1980 Mult	1980 %MVA	1980 %EMP	2000 Mult	2000 %MVA	2000 %EMP	2025 Mult	2025 %MVA	2025 %EMP
Agro-food	1	25.4	21.1	1.6	14.6	9.5	5.9	12.8	8.7
Heavy	1	44.4	31.6	2.3	37.1	25.7	9.0	33.9	23.8
Light	1	18.4	32.2	3.7	30.0	40.8	16.1	25.3	32.4
Machinery	1	11.8	15.1	4.3	18.3	24.0	27.9	28.0	35.1
Total	1	100.0	100.0	2.8	100.0	100.0	11.7	100.0	100.0

Table II-13 TURKEY : MANUFACTURING STRUCTURE (A-1 scenario) 1980, 2000 and 2025

EGYPT	1980 Mult	1980 %MVA	1980 %EMP	2000 Mult	2000 %MVA	2000 %EMP	2025 Mult	2025 %MVA	2025 %EMP
Agro-Food	1	18.1	16.9	2.5	17.6	16.8	11.6	15.1	15.8
Heavy	1	31.5	32.0	2.5	30.8	31.4	16.0	36.6	38.4
Light	1	33.8	42.8	2.4	31.6	41.8	9.8	24.1	33.4
Machinery	1	16.6	8.3	3.1	20.0	10.0	20.1	24.2	12.3
Sector	1	100.0	100.0	2.6	100.0	100.0	13.9	100.0	100.0
MAGHREB	**1980 Mult**	**1980 %MVA**	**1980 %EMP**	**2000 Mult**	**2000 %MVA**	**2000 %EMP**	**2025 Mult**	**2025 %MVA**	**2025 %EMP**
Agro-Food	1	28.1	18.6	1.9	19.6	13.1	12.2	21.3	16.8
Heavy	1	31.3	25.9	2.5	29.4	18.7	16.8	32.7	19.3
Light	1	30.0	45.8	3.6	40.8	57.9	16.2	30.3	48.1
Machinery	1	10.6	9.7	2.6	10.2	10.3	23.7	15.7	15.8
Sector	1	100.0	100.0	2.7	100.0	100.0	16.1	100.0	100.0

Table II-14 EGYPT AND THE MAGHREB : MANUFACTURING STRUCTURE (A-2 scenario) 1980, 2000 and 2025

Notes : Mult = Volume multiplier compared to 1980
MVA = Manufacturing value added in 1975 dollars
EMP = Employment as % of total employment in manufacturing branch

Source : *Blue Plan projections (see box)* case in a study focused on development alone).

An indication of the distortion of structures within the manufacturing sector, with reference to manufacturing value added and employment in France and Italy, is given in Table II-12.

The main trend lies in the continued expansion of the capital goods industry ("machinery" in Table II-12) to the detriment of other branches : at the end of the period over half the manufacturing jobs would be in this branch of industry. Still in terms of employment, the agricultural and food industries would lose two percentage points, primary transformation industries ("heavy industry" on the table) would lose twice as much, and light industry three times as much, this progression reflecting implicit priorities.

Despite being very general, the interest of these observations is to adumbrate an international division of labour in which industrialized countries like France and Italy would export technology in the form of capital goods in exchange for imports of products from other branches. It is precisely this kind of specialization that is supposed to take place, not on the world market as in the trend scenarios, but between the northern and southern sides of the Mediterranean in one of the alternative scenarios (A-1).

If Spain and Greece are added to France and Italy, the average for the Mediterranean countries of the European Community changes little as these two countries are gradually reaching the same kind of structure.

This structure can be compared to that obtained for Turkey (Table II-3). In terms of major sectors, trends seem fairly positive for Turkish agriculture, whose domestic market is far from saturation point. Output in volume would increase by 2.6 in 2025 compared to 1980, admittedly a multiplier lower than that of the GDP anticipated in the A-1 scenario, a fortiori that of electricity and gas infrastructure (10.8), and of the manufacturing industry (11.7). In 1980 the agriculture and food industries, and initial processing of raw materials ("heavy industry" in the table) represents more than 70 % of the manufacturing value added and provides over half the jobs, a typical structure for developing countries. Assuming a rather high growth rate and economic integration in the European Community (scenario A-1), these industries would lose their predominance by 2025, to the benefit of light and capital goods industries, the former growing faster up to 2000, the latter after that date. Turkey in 2025 would resemble Spain in 2000, not only because of production volume but also its manufacturing structure.

B. THE COUNTRIES IN THE SOUTH AND EAST OF THE MEDITERRANEAN

The case of southern and eastern coastal countries is illustrated by two examples, the Maghreb (Algeria, Morocco and Tunisia) and Egypt (Table II-14). A comparison of the initial structures of the two in 1980 highlights, the relative importance of Egyptian agriculture (22 % of GDP compared to 15 % in the Maghreb), and of its industry (20 % of GDP compared to 17 % in the Maghreb), offset by the construction and service sectors. These differences would persist for agriculture in the projections to 2000 and 2025, and would diminish or even be reversed -depending on the scenario- for industry, which would reach 27 % to 29 % of GDP in both cases (except in the worst trend scenario).

It is interesting to make a comparison with Turkey. In all cases, infrastructure for electricty and gas would grow faster than GDP, but on the southern side primary transformation industries ("heavy industry" in the tables) would remain important, at least in terms of volume, which can be ascribed to their wealth of natural resources (petrochemical industries). As regards employment, light industry would predominate, providing one-third of jobs in Egypt and nearly half in the Maghreb (reflecting the international division of labour simulated here). Capital goods industries would experience strong growth, with a twentyfold increase in production in 2025 (in volume) compared to that of 1980, although still distinctly lower than in the Turkish projection.

V. COMPARISON OF THE DETERMINANTS OF GROWTH

To conclude this analysis of the hypotheses for economic growth and production structures, the breakdown of industrial growth can be examined in the light of two factors, employment and productivity, for the countries or group of countries under reference (Table II-15). In fact, the annual growth rate of employment and productivity per worker can be added together to give the growth rate of industrial production.

According to these projections, productivity per worker would increase at the rate of 2 % to 2.3 % per year for France and Italy between 1980 and 2025 (corresponding figures per hours worked would be higher). Growth of industrial employment would be slower, but nevertheless positive, between 1.2 % and 1.4 % per year. Moreover the phenomena of the underground economy have not been taken into account, which tend to increase the growth of employment considerably in the south of Europe. In all, the scenario projections show employment in industry and the services as being complementary.

For Turkey , Egypt and the Maghreb, it can be noted that unlike trends in the industrialized countries, industrial employment should grow faster than productivity, which corresponds to factor endowments. In the worst case (worst trend scenario T-2), employment should grow at the rate of 2 % to 3 % per year, and in the best case (A-2 scenario), more than 4 % per year. These rates depend on at least three variables : the general growth-rate structure by branch (notably, an increase in high productivity heavy industry tends to reduce the growth of employment), and finally the distribution within the production structure of large medium- and small-sized businesses, the latter tending to generate more employment. Application of a policy promoting this last group, and more generally low productivity sectors, is in fact assumed in the A-2 scenario, in which employment growth would reach its maximum.

	scenario T-2			scenario* A		
	Production	Productivity	Employment	Production	Productivity	Employment
France-Italy	3.2	2.0	1.2	3.7	2.3	1.4
Turkey	3.6	0.7	2.9	5.8	1.6	4.1
Maghreb	3.9	0.7	3.2	6.4	2.2	4.1
Egypt	3.3	1.2	2.1	6.0	2.5	4.4

Note : *For France-Italy and Turkey, scenario A-1 ; for the other countries scenario A-2

Source: Blue Plan projections

Table II-15 INDUSTRIAL GROWTH DETERMINANTS 1980-2025
(annual growth rates in %)

CHAPTER II.7

PRESENTATION OF THE SCENARIOS

I. GENERAL PRESENTATION OF THE TREND SCENARIOS

The framework of the trend scenarios can be explained on the basis of the five dimensions chosen earlier. The starting point is the international economic context (first dimension), in which it is assumed that the Mediterranean protagonists will be eclipsed to some extent, and decision-making centres outside the Mediterranean, chiefly the United States and Japan, will predominate. National development strategies (third dimension) accordingly hinge as a priority on policies of participation in the world market. Another strong hypothesis is a certain passivity as regards management of coastal areas (fourth dimension) and consideration of the environment (fifth dimension) : in the best of cases a short-term ecological view is advanced, closely tied to the demands of competition characterizing the international economic context ; in the worst case negligence prevails... If in addition it is assumed that a laissez-faire policy is adopted on population growth, notably as regards urbanization phenomena (second dimension : population movements), this all gives a very undesirable picture, which emphasizes the features of the major trends observed.

The framework thus built up seems to be fairly consistent. In an economic environment in which competition is harsh, the weak are vulnerable and long-term economic needs are not recognized, participation in the world market seems to be an inevitable priority, almost regardless of the social or environmental impact. It should be stressed, however, that these trends are not necessarily compatible among themselves beyond the short or medium term. In the long term -the Blue Plan 2025 horizon- the priority given to macroeconomic success may indeed produce positive results as regards growth, modernization of the economy, foreign trade and the balance of payments, although the countries are not all on a same footing in this struggle. Nevertheless, even in the case of good economic results, shortsightedness as regards environmental management, notably through the wastage of scarce resources, such as water or coastal areas, could be counterproductive, to the point of jeopardizing both the economic and social aspects of development. These contradictions will later be pinpointed, and the importance of better balanced policies shown in the alternative scenarios.

A. THE INTERNATIONAL ECONOMIC CONTEXT

The parameters to be considered are first the growth of the world economy,then trade and lastly regulations on finance and debt. As already mentioned, growth would remain weak until 2000, then subsequently recover, slowly in the worst trend scenario T-2, more robustly in the moderate trend scenario T-3 (the T-1 scenario lies between the two).

As regards trade, the main hypothesis is that it will take place within the context of a policy of participation in the world market. For some countries this trend merely extends the effect of the forces pulling away from intra-Mediterranean trade. For others, chiefly the Mediterranean countries belonging to the European Community, it is a matter of suspending their integration policy. These aspects are worth consideration, by reviewing trends over the past fifteen years.

The yardstick adopted for measuring the degree of integration between either two countries or groups of countries, is the so-called "economic tie" between two partners. This indicator compares the market share of

COUNTRY	MOROC.	ALGE.	TUNIS.	LYBYA	EGYPT	LEBANO	SYRIA	ISRAEL	SPAIN	FRANCE	ITALY	GREE.	MALTA	YUGOSL.	CYPR.	TURKEY	MED.	COUNTRY
MOROCCO	.		5.0	1.2		2.2*	2.4*		3.7	3.9	1.2	2.4		1.3		1.8	2.5	MOROC.
ALGERIA		..							2.2	2.1	1.3				1.1		1.4	ALGERIA
TUNISIA		3.9	..	1.8						2.4	3.5	38.8	0.8	1.0		3.1	3.3	TUNISIA
LIBYA				..					3.1		4.1	7.0		1.8		8.7	2.1	LIBYA
EGYPT			1.6		.	2.9*	2.6*	16.0	1.0		6.3	6.2		3.0	1.8		2.6	EGYPT
LEBANON	0.8*	4.4*		30.0*	7.7*	.	...					0.8*		1.9*	20.2*	6.3	1.3*	LEBANON
SYRIA				..	2.5*	1.0*	..				4.5*	10.7*		7.7*		1.0*	2.0*	SYRIA
ISRAEL										0.8	1.1	. .		0.9	9.5	1.9	0.9	ISRAEL
SPAIN	8.7	4.6	3.4	3.8	2.6	2.0*	2.7*		.	2.5	1.7	1.2	2.0	0.7	2.2	1.3	2.1	SPAIN
FRANCE	5.2	4.9	4.8	1.3	2.5	2.2*	1.8*		1.8	..	2.7	2.3		0.9	1.0	1.3	1.5	FRANCE
ITALY	1.5	3.5	3.9	7.3	1.8	2.3*	2.6*	1.0	1.3	2.3	..	3.3	6.3	2.3	3.1	1.5	1.7	ITALY
GREECE		2.4	7.4	7.2	5.8	6.6*	8.5*	1.1		1.1	2.1	..	3.7	2.7	28.8	1.1	1.9	GREECE
MALTA				17.4		1.8*					1.3		.	1.8			1.0	MALTA
YUGOSL.	1.2	1.6	1.5	4.1	3.7	1.0*	0.8*				2.0	3.8	1.3		1.2	2.0	1.2	YUGOSL.
CYPRUS				18.2	3.5	7.2*	45.3*					5.4	3.6				0.9	CYPRUS
TURKEY			2.6	4.6	1.5	29.2*	10.1*	0.7		0.9	1.6	0.7		1.3			1.2	TURKEY
Total MED	3.2	3.4	3.5	3.3	2.0	2.4*	2.1*	0.8	1.5	1.1	1.9	3.1	2.3	1.4	2.3	1.9	1.6	MED

Notes * : Lebanon, 1970 figures ; Syria, 1975.
"..." = inapplicable or unknown

Definition of an economic tie between exporter i and importer j :
Delta ij = market share of i in total exports of j/share of total world exports of i.

The tie between i and j is said to be "special" when the coefficient delta ij is greater than one (see box). The table refers only to values over 0.7. The groups of countries whose special ties seem particularly important have been boxed, as well as the borders, which indicate a given country's tie with the Mediterranean as a whole.

Table II-16 SPECIAL ECONOMIC TIES IN INTRA-MEDITERRANEAN TRADE, 1980 country A's exports in the imports of country B's with the world market share of country A. If this ratio is equal to or higher than one, there is a "special economic tie" for A's exports to B*.

The interest of these indicators is their long-term stability, so they are rather useful for measuring a "trade structure".

These indicators will be used to analyse briefly intra-Mediterranean "ties", then to define the major trends to be taken into account in the scenarios.

As regards intra-Mediterranean "ties", an examination of the two "ties" of each coastal country with the Mediterranean basin a whole, for 1980 for example (Table II-16 and Figure II-11), produces an initial, very significant conclusion : some degree of economic integration clearly exist among the coastal countries because of the proximity due to the sea... or the influence of the past. Out of 32 indicators (two per country, in both directions), thirty are greater than one, thus reflecting "special ties".

The trend of the coastal countries' ties with the basin as a whole can easily be traced before 1980, and with less detail after this date (because calculations are very complex). Taking the most global indicator possible for this intra-Mediterranean tie (in fact comprising the ties of all the basin countries with all the basin countries !) it can be observed that it was 1.7 in 1970, fell to 1.4 in 1975 (result of the first "oil shock" ?), and climbed again in 1980 to 1.6, close to the 1970 value, though still a little lower. The downswing in fact stemmed from diverging trends between some ties that contracted sharply and others that expanded. The Maghreb countries, Yugoslavia and Turkey reduced their exports to the Mediterranean, and Algeria, France and Yugoslavia reduced their imports from the basin, whereas Egypt and Spain expanded their Mediterranean exports and Libya, Greece and Turkey increased their imports from the Mediterranean countries.

It can be confirmed, for example, that the exploitation of natural resources (phosphate and oil) in the three Maghreb countries and Libya, systematically led to an expansion of the economy within the world context during the 1970s. The use of trade surpluses, inter alia for imports, especially in the case of Algeria, led to attempts to diversify suppliers, prompted by their growing competition on the world market. These orientations, in which manufactured products play an important part, seem therefore to form a major trend, very likely to persist in the absence of interventionist policies (such as those assumed in the alternative scenarios). Libya, an exception, illustrates the importance of this huge import market for the other Mediterranean countries after 1973. The contraction observed for France reflects the diversification of energy supplies : France's ties with all the other Mediterranean basin countries as regards energy products fell from 2.5 in 1970 to 0.7 in 1980.

Conversely, an exceptional redeployment of Spanish exports can be observed towards the Maghreb, the other Mediterranean countries of the European Community and Turkey. Finally, analysis of imports shows that Greece and Turkey actively diversified their suppliers, especially in the west of the basin (Maghreb, southern Europe), more so than outside the Mediterranean.

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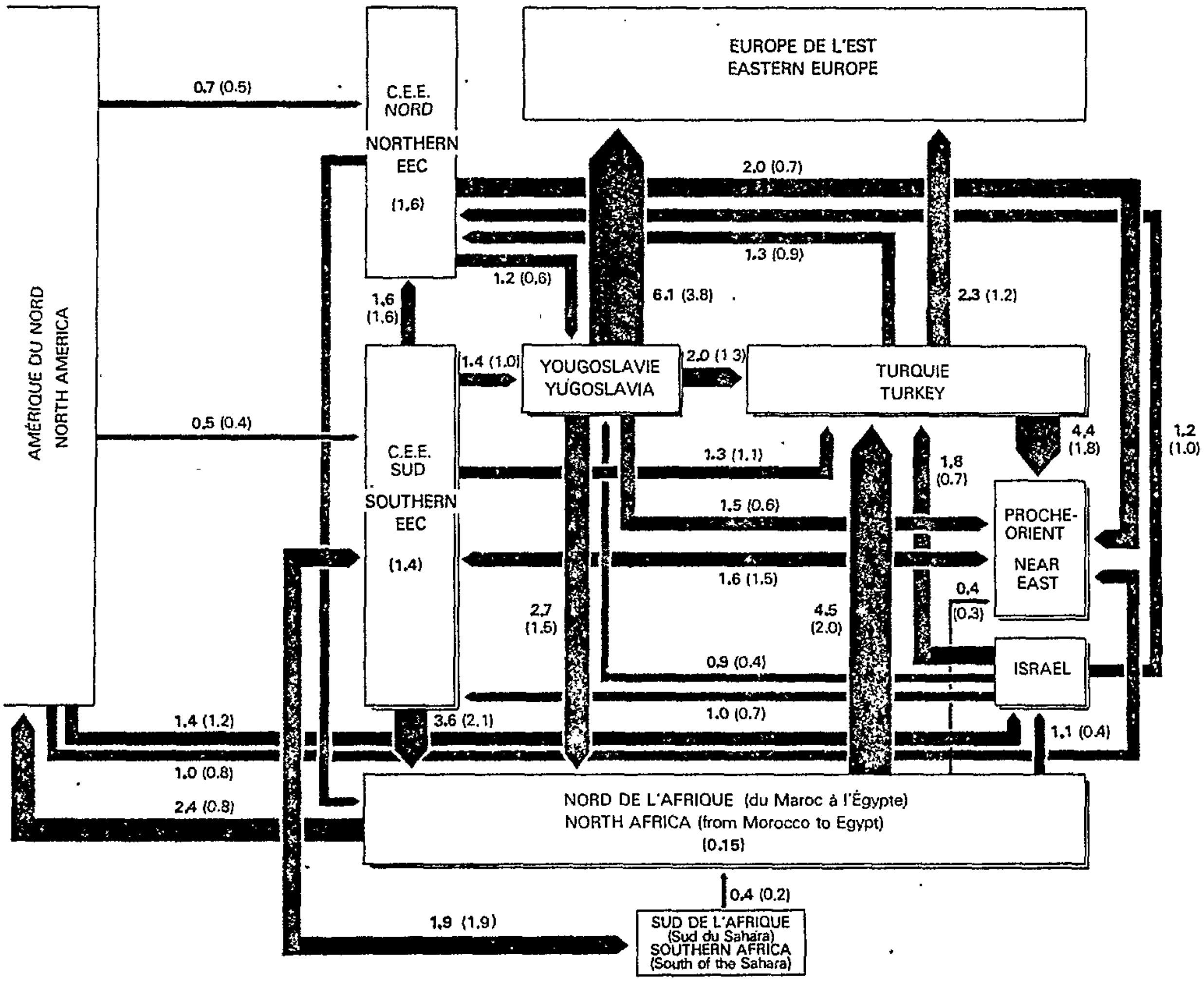
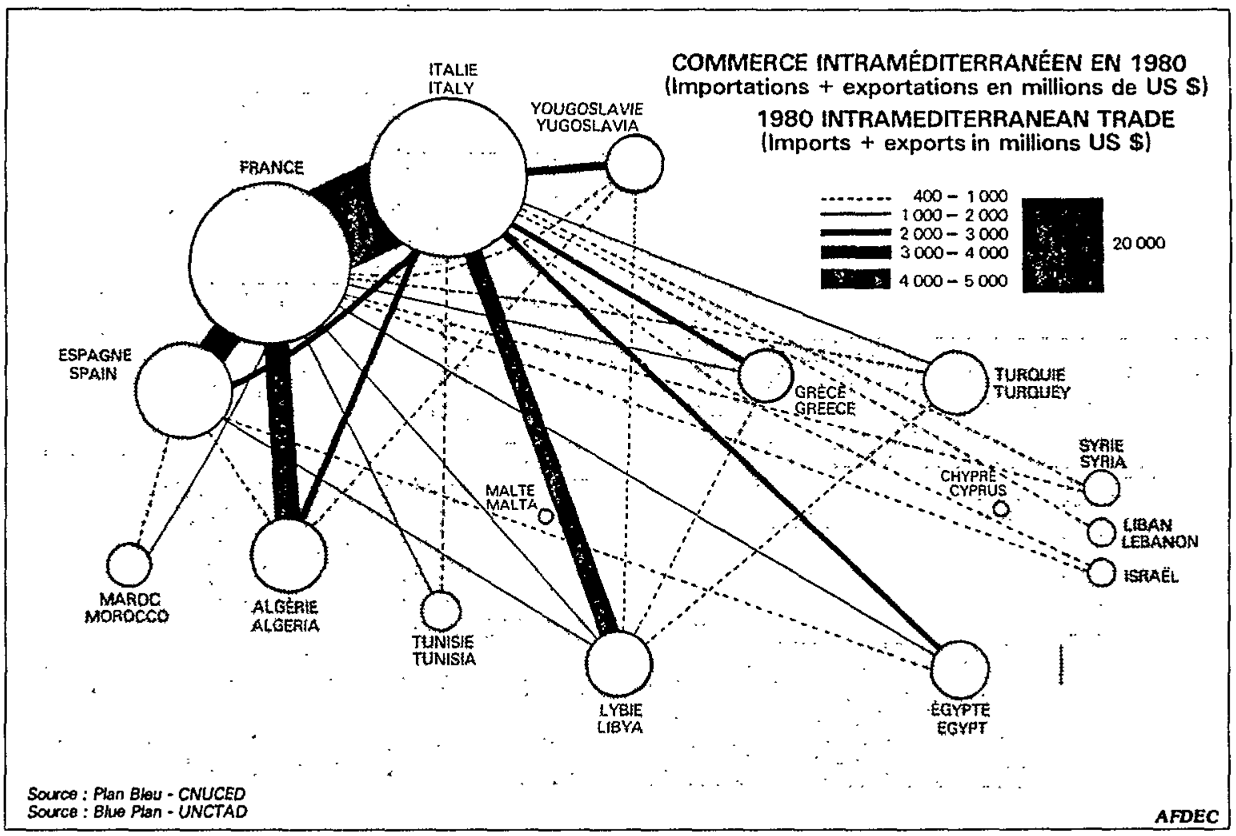
* So for each pair of partners there are two measurements of their ties depending on whether trade from A to B or from B to A is considered.

LES LIENS ÉCONOMIQUES DES PAYS MÉDITERRANÉENS EN 1980
ECONOMIC LINKS OF MEDITERRANEAN COUNTRIES IN 1980



Liens économiques entre les pays (sur la base des échanges commerciaux en 1980).
Le 1er chiffre représente le lien dans le sens de la flèche ; le 2e, entre parenthèses, représente le lien en sens inverse.
Economic ties among countries (based on 1980 trade).
The first figure represents the economic tie in the direction of the arrow ; the second figure (in brackets) represents the economic tie in the opposite direction.

Source : Plan Bleu - CNUCED *Source : Blue Plan - UNCTAD*



Source : Plan Bleu - CNUCED
Source : Blue Plan - UNCTAD

How can this kind of analysis be used for the trend scenarios ? In this case, countries or groups of countries outside the basin also have to be taken into account. Particularly noteworthy is the strength of the ties (first for exports, then for imports) of the EEC Mediterranean countries with the whole of North Africa (2.1 and 3.6 respectively), the Near East (1.6 and 1.5) and even with sub-Saharan Africa (1.9 and 1.9), and the comparative weakness of their ties with North America. The only countries with a strong exporting tie with North America are those of North Africa (2.4), chiefly because of hydrocarbons. The analysis also confirmed the weakness of inter-Arab trade or "ties", which plunged in the 1970s (either intra-North Africa with 0.15, or between North Africa and the Near East, around 0.3). This weakness contrasts with the strength of ties forged among the four Mediterranean countries of the European Community (1.4), and between these four countries and the rest of the European Community.

Examination of the evolution of some of these ties between 1970 and 1985 (Table II-17) indeed confirms the continued strengthening of integration within the European Community. On this point the trend scenarios in fact diverge from the trend by assuming that the world market could go as far as disrupting intracommunity ties. This hypothesis is based on the fierceness of some current trade disputes (issue of American maize exports to Spain, the market for long-distance aeroplanes, or the commercial offensives of Japan and East Asia), and assumes a certain slackening of Europe's political cohesion. These hypotheses are naturally much clearer in the T-2 worst scenario than in the T-3 moderate scenario.

	Export			Import		
	1970	1980	1985	1970	1980	1985
EEC-12 with						
EEC-12	1.4	1.5	1.7	1.4	1.5	1.7
North America	0.6	0.4	0.6	0.7	0.6	0.5
Japan	0.2	0.15	0.1	0.3	0.4	0.4
YUGOSLAVIA						
EEC-12	1.1	0.7	1.0	1.5	1.2	0.8
Eastern Europe	3.5	6.1	6.2	2.1	3.8	3.6
TURKEY						
EEC-12	1.4	1.2	1.2*	1.5	1.1	0.9*
North America	0.6	1.2	0.3*	0.3	0.5	0.6*
Japan	0.7	0.2	0.1*	0.3	0.4	0.4*
Near East	6.1	4.4	6.1*	2.0	1.8	4.5*
NORTH AFRICA						
EEC-12	2.0	1.3	1.9**	1.7	1.9	1.7**
North America	0.1	2.4	1.1**	0.6	0.8	0.7**
Japan	0.2	0.3	0.3**	0.4	0.8	0.7**

Notes : * figure refers to 1983
** figures refer to 1984 and 1985.

Table II-17 TRENDS IN SOME ECONOMIC TIES FROM 1970 TO 1985

The analysis also reveals the so-called "ratchet effect" with regard to Mediterranean countries' (the EEC countries, also Turkey and North Africa) imports from non-Mediterranean countries, (Japan in the lead, and the United States) : growth of imports during the expansion of world trade, then consolidation (or at most slight decline) despite the reversal of trends, whereas the inverse ties (exports towards these non-Mediterranean countries) continue to contract. These exports were naturally affected by the value of the dollar, high during the first half of the 1980s.

Finally, Yugoslavia's export and import ties with eastern Europe tightened throughout the period under review, which may be related to its weakening position as regards market economies and to payment difficulties.

In conclusion, it seems that the trend scenarios must take into account both incipient economic integration among Mediterranean countries, the Community apparently gaining strength as a focal point on the northern side, and two factors that may on the contrary weaken these Mediterranean ties. The first is the internationalization of the hydrocarbon and raw material markets, with its radiating effects. The second is the ratchet effect as regard imports from non-Mediterranean countries (which has spread to include other countries in the Pacific region, and may continue its expansion), linked to the increasing internationalization of trade within in a neo-liberal context, whose initial impact was detected in the 1970s. The trend scenarios assumed that this major orientation would continue to develop, and in the worse case, T-2, include the strong hypothesis that it could even affect the cohesion of the European Community.

B. NATIONAL CONTEXT OF THE TREND SCENARIOS

The population hypotheses (Chapter II-5) concerning the trend scenarios make the search for full employment difficult for the disadvantaged masses of the population in the countries in the south and east of the basin. They would tend to widen even further the per capita income gap between the north and the south, especially in the worst trend scenario T-2, in which population growth rates are maximal in the south and minimal in the north.

These scenarios postulate poorly controlled urbanization in the south and moreover the north. But two phenomena complicate the hypotheses. In absolute terms, the rural exodus is swollen by the size of the population and rural poverty (situation in the T-2 worst scenario), although poverty could represent a curb on mobility. Relatively speaking, economic growth could speed up the rural exodus (situation in the T-3 moderate scenario), particularly towards the largest cities (the case during the 1970s, contrary to planners intentions). These scenarios cannot exclude the fact that social tensions in the less industrialized countries in the south and east of the basin may provoke political confrontation with the more industrialized countries in the north. Thus, by taking the hypotheses to the extreme, it is suggested that the policies simulated in the trend scenarios, once incorporated into an overall (perspective, could tip the balance in the Mediterranean basin and so threaten the long-term interests of the most industrialized countries too. Approaches that precisely pay more attentive to the future are simulated in the alternative scenarios.

As regards management of scarce resources, such as water and land, the difference between the two extreme trend scenarios, the T-2 worst trend and the T-3 moderate trend, should be stressed. The sluggish growth postulated in the first scenario in a way minimizes pressure on resources. However, even if the growth of demand slows down, a breach between the supply and demand of urban water could occur because of inadequacy of investment (particularly in dams), to the extent that the comparative passivity postulated with respect to the environment could be assimilated to lack of foresight. In the T-3 moderate scenario the risk will be heightened by strong pressure exerted by both the supply of large urban centres and agricultural requirements (including for exports).

In the same way, cities and their infrastructure exert considerable pressure on coastal areas in the T-3 moderate scenario. Coastal management would be faced with the conflicting needs of industry, urbanization and more or less disorganized tourism. The efficiency of institutions responsible for physical planning will be sorely tested, since economic policies would tend towards a concentration of modern industry around a few urban poles, with a virtually uncontrollable expansion of cities.

As regards pollution, risk also seems lower in the slow growth scenarios than in the case of fast growth ; but this may be a mistaken impression to the extent that the shortage of public services could lead to the supply of poor-quality water and the inadequacy of wastewater networks. In the strongest growth scenario, air pollution in cities and epidemiological hazards in rural areas linked to the extension of irrigation are additional problems.

In all, the trend scenarios are likely a priori to be harmful to the environment. Formulation of the scenarios should make it possible to check or confirm this assumption. The T-3 moderate scenario in particular should help to test the effect of prolonged uncontrolled growth on the environment, which was the case when there was less concern about ecology, even none at all. A reaction to environmental degradation is very likely to occur, in other words a backlash on the economy at the end of the period.

II THE ALTERNATIVE SCENARIOS

For the countries in the north of the basin the alternative scenarios are based on the pursuit of European integration with its repercussions, together with a growing concern for spatial management and environmental protection. For the countries in the south and east of the basin, they are based on the adoption of goal-oriented development policies focusing on domestic objectives, which in no way excludes a realistic appreciation of external or environmental constraints.

A. GENERAL PRESENTATION AND INTERNATIONAL CONTEXT

European integration is reflected by the simultaneous advance of political and monetary institutions, in which the ecu plays an international role. In the world context, the importance of Europe is sufficient to give a multipolar structure the international institutions governing trade, money and financial transactions, which implies a disruption of current balances based on the strengthening of the economic and political role of the Pacific region. Europe's self-assertion provides many countries with a broader margin for action than in the past, and the North-South dialogue benefits, becoming more active and diversified.

In the first alternative scenario A-1, termed the reference scenario, Europe draws on an ideal of North-South solidarity to provide exemplary development assistance in the Mediterranean basin, endorsing a true "Pax Mediterranea" in an atmosphere of cultural exchange. A huge solidary region is formed on both sides of the Mediterranean. The institutional aspects of this co-operation comprising both sides of the basin are necessarily varied, from possible adhesion to the European Community for some countries, to more flexible contractual commitments for others, all structures of dialogue being designed in a long-term perspective.

The second alternative scenario A-2 retains the principle of a multipolar world system, with a strong Europe open to North-South solidarity. Unlike the first scenario, however, the links between the northern and southern side of the Mediterranean are not institutionalized as such, but are formed within world institutions. This is the level in particular at which solutions to Third World debt are found, and the rules of trade and of technology transfer between industrialized and less industrialized countries are applied. The second premise of this scenario is the development of subregional solidarity within the Mediterranean basin (even including some nearby countries). Aside from the European Community, "groups" are formed which do not have to be described in detail here but, to outline a few examples, the greater Maghreb would be strengthened, Egypt would play a pivotal role between the Mediterranean, sub-Saharan Africa and the Near East, Turkey would link the eastern Mediterranean with western Asia, and Yugoslavia would act as liaison between the European Community and eastern Europe...

The hypotheses specific to each of the two alternative scenarios are described below.

B. REFERENCE ALTERNATIVE SCENARIO A-1

Once the international context has been defined by strong links between the European Community and the other Mediterranean countries within the framework of long-standing ad hoc institutions, the terms of development strategies can be specified. On the side of the European Community, a share of savings are invested in Mediterranean development. In exchange, the Community benefits in the long run from a larger agricultural and industrial market. Growth is therefore stronger than in the moderate trend scenario T-3 (as shown in Table II-9).

For the countries in the south and east of the Mediterranean basin, this scenario is no doubt the one in which the modern sector grows fastest, fostered by numerous cultural, technological, commercial, financial and even monetary links with the European Community. With credit and support from the Community's financial centres, a satisfactory solution is found for the debt problem, so that long-term domestic savings, supplemented by foreign assistance, can be invested in development.

This growth in the countries to the south and east of the Mediterranean basin is based on industry, which can develop with a guaranteed market in the north in conditions similar to those experienced by East and South-East Asia vis-à-vis the United States and Japan : the North-South division of labour provides outlets first for the food industry, light industry and primary transformation industries, finally followed by the capital goods industry. Transfer of technology is facilitated by direct investment from Europe which enables her -as is currently the case of Japan through its industries located abroad- to keep world market shares for products in which the southern and eastern countries of the Mediterranean basin are more competitive.

As regards agriculture, the coastal countries on the northern side (from Spain to Turkey) and on the southern and eastern side manage to reach a compromise altenuating competition. For the southern and eastern countries access to modern irrigated agriculture on the one hand reduces pressure on scarce resources such as water and land (and the use of fertilizer) and, on the other, enables them to gain market shares. This reproduces to some extent the Ricardian division of agricultural labour analysed in the trend scenarios, namely fruit and vegetable from coastal regions in exchange for food staples from the temperate climates (from cereals to animal products). The impact of this trade on the south and east of the Mediterranean should be assessed.

The appearance of a middle class with growing economic and political influence has a stabilizing effect on institutions. But there is also an undeniable negative impact on employment in traditional agriculture, in direct competition with less expensive imports from the north. Three factors may nevertheless offset this effect as compared to the trend scenarios :
- the growth of modern agricultural and industrial sectors is stronger and therefore generates employment ;
- the governments of the southern and eastern countries of the Mediterranean basin may obtain assistance for traditional agriculture from the European Community, similar to the regional assistance granted to member states to ease transitions ;
- regulations concerning the admission of migrant workers into Europe are more liberal, which somewhat relieves the effects of labour force growth. Although the population hypotheses for the north are the same as in the moderate trend scenario T-3, they are more favorable for the south and east as population growth is slower, corresponding to higher standards of living.

In addition to agricultural and industrial products, North-South trade includes natural gas, to the advantage of industry on both sides of the Mediterranean. As regards the tourist trade, flows are important both from northern Europe towards the Mediterranean shores and within the coastal countries themselves, since the rise of the middle class is conducive to the growth of domestic tourism.

Conflict over the use of coastal areas remains acute, as in the trend scenarios, since more restrained urban development is offset by high levels of irrigated agricultural production and industrialization.

The trend towards increased polluting emissions due to the higher level of economic activity is offset by a more rigorous position on the part of governments as regards to the quality of life and by real North-South solidarity aimed at conserving the Mediterranean. Hence a common concern to resort to less polluting technologies in all sectors, the adoption of common standards, and the setting up of effective networks for monitoring pollution levels or environmental degradation, starting with the sea itself and the coast. This solidarity leads to a fair sharing of rehabilitation costs.

C. INTEGRATION ALTERNATIVE SCENARIO A-2

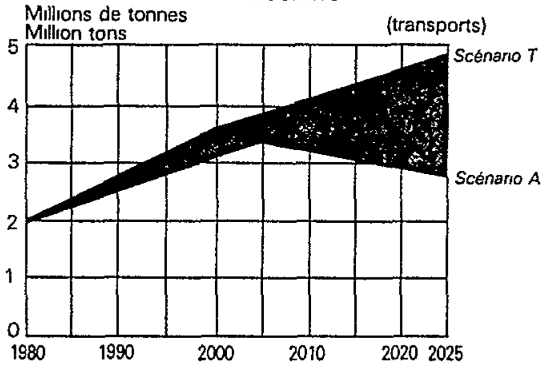
Compared to the previous one, this subregional co-operation scenario is characterized by better control of the internal structures of the economy in the south and east of the Mediterranean, accompanied admittedly by greater external risks, and by a lesser economic and financial commitment towards Mediterranean development in the north, related to slower growth.

The northern economy is tied more to the world market and less to the Mediterranean market than previously, and the European Community is the focal point for a number of countries with which it has special relations (in keeping with the Lomé agreement). In order to vary the hypotheses, in this scenario the European countries population trends recover, unlike the other scenarios in which replacement level is not reached in a growing number of countries (while admitting that this hypotheses, which combines rather well with that of a strong Europe, is somewhat arbitrary). European industry is little affected by this variation, but its agriculture has greater difficulty in finding foreign outlets, which further restricts its production capacity.

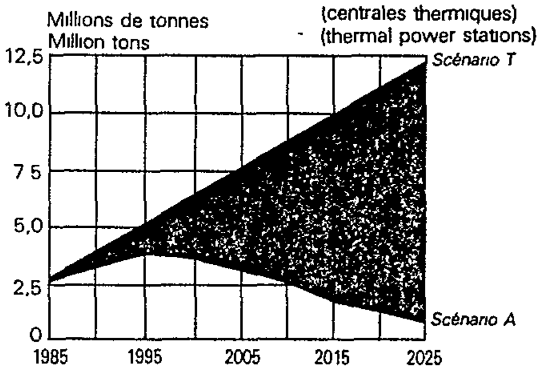
QUELQUES RÉSULTATS DES SCÉNARIOS DU PLAN BLEU (pour l'ensemble des pays méditerranéens)

SOME OF THE BLUE PLAN FINDINGS (for the Mediterranean countries as a whole)

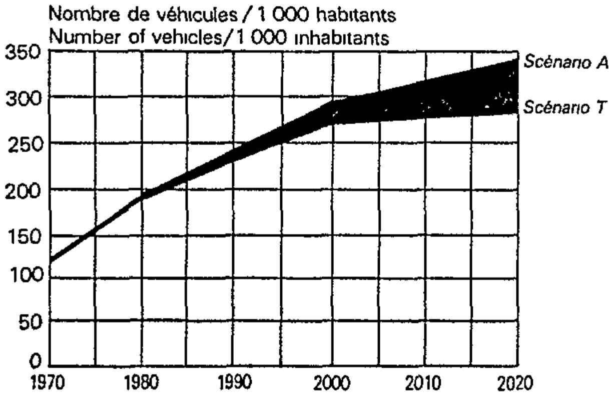
ÉMISSIONS DE NO X
NO X EMISSIONS



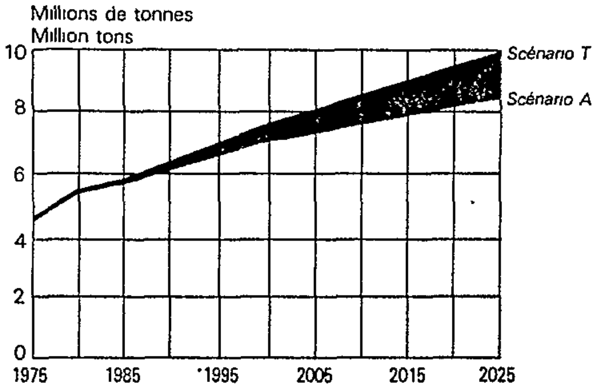
ÉMISSIONS DE SO_2
SO_2 EMISSIONS



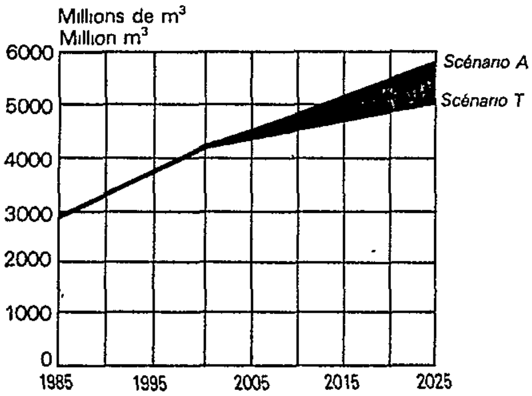
PARC AUTOMOBILE
AUTOMOBILE STOCK



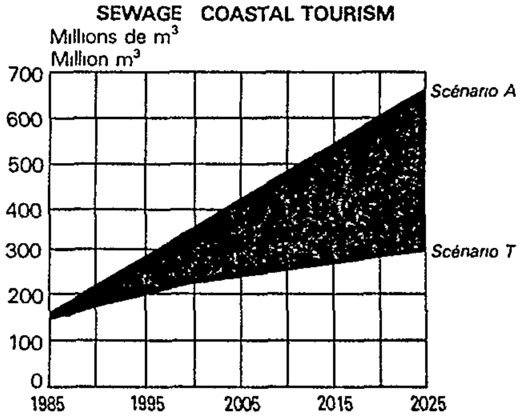
CONSOMMATION D'ENGRAIS
FERTILIZER CONSUMPTION



EAUX USÉES : POPULATIONS LITTORALES
SEWAGE : COASTAL POPULATION



EAUX USÉES : TOURISME LITTORAL
SEWAGE COASTAL TOURISM



Ces diagrammes, comme les autres cartes prospectives du rapport, comportent en noir le champ d'incertitude de l'avenir entre les scénarios extrêmes pour un sujet déterminé L'ouverture plus ou moins grande de ce champ dépend, en grande partie, des hypothèses choisies pour les scénarios ainsi que de l'effort entrepris par les pays pour la mise en œuvre des politiques d'environnement.
These diagrams, like the other prospective maps in the report, indicate in black the margin of uncertainty for the future between the two extreme scenarios on a given subject The extent to which this margin opens up depends largely on the hypotheses chosen for the scenarios and on the efforts undertaken by countries to implement environmental policies

In the south and east of the basin, industry diversifies its outlets, which implies a difficult breakthrough on the world market. However, the subregional solidarity postulated in this scenario enables industry on the other hand to rely on an enlarged "domestic market" whose size corresponds to each regional group. Technological advance is an essential parameter which excludes any hope of self-reliant development. It is assumed that the world system is conducive to direct investment in the context of the guarantees furnished by international codes.

Governments and modern industrial circles attempt to foster the productivity of those informal activities - usually urban- whose structures are the most advanced, by encouraging subcontracting between these two sectors with different levels of productivity through fiscal policy, training incentives, credit, price structures, salary legislation, etc.

Unlike industry, agriculture can be largely dissociated from world influences, the dual aim being to ensure a high level of food self-sufficiency and to maximize rural employment as long as other sectors are unable to provide a sufficient number of jobs. These objectives involve efforts to maximize the productivity of both traditional farms and those in irrigated plains, or to organize rural industrial or service activities for farming families. This growth of agricultural productivity is achieved through radical reform, including an appropriate price structure, the suitable orientation of research and agricultural extension work, the organization of rural credit, etc. These efforts are geared not only to reducing the gap between urban and rural incomes but also to economizing scarce resources, in particular water and agricultural land.

In this optimal social-policy scenario, the lower population growth rate provides the best conditions for reducing both urban unemployment and underemployment in rural and urban areas. To achieve this, however, considerable levels of savings are required to finance not only productive activities but also all the public budget items needed to attain the levels of education, training and public health without which these objectives could not be realized.

As regards trade, Europe tends to diversify further its sources of supply of raw materials and energy, to the point of changing the hierarchy of its energy sources. Tourist flows and styles of tourism, are more varied with more importance inside subregional groups.

These groups also contribute to a better mastery of physical planning, aimed at improving the balance between, on the one hand, rural and urban areas and, on the other, coastal and hinterland areas. Management of coastal areas stems not only from an expressed goal, but also from all the provisions governing the economy.

Pressure on natural resources (forest, soil, water) is not necessarily reduced because of this : irrigation techniques aim at saving water, but water is required over larger surface areas, and crop areas are larger than those in the other scenarios.

Governments do not gain as much as in the previous scenario from anti-pollution measures resulting from European Community assistance, and so do not adopt European standards. However, the state of pollution in cities is less alarming because of the better balance between rural and urban areas and between large- and medium-sized agglomerations. The comparatively large number of low-productivity activities also helps, at an equal level of production.

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In all, two general lessons can be drawn from this presentation of the alternative scenario hypotheses. The first is that these scenarios do not lack plausible components. The second is that variations between the two scenarios aim at revealing different avenues for protection of the Mediterranean environment, bearing in mind development constraints. Even if reality is very unlikely to resemble either of the hypothetical situations described here, the aim of these very diverging scenarios is to assist decision-makers to enhance their perception of the nature and repercussions of their choices, in the absence of any miracle solution that optimizes at the same time growth, income equality, social security, employment and .... the environment, just mention the major issues.

PART THREE :

THE ECONOMIC ACTIVITIES AND THEIR IMPACT ON THE ENVIRONMENT

CHAPTER III.1

AGRO-FOOD PROSPECTS

The first section (I) of this chapter outlines the issues concerning food and agriculture in the Mediterranean by identifying the specific features of the Mediterranean countries and agro-food demand trends. There is certainly room for progress in agricultural production, but this potential can only be exploited when a number of constraints have been better understood and overcome.

On this basis, the second section (II) tackles the prospective study for food and agricultural production in the Mediterranean. The general hypotheses of the economic scenarios are specified as regards their content and meaning for food and agriculture, leading to a modelling of the sector in order to explore the future. The term "explore" refers to major lines, and is well chosen, for there can be no question of making projections of agricultural output product by product, since it is too dependent on price policies, subsidies, taxation, marketing, or physical limitations. The possible shape of changes to come are then outlined.

It should be recalled that the aim of the exercise was not to define agro-food policies, but to assess the consequences of certain options on natural resources and the environment in the Mediterranean. This goal guided the choice of factors and of their interrelationships.

Agriculture and environment are interrelated in many ways. The essential points described in the third section (III) start with the necessary upstream and downstream industrialization and its impact on the environment, including the specific features of non-soil agriculture, which is highly polluting.

In addition to land under cultivation, special attention has been paid to the effects of variations in plant cover or uncultivated soil through either soil impoverishment (problems which will be dealt with in Part IV, chapter on soil) or a reduction in grazing land.

Finally, special consideration has been given to fertilizers (and pesticides), essential inputs for agricultural intensification. The matter has been tackled through the environmental "chain" method, linking development activities and impacts on the environment in order to obtain data on the possible discharge of nitrogen and phosphorus of agricultural origin into inland or sea water.

Finally, the very brief fourth section (IV) considers possible trends of the Mediterranean fishery sector within the context of the scenarios.

I. AGRO-FOOD ISSUES IN THE MEDITERRANEAN

A. SOME FEATURES OF THE MEDITERRANEAN COUNTRIES

The study of food and agriculture issues in the Mediterranean is influenced by two ever-present factors : the limitations and fragility of natural resources, and food dependency.

Regarding natural factors, it should be recalled that there are few alluvial plains (Rhone, Po, Nile), and that agricultural areas are compartmentalized off. A large part of the land can be used only for extensive stockfarming (or for forests). Adaptation to climatic constraints has taken the form of dry farming and traditional rainfed shrub and tree crops (grapes, olives, almonds, pistachios). Greater intensification of agriculture necessarily requires the introduction of artificial elements into the environment, basically irrigation, with the mobilization of investment in capital and labour. All this, combined with the limited size of holdings or available land, explains to a large extent the comparative inertia of Mediterranean agriculture. Industrialization of the production process is likewise hampered and so spreads rather slowly, especially because some operations are difficult to mechanize.

In the Mediterranean countries the area of land under annual or perennial crops is always less than 50 % of the total surface area , and even less than 10 % in some cases (Algeria, Libya, Egypt, comprising mostly desert). For a total surface area of approximately 850 million hectares, 125 million are under annual or perennial crops, and several hundred million hectares are devoted to ranges and grazing land - extensive stockfarming areas poorly suited to furnishing the basis for increased productivity (which does not exclude the possibility of improved management). Even if the surface area under cultivation remains fairly stable for the Mediterranean as a whole, there are countries in which it is contracting (France, Italy) (Figure III-1).

Concerning the use of water resources, six countries irrigate more than a quarter of their cultivated land, the others around 10 % or less. The case of Egypt, where agriculture is entirely irrigated, is an exception. More than 60 million hectares are currently under irrigation ; in the past fifteen years the area has increased by 3 million hectares, and the growth rate seems to have stabilized at around 200,000 hectares per year. This assumes the availability of an additional capacity of some 2,000 million cubic metres of water per year for agriculture alone, which poses a difficult choice between agricultural and urban needs when allocating water resources. The recovery and recycling of both urban and agricultural wastewater may become necessary in a number of countries, with the possiblity, for example, of creating green belts, market gardens and orchards around cities.

A large part of agriculture in the Mediterranean countries has been modernized and intensified since 1970. For example, global fertilizer consumption has increased by nearly 50 %, and the number of tractors in service has increased by more than 40%. But this increase in the means of production is very unevenly distributed : the richest countries have benefited most from intensification (with France, Italy, Israel and Yugoslavia in the lead). Considering its intensive labour-based production system, Egypt is second among fertilizer consumers (248 kg/ha), but its level of motorization, although it increased at the average rate (40 %), remains very low (less than 15 tractors per thousand hectares).

Yields are therefore extremely variable, ranging, in the case of cereals, from less than 10 quintals per hectare in the Maghreb, to 40 quintals per hectare in Egypt and well over 50 quintals per hectare in the countries north of the basin (taken as a whole). In addition, there are shortcomings in crop protection, which also contributes to low cereal yields.

Finally, progress in the introduction of new varieties is slow, either because innovations are few, or because the dissemination of new strains takes a long time.

The diversity of situations is particularly striking when examining the use of technical factors, the less wealthy countries having a less intensified agriculture, although the possibility of doubling yields for most of their crops seems quite conceivable.

The traditional sector is very small in the most developed areas of some less industrialized countries, but obsolescence can affect certain areas that were considered modern only a short time ago. The traditional sector often includes extensive forms of resource exploitation (pastoralism, rainfed cereal and tree crops). This is often linked to a high population growth rate, which requires the cultivation of virtually infertile land. Far from being a hindrance, however, the traditional sector can act as a complement, if not as competitor, to the modern sector, and its usefulness can be demonstrated by the dynamics of the agro-food system. Activities deriving from the traditional craft sector may be innovative and result in significant productivity increases (small-scale mechanization, inputs, transformation, marketing).

But a country's agro-food situation also depends on the international environment. As a result of the Mediterranean countries natural and socio-economic conditions, their specialization in "Mediterranean products" (fruit and vegetables, seeds, etc.) will intensify as trade prospects expand. The corollary to this is food dependency, although the countries south and east of the basin would be likely to have a food deficit in any event.

With respect to trade, the Mediterranean is at the crossroads of different influences : the EEC, other non-Mediterranean Arab countries, then the United States and the eastern bloc countries (COMECON). The latter have significant economic relations with the Mediterranean countries that moderate the influence of the EEC.

B. FOOD AND AGRICULTURE DEMAND TRENDS

Mediterranean agricultural production is basically intended to meet food demand ; the most important non-food industrial crops are tobacco and cotton (although the latter provides oil from its seed) which, considering the unattractive prospects on the international market, are geared more to quality (special tobaccos, long-fibre cotton) than to large output.

Food demand trends depend basically on four factors, whose individual influence is difficult to grasp in practice :

. population growth is the most obvious, reliable and easily predictable factor in the growth of food demand. It is the principal factor in the dynamics of food demand in the countries east and south of the basin ;

. per capita income has an impact through income elasticity. This is low and less than one for consumer staples, cereals in particular, higher and even greater than one for animal products ;

ALGERIAN AGRICULTURE

The main features of Algerian agriculture are still :
. a limited agricultural area ;
. inadequate production compared to the needs of the population and the prevailing consumption model in the country ;
. low yields per hectare.

1. A limited agricultural areas

Since the land used for agriculture covers 39,696,000 hectares, i.e. 16.6 % of the total surface area of the country, unproductive land is equal to 79.6 % of the surface area. Out of the 39 696,000 hectares used for agriculture, 7.5 million ha corresponds farmland i.e. barely 3 % of the national territory.

Studies undertaken by the BNEDER (National Office for Rural Development Studies), indicate that the agricultural property could scarecely exceed 10 million hectare. It is easy to understand that efforts to increase agricultural production necessarily imply "the intensification of production, the increase of yields per hectare, the reduction of fallow land, the combination of stockfarming and croping, the protection of soil against all hazards (erosion, salinity, alkalinization, etc.), extension work in agricultural techniques suited to the nature of the soil in the country, and the mastery of mechanization and its profitability".

2. Trends in agricultural production

1. Crop production

Even if the production of cereals and dry pulses has stagnated to some extent (despite the 30 million quintals produced in 1985), market-garden and industrial crops developed considerably between 1966 and 1984.
Cereal production rose between 14.8 million and 26.8 million quintals from 1966 to 1975, whereas it varied between 11.4 million and 24 million quintals from 1976 to 1984. The production of dry pulses fell continously between 1974 and 1984, from 754,570 quintals to 449,340 quintals.
Market garden production increased by a factor of three between 1966 and 1984 (from 5.7 million quintals to 15.4 million quintals). Industrial crop production rose from 638,980 quintals to 1,320,819 quintals, with peaks up to 2.3 million quintals in 1980-1981.
Conversely, production of traditional crops (citrus fruit, olives, dates, figs), has dropped continuously.

2. Meat production

In the last ten years, livestock numbers of bovine, ovine and caprine herds have increased by about 50 %, although a considerable drop was recorded in 1983-1984. Inspected slaughterings of cattle increased up to 1979, at which time slaughtering fell again to the 1977 level (in tonnes).
Slaughtering of sheep and goats has remained on the increase, reaching 31.000 tonnes for sheep in 1984.

3. Agricultural yields

Trends have been similar to that of production, confirming the dependence of agricultural production on climatic hazards, and are shown in table below :

products \ crop year	76/77	77/78	79	80	81	81/82	82/83	83/84
cereals	4.11	5.86	5.61	7.60	6.46	5.93	5.63	5.45
dried pulses	6.9	6.1	4.5	4.1	4.4	3.3	3.0	2.87
market garden crops	56.9	57.9	60.2	64.1	56.4	65.75	57.12	76.53
industrial crops	86.5	43.8	72.0	46.5	92.2	41.97	89.35	61.12
artificial fodder	18.2	20.0	20.4	21.2	20.2	17.00	16.00	15.90
natural fodder	11.4	11.6	12.0	10.7	15.4	13.21	11.23	13.12
citrus fruit	113.5	99.6	102.6	98.9	86.1	37.04	30.18	63.60
olives	10	7	12	7.8	16.2	8.09	7.34	6.33
dates	20	31	33.3	32.6	31.4	29.03	25.56	25.67
figs	19	18	20.7	16.8	18.6	7.32	11.00	9.93
other fruit	22.6	18.8	18.9	19.3	22.5	8.28	9.28	18.40

VARIATIONS IN AGRICULTURAL YIELDS
(Quintals per hectare)

Output remains comparatively low despite major efforts made for several years with respect to both the organization of agriculture and its supply of equipment and tools, even though the petrochemical industry provides various kinds of fertilizers (phosphates and nitrogen).

The main trend for agriculture is towards stagnation of production and output, leading to a broadening of the gap between food needs and possiblities of meeting them, which hampers the goal of food self-sufficiency and calls for special efforts in the coming decades.

(Source, Algerian National scenarios)

. varying price levels can be attributed to differences in purchasing power, which have the same effect as an income variation (excluding specific changes, with possible product substitution when the price of only some products vary) ;

. a trend effect (often neglected) which influences and modifies individual consumption -regardless of prices and incomes- through advertising, novelty, fashion, upbringing, availability, etc. This effect increases as on-farm consumption drops and new life styles appear : urbanization plays a significant role in changing habits, including eating habits.

The traditional Mediterranean consumption pattern is based on cereals. Two other features are found in virtually all countries : the comparatively high level of fruit and vegetable consumption and the large proportion of vegetable oil in fat intake. However, these features are more or less pronounced depending on the standard of living, particularly with respect to the direct consumption of cereals which may even increase twofold. (Patterns may differ considerably between the Mediterranean and non-Mediterranean regions of the same country.)

On the whole, up to 2000, trends will most probably reflect a certain inertia, with possibly a slight increase in the consumption of animal products if price ratios do not change (increase of per capita income in the less industrialized countries may be curbed by population growth). The demographic variable will therefore be determinant in the variation of net global demand for food products : low or zero in the north, rising fast in the south and east, possibly heading for an increasing shortfall in the main food products.

In 1983, out of seven countries south and east of the basin (Morocco, Algeria, Libya, Tunisia, Egypt, Syria and Turkey), all, save Turkey, had a significant shortfall in the main food products except meat, for which the deficit was small but with very low consumption levels*.

In 2000, according to the FAO average trend scenario, all these countries, except Turkey for sugar and meat, would experience a shortfall particularly in cereals for which the increased demand deriving from stockfarming could not be met from domestic sources. Levels of self-sufficiency would drop between 1983 and 2000, despite significant growth rates for various kinds of produce.

According to the same FAO scenario, the estimated shortfall in 2000 for these southern and eastern countries would be in the region of 30 million tonnes of cereals, 3.5 million tonnes of sugar, 2.5 million tonnes of vegetable oil and, for the southern countries alone, 600,000 tonnes of meat. In addition to financial difficulties, this would pose problems related to transport, warehousing and processing, which would be carried out mostly near port zones, i.e. on the Mediterranean coast, increasing environmental stress through acquisition of land, water consumption, discharge of effluents, and a growing population attracted by new jobs.

C. SCOPE FOR PROGRESS IN AGRICULTURAL PRODUCTION

The future agro-food situation in the Mediterranean basin countries depends on natural potential and existing techniques, and on the ability of societies to exploit them. On the basis of the current situation, it is a matter, on the one hand, of identifying the scope for possible progress in agricultural production and, on the other, of comparing it to the various constraints which impede practical applications.

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* Blue Plan analysis and FAO studies

Despite several basic common features, Mediterranean agriculture is very heterogeneous and an initial distinction could be made between less industrialized and industrialized countries.

In the less industrialized countries, generally speaking, technical performance in the agricultural sector is rather weak and advances little ; increase in the surface area devoted to wheat takes place at the expense of fallow and rough grazing, and on increasingly marginal land. Techniques remain extensive and yields have scarcely changed in twenty years or so. The technological level remains very low in general, demonstrated by the limited use of industrial inputs : motorization remains below one tractor per 100 hectares and, aside from Egypt, fertilizer consumption does not exceed an average of 40 kilos per hectare. Increased use of inputs during the past decade has not produced a really significant leap in the modernization of agriculture (Figure III-2). The incorporation of agriculture in general economic activity is delayed. The labour force is both plentiful and mostly unskilled compared to what is required by modern agricultural practices, and is therefore poorly remunerated and has difficulty in acceding to physical factors of intensification and their efficient use. Domestic production is increasingly unable to meet food demand, which rises along with the population.

The situation is different in the industrialized countries. Climatic conditions are less dry (except for Israel). The countries' general economic development means that agriculture employs a smaller labour force and that production is located in more suitable places, such as the coastal plains for the Mediterranean regions. Marginal areas or those difficult to exploit, such as the mountains, play only a secondary role in production. The existence of large fluvial plains (Ebro, Rhone, Po) make it possible to produce major crops ; and, on the coastal plains, the specialized and highly intensive cultivation of "Mediterranean producte" has been introduced, with high value added and gross income, and fast productivity gains. In these countries, or in the economic groups to which they are linked (EEC), Mediterranean zones of modernized agriculture facilitate this kind of complementary specialization, while the general standard of living ensures remunerative outlets.

This kind of agriculture needs very strong linkages with upstream activities, because production requires numerous and varied industrial inputs (fertilizers, pesticides, appropriate machinery, irrigation or crop covering equipment). The often fragile crops must then have access to packaging and processing infrastructure, fast transport, and efficient marketing networks to be able to meet the demand of exigent consumers. All this is made possible by the availability of capital at all levels of the agro-food system, in the form of direct transfers (establishment of infrastructure, subsidies), or indirect transfers (cheap credit). In this case market management is the principal driving force of agriculture.

This comparison between the agricultural situation in the industrialized and other countries shows that the resources used to implement agro-food policy are very different in the north and in the south or east of the basin. The starting points are also very different, since the southern and eastern countries have not yet reached a level of intensification comparable to that of the northern countries. In the years 2000 and 2025 - the scenarios' horizons- agro-food systems in the less industrialized countries could be improved by tightening up current linkages with upstream and downstream activities, if only to apply well-known technologies used on a large scale in the northern countries. But this access to and application of modern techniques will depend on general economic growth and on the content and dynamics of international relations.

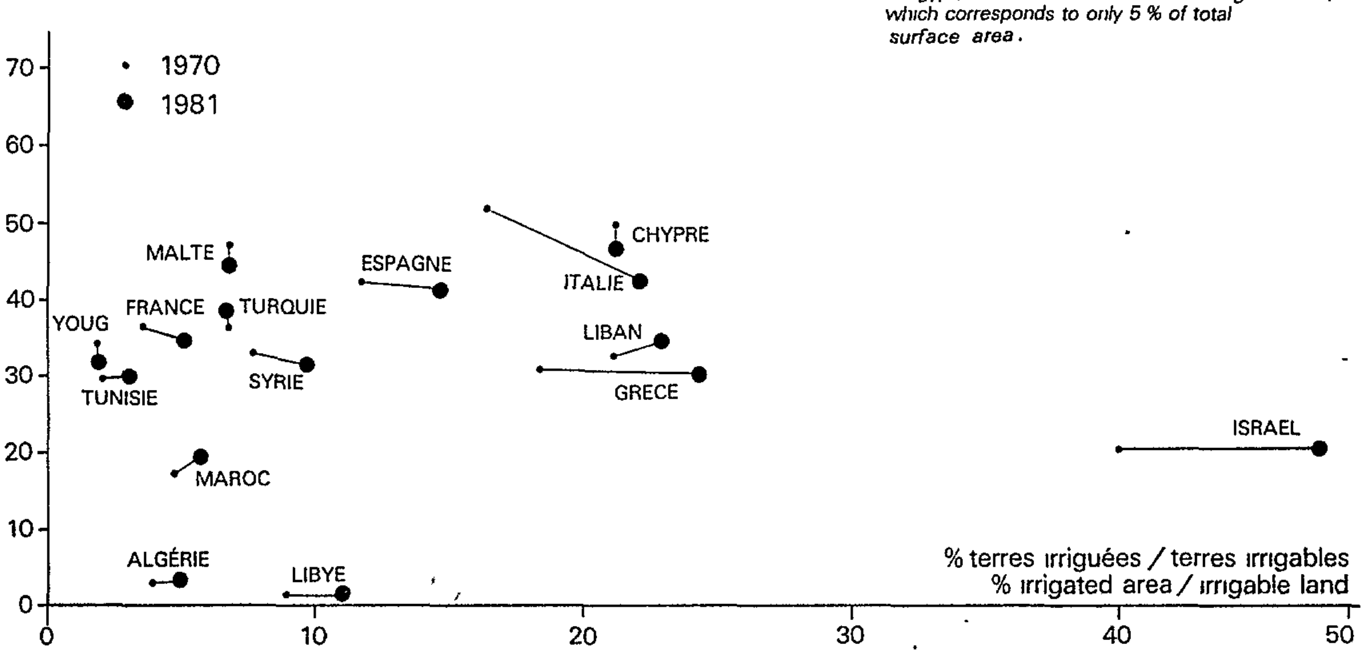
Production levels over the past twenty to thirty years for virtually all products in all countries have tended to rise fairly steadily, naturally in an irregular fashion for rainfed crops which depend on the vagaries of

QUELQUES ÉVOLUTIONS DE L'AGRICULTURE, 1970-1981
SOME TRENDS FOR AGRICULTURE, 1970-1981

SURFACE TOTALE, SURFACE CULTIVÉE, SURFACE IRRIGUÉE
Évolution 1970-1981

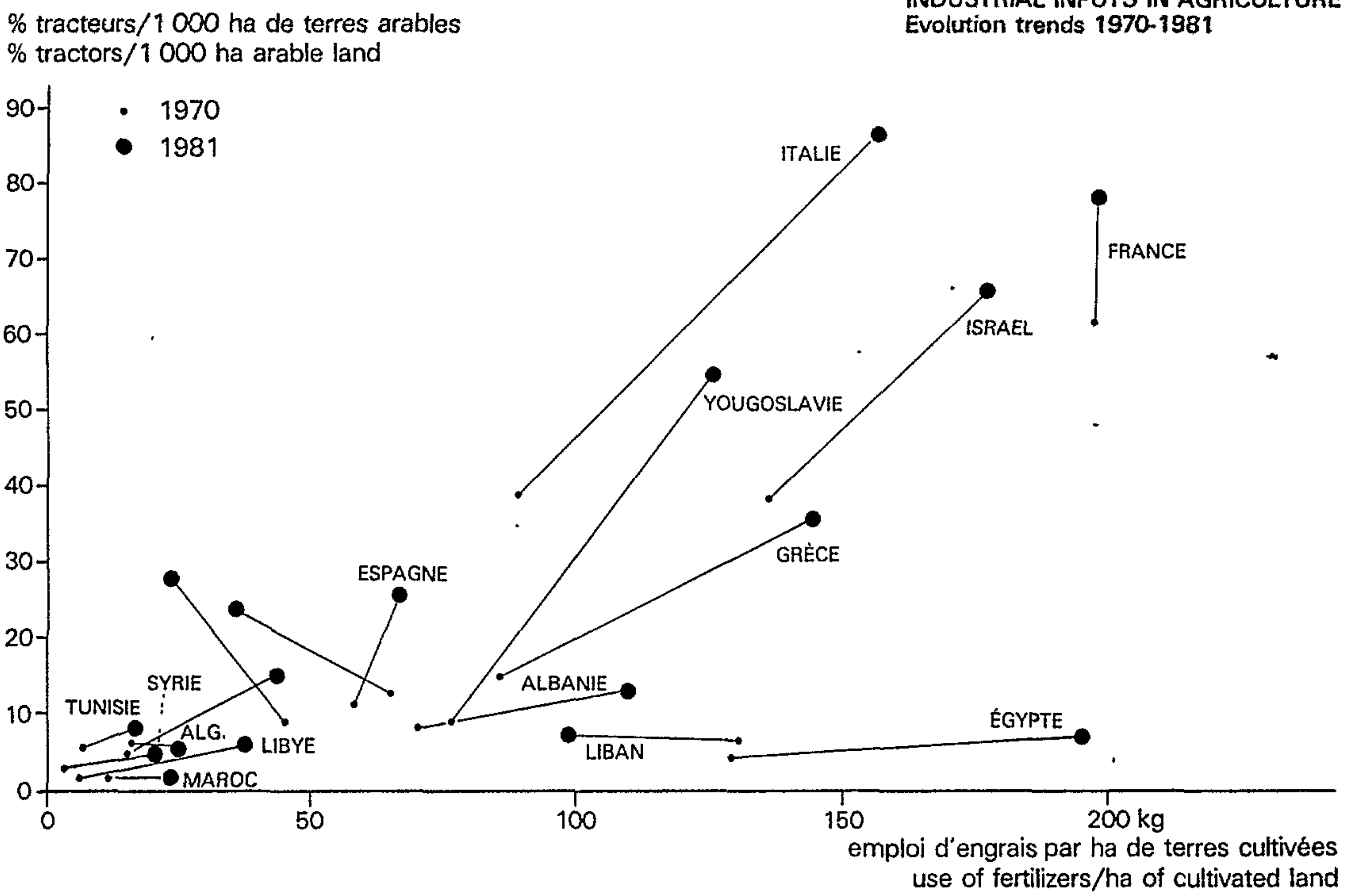
TOTAL LAND, CULTIVATED AND IRRIGATED AREAS
Evolution trends 1970-1981

En Égypte, 100 % des terres cultivées sont irriguées, sur 5 % seulement de la superficie totale du pays
In Egypt, 100 % of cultivated land is irrigated land, which corresponds to only 5 % of total surface area.



UTILISATION D'INTRANTS INDUSTRIELS
Évolution 1970-1981

INDUSTRIAL INPUTS IN AGRICULTURE
Evolution trends 1970-1981



rainfall. Over this long period yield growth rates in the region of 3-5 % per year were fairly frequent in the Mediterranean basin countries.

The intensification needed by some countries will be reflected technically by a bigger direct or indirect use of energy (fossil fuels in particular) and economically by the use of more capitalistic forms of production. (It should be noted that the option between labour-based or capital-based intensification is out of place in the Mediterranean ; capital, land and labour will be combined in varying proportions, although efficient intensification will nevertheless be the one incorporating the most capital.)

Increasing yields will depend on the more or less widespread use of industrial inputs, linked to the introduction of more productive plant and animal strains. These more or less hardy varieties require good control of the environment and the reduction of natural climatic hazards in particular. The development of irrigation is a response to this need for production control.

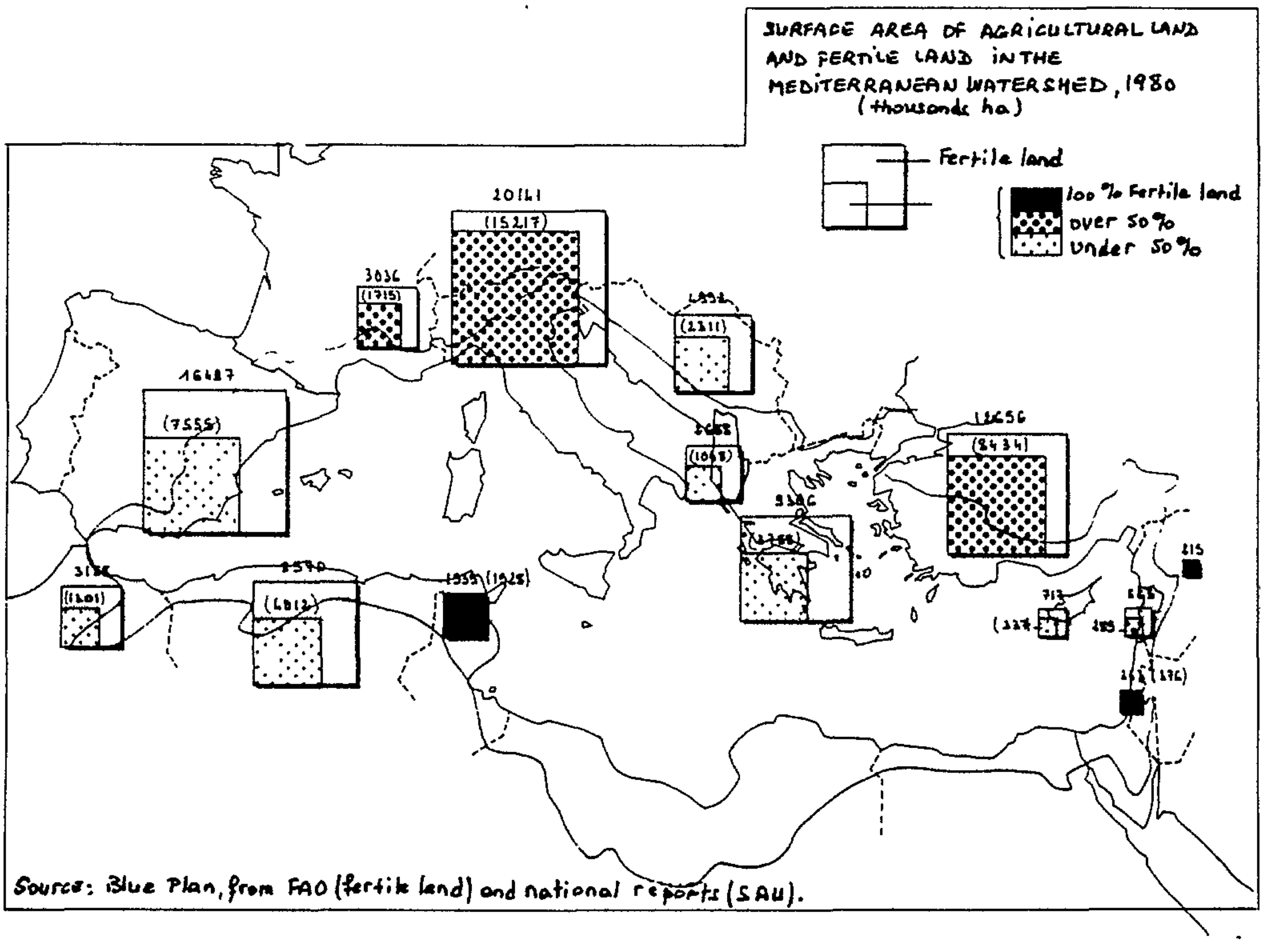
In the north, the area of land under irrigation has increased significantly (Figure III-2), whereas the area of land under tillage or permanent crops has shrunk. In the southern and eastern countries, irrigation could be the basis of a fundamental qualitative leap towards food security (and the saving of foreign currency), beyond the goal of increasing agricultural income. Linked to intensification, this control of production will be an important condition for establishing a profitable processing industry, ensured of a more or less regular supply. Agricultural intensification therefore means development of upstream and downstream industries. According to the scenarios, this progress could be furthered to a greater or lesser extent by the transfer of technology and capital from the north to the south and east, together with an opening of market outlets for processed products.

D. PRODUCE WITH INTENSIFICATION POTENTIAL

Despite progress achieved between 1960 and 1980, average yields are still low in the same countries where they had already been poor twenty years earlier. Results attained in experimental stations indicate the margins for improvement and suggest, at the technical level, the possibility of doubling yields for most plant production by 2000. A tripling or .quadrupling of yields by 2025 is not to be disregarded in a number of countries, as shown by some examples, since this gain would depend on the generalized and efficient application of techniques already well-known today.

1. Cereals

In dry farming systems, current yields for wheat and barley are low in the south and east of the Mediterranean basin when varieties are cultivated with traditional techniques. Depending on rainfall, yields vary, for example, from 3-8 q/ha in Algeria, from 7-15 q/ha in Tunisia, and are in the region of 10 q/ha in Syria. In the Fretissa experimental zone in Tunisia, yields of 50 q/ha have been obtained, still with dry farming (also in Jordan, with improved strains and good fertilizers). Taking possible yields of 30-40 q/ha as a basis, productivity could increase by a factor of about 3 to 4 in Morocco and Tunisia, 2 to 3 in Syria and 4.5 to 6 in Algeria for rainfed wheat, and between 4 and 6 for rainfed barley in these countries. Productivity gains for maize would be even higher.


SURFACE AREA OF AGRICULTURAL LAND
AND FERTILE LAND IN THE
MEDITERRANEAN WATERSHED, 1980
(thousands ha)
Fertile land
100 % Fertile land
over 50 %
under 50 %
20141
(15217)
3036
(1715)
16487
(7555)
(2311)
(4812)
(8434)
713
215
Source: Blue Plan, from FAO (fertile land) and national reports (SAU).

2. Industrial crops

In dry farming systems, yields are currently limited to 300 q/ha for sugar beet (400-500 q/ha in irrigated systems). Rainfed Israeli yields give an idea of what can be achieved : 500-550 q/ha with improved strains and good nitrogenous fertilizer. These levels would make it possible to increase yields by a factor of 2 to 2.5 in Algeria and Syria, by 1.5 to 2.5 in Turkey, and by 1.5 in Tunisia and Morocco.

3. Fruit and vegetables

Many Mediterranean countries are improving tomato-growing techniques, notably by developing covered crops (plastic tunnels) with yields in the region of 800 q/ha (in the Ferhat estate in Algeria, for instance). Taking as a reference base 600 q/ha under cover and plastic tunnels, 800 q/ha in heated greenhouses, and 2000 q/ha with hydroponic farming methods (which require sound mastery of fertilization techniques and trickle-drip irrigation), the following productivity margins are obtained for Morocco, Tunisia, Syria and Egypt : a potential threefold increase in yields with the spread of covered farming, a fivefold increase with heated greenhouses, and eight to tenfold increase with hydroponic farming ; and for Algeria and Yugoslavia, six, eight and twentyfold respectively.

The yields of Mediterranean citrus groves vary in ratio of 1 to 4. The highest yields are obtained in the Moroccan royal estates, with 400 q/ha. Yields of this level can be considered attainable elsewhere to the extent that irrigation, fertilization and the upkeep of groves are correctly carried out, and if the grove is undamaged by virosis (on the other hand, some low yields are a result of the poor soil quality of many groves established in marginal areas). Taking 400 q/ha as a reference base, yields of most of the other producer countries in the Mediterranean basin, currently in the 100-200 q/ha bracket, could be doubled or quadrupled.

4. Animal products

In irrigated areas, intensive milk production (cow), using European stock, with fodder and concentrate feeding-techniques, can be incorporated fairly easily into irrigated production systems, since these require large amounts of fertilizer. This kind of system can produce at least 4000 litres of milk per lactation, yields depending heavily on efficient herd follow-up. Taking 300 to 400 litres per lactation with local breeds as a reference base for current milk yields in the traditional sector, yields could be increased approximately tenfold with a change of breeds and intensive herd management. In non-irrigated areas and taking as reference current productivity of local southern Mediterranean breeds of 80-100 kg weight increase per cow and progany, and of 200-300 litres of milk per cow and progany, a doubling of meat and milk yields could be expected (assuming a solution is found for problems related to reproduction and breeding within the herd carried out by the stockfarmer).

In the same way, goat-breeding yields in irrigated areas could be increased by a factor of 1.5 to 2 for meat production, and 4 to 8 for milk production. On the other hand, the countries south and east of the Mediterranean basin are developing their poultry breeding along similar lines to that in the north and are obtaining comparable yields.

In conclusion, currently known improved farming techniques and high-yield varieties make it possible in principle to increase output considerably for most of the crops reviewed. It is possible at least to double

Crop / Country	Dry farmed wheat	Dry farmed barley	Irri-gated wheat	Maize (grains)	Suggar beet	Sunflower	Tomato	Citrus fruit	Soya	Broad bean	Chick pea
ALGERIA	4.5-6	6	2-3	4-5	2-2.7	8.5 11	6/8/20	2-4		4.5	4.4
EGYPT			2-3	2-3	-	1.6 à 2	3/5/8	2-4	2	1.5	1
FRANCE			2-3	2-3	2.2	1.3 à 1.7	1.3 1.8 4.5	2-4	2.5	Réf.	
GREECE			2-3	2	1.7	2 à 2.6	1.3 1.8 4.5			2.2	1.5
ISRAEL		5	2-3	2-3	2.2	3.6 4.8	1,3 1.8 4.5	1		1.5	1.5
ITALY			2-3	2	2.2	1.6 à 2	1.7 2.3 5,7		2	2.2	1.5
SPAIN			1.5-2	2-3	1.4-1.6	4.5 6.3	1.7 2.3 5.7		2.5	3	2.5
MOROCCO	3-4	4	2-3	7-8	1.4-1.6	3.6 à 4.8	3/5/8	2-4		4.5	2.5 à 3
TUNISIA	3-4	6	2-3	-	1.4-1.6	4.5 à 6.3	3/5/8			4.5	2.5 à 3
SYRIA	2-3	4	2-3	2-2.5	2-2,7	1.8 à 2.5	3/5/8			1.5	2.5 à 3
TURKEY			1.5-2	2-2.5	1.6-1.9	2 à 2.6	1.7 2.3 5.7		5	1.5	1.5
YUGOSLAVIA	SP		1.5-2 2-3	2-3	2.6	2 à 2.8	6/8/20		2.5		1.5

Table III-1 THEORETICALLY POSSIBLE MULTIPLIERS FOR VARIOUS CROPS yields as from now for all crops and for meat and milk production, but in some cases this is the limit to productivity gains, given the current state of agronomic knowledge (maize in Italy and Greece, sugar beet in Greece, sunflower and legumes in Egypt, Italy and France, where yields are already high). In most other cases, yields could be increased by a factor of three to four, even up to seven or eight for some crops by using improved techniques now known for over a decade.

Table III-1 recapitulates the estimated productivity margins for all the Mediterranean countries and for the different crops. These encouraging figures do not take into account however either the socio-economic problems related to the application of improved farming techniques, nor those concerning their dissemination among agricultural populations. Nor should they on any count be interpreted as a forecast of Mediterranean agricultural yields to the 2000 and 2025 horizons. They simply help to identify the productivity margins in agriculture.

In fact, many constraints exist and add to the technical limitations of farming.

D. CONSTRAINTS TO AGRICULTURAL GROWTH

Important work carried out notably by FAO, such as its study on the carrying capacity of soil in developing countries or "Agriculture 2000" provides a rough estimate of the differences in agricultural growth which could result from a slackening, to a greater or lesser extent, of a number of constraints in the less industrialized countries. So only the major existing constraints will be recalled here, stressing their specific characteristics according to the country.

As regards land, surface areas under cultivation are contracting in the more developed countries north of the basin, and economically marginal areas are being returned to fallow. In the southern and eastern countries only 10-11 million hectares (out of 600 million) are highly suited or suited to bear crops, according to FAO ; 4 million are marginally suited, and the surface areas actually under cultivation (including fallow land) amount to 20-21 million hectares. This means that submarginal land has been opened up and that this trend has not yet been halted. This is the point at which a physical limitation is reached.

Output control around the Mediterranean requires irrigation. Very high annual increases in the demand for water, a resource whose limitations have already been mentioned, implies competition with industry or human consumption, especially in cities. It is clear that the problem of water will be crucial during the period 2000 to 2025. Surface areas under irrigation will reach a ceiling that can only be exceeded by the use of water-saving irrigation methods, with an increase in farming intensity during the periods of lower evapotranspiration. In the scenarios this ceiling for irrigated crops has been estimated in the traditional way, i.e. with an input of water per plot in the order of 10,000 cubic metres per hectare (in accordance with FAO's various prospective studies).

Another kind of constraint is the fact that agriculture in the less industrialized countries -contrary to that in the Mediterranean regions of industrialized countries- must stay fairly mixed in order to ensure a certain degree of food security for the population. The scenarios took this into account, including for the use of limited natural resources.

As regards constraints related to animal and plant genetic material, a modification of the genetic heritage is visible all round the Mediterranean. In the case of animal resources, it is linked to the introduction and dissemination of several improved breeds, whereas the hardy local ones tend to remain static, if not dwindle. A good example of this is the virtual disappearance of Guelma cattle in Algeria. New breeds require environmental control and the introduction of artificial elements which implies a capitalistic style of agriculture centered around improved stockfarming methods. The part played by feed-lot poultry breeding in the meat supply is another example of this change. But the resources available to improve high-yield breeds or create new ones differ greatly from one country to another, and the possibility of reaching performance ceilings in animal production still seem remote. The same situation, and the same differences, prevail for plant production.

Generally speaking, the question arises of research and development capacity, which is lower in the southern and eastern countries. Whereas in these countries there is a vast margin for intensification, in the north the qualitative aspect of the use of inputs prevails over the quantitative aspects (mechanization of certain areas, fertilization techniques, resistance of different varieties , etc.).

Depending on the countries, still other constraints are linked to availability of capital and access to financial resources (transfer policy), including farmers' saving capacity and investment possibilities. At the qualitative level, labour is usually more skilled in the northern countries, especially among young farmers. In the southern and eastern countries, the general level of training is still lower, despite major efforts ; this handicap curbs the efficiency of guidance structures and hampers the access of farmers to responsible positions in farmers' organizations. The way to agricultural intensification lies through the extension of modern techniques and the means to acquire them.

Land-tenure issues are also extremely diverse, and a broad variety of land-tenure or agrarian reforms exist in the Mediterranean, ranging from simple plot consolidation or regrouping of plots to the management of most farmland through collective forms of agriculture.

Finally, institutions associated with the technical and economic guidance of the sector vary as to their nature, and their capacity to contribute to food and agricultural growth : co-operatives or agencies managed by farmers with state financial assistance and fairly broad autonomy of action, more or less compulsory state-managed co-operatives, etc.

II. AGRO-FOOD PRODUCTION IN THE BLUE PLAN SCENARIOS

The agro-food part of the Blue Plan scenarios was designed mainly to explore :
. land use
. water use
. agricultural intensification and pollution
. activities upstream and downstream from agriculture.

Although the role of agriculture in the socio-economic development of the Mediterranean as a whole up to 2025 is unlikely to be subject to major reversals, since the factors of inertia prevail over the factors of change, the narrowness of the margins for manoeuvre should not lead to the conclusion that all policies will produce the same results. The Blue Plan scenarios each provide a logical matrix of development options which make it possible to cover amply the range of possibilities. Some reference points can be identified in four of them to illustrate the differences between the scenarios.

A. MODELLING THE AGRO-FOOD SECTOR IN THE LIGHT OF THE SCENARIOS

The development of agricultural production and national agro-food systems in the Mediterranean region can be understood from the current situation and the recent past, in terms of either the internal dynamics of agricultural production or the dynamics of certain key elements of the agro-food system. Methods vary and it is important to choose those most relevant to set objectives and to the quality of information that can be gathered. The objectives were basically to understand better the extent of the impact of foreseeable agricultural development on the environmental components most affected -namely, inland water and the soil- in a number of Mediterranean countries.

In the specialized model developed, the starting point was a set of equations, termed production functions in macroeconomics, which link production at national level to a number of factors such as, in this case, land (the soil), irrigation (water), agricultural machinery, fertilizers (and their impact on water pollution) and labour.

Simulated agricultural production is in fact an aggregate figure : the quantity of each agricultural product harvested is multiplied by a deflated price, and additions are made for all products (it was not possible to study output in detail, product by product, although a number of individual values were estimated for 2000). An increase in the value of agricultural production can therefore be obtained in two ways : either by an increase in the quantities of certain crops harvested, or by the substitution of lower priced products with higher priced produce. In the first case, there is an intensification of agriculture without any basic change in the national production system (as in the T trend scenarios), whereas in the second case, over and above any possible intensification, there is a specialization linked with increased trade, within the logic of the A alternative scenarios.

The first production factor is the surface area cultivated annually, and the area under permanent crops (orchards, vines, etc.), excluding fallow land and rough grazing. The extension of the surface area under cultivation could result from either land clearance or a reduction of fallow land. In both cases, any extension leads to a reduction of grazing land and disappearance of its richest areas. It should be noted that the ratio of agricultural production to cultivated area corresponds to yield, or productivity, per surface area unit.

Special attention was given to surface areas under irrigation. It should be observed that areas recorded as under irrigation differ widely as to the type of irrigation in service, some using flood water or winter irrigation, others having complete control of water throughout the year. The prospective study assumes complete control in the future, ensuring 10,000 cubic meters per hectare, sufficient for efficient irrigation and good agronomic results. Any use of water-saving techniques would be reflected by an increase in real irrigable surface areas.

The use of NPK fertilizers has also been included, regardless of their kind and form of application. Methods of use do not necessarily combine efficiently to exclude wastage. Moreover, the distribution of fertilizer on crops is not homogeneous, and this factor must be considered above all as an indicator of intensification and the use of industrial inputs. It therefore also indicates the extent to which agriculture is linked to the general development of the country and its industry, the chemical industry in particular.

The introduction of mechanization is important. It is not clear how intensively the tractor stock is used. In the industrialized countries, there is often over-mechanization linked to specific farming practices, private ownership, etc. In the less industrialized countries, a considerable part of the stock is often immobilized due to breakdowns and to the fact that spare parts are not immediately available. Mechanization should therefore also be considered as an indicator of agricultural intensification through the use of industrial inputs, and in addition represents a link with the development of upstream industrial activities.

The agricultural labour force as a factor of production can reflect to some extent the state of intensification through labour. But this factor also partly contributes to consistency in the interpretation of results with respect to the general level of economic development and to specific problems such as rural exodus, urbanization, etc.

Finally, the model took into account possible advances stemming from better use of existing techniques and their improved efficiency (selected seeds and high-yield varieties, observance of the calendar for agricultural tasks,-appropriate location and apportioning of fertilizer inputs, etc.), through a "technological multiplier". This factor is above all linked to the alternative scenarios, which assume technological transfers and technical co-operation among Mediterranean countries. It takes into account performance comparisons, results of experiments and ecological similarities in the various scenarios and for different countries.

Projections have been drawn up for 2025 (the year 2000 was usually deduced by geometrical interpolation, except when an intermediate exogenous value was available) for four scenarios : T-2 worse trend, T-3 moderate trend, A-1 reference alternative, and A-2 integration alternative, for two groups of countries :

. Morocco, Tunisia, Libya, Syria, Spain, Italy and Turkey, for which there were acceptable descriptive equations,

. Algeria, Egypt, France, Greece and Israel, for which it was not possible to determine a production function.

The first step for the countries in both groups was to set a level of agricultural production, scenario by scenario, for 2000 and 2025. For EEC member states, this level reflects assumed market constraints ; for the others, a country's known potential was taken as a basis. Then the size of the agricultural labour force was estimated according to the mechanisms of agricultural income trends per worker (in relative terms, compared to the average income per worker in the economy) ; these mechanisms amount to an assumption that the agricultural exodus is discouraged when income per agricultural worker reaches a given level.

When production functions were available, they were used to estimate factor demand, basically land and fertilizers or machinery. The coefficients of these functions were set at their assumed value in a state of equilibrium. The multiplier coefficient which simulated technical progress was given different values for the southern and eastern countries on the one hand, and the northern countries on the other. For the first group it was given the value of 1.5 for the reference alternative scenario A-1, and 2.5 for the integration alternative scenario A-2, in 2025. These values were respectively 2 and 1.5 for the northern countries, the highest value for the members of the European Community being attained in A-1, where markets and trade are the broadest.

To conclude on the subject of methods and hypotheses, it can be said that the comprise between a purely technical analysis of agricultural potential in each separate locality (a huge task for such a heterogeneous set of countries) and greater degree of formalization or modelling (with the risks associated with the remoteness of the horizon) is justified basically by the fact that formalization serves mainly to guide the evaluation of agronomists or economists.

B. FINDINGS OF THE SCENARIOS

Tables III-2 give some of the findings by country, by scenario, and for the two horizons 2000 and 2025 (together with 1980 reference walues for comparison purpose). Information here will be confined to a general outline of projections for the countries south and east of the Mediterranean basin as a whole, and for the countries north of the basin.

1. Countries south and east of the Mediterranean basin

In this set of countries the worst trend scenario T-2 stands out from the other trend and alternative scenarios.

For the sake of consistency, low agricultural growth, even decline in one country has been linked with the T-2 scenario general hypothesis of slow economic growth. The agricultural labour force was estimated to keep the income gap between agriculture and the other sectors to a level close to that of 1980. Rural exodus therefore remains reduced, although this scenario assumes the highest rate of population growth : the labour force (all sectors) for the countries south and east of the basin as a whole thus nears 100 million, from a starting point of 26 million in 1980. The agricultural labour force, although declining fairly fast compared to the total economically active population, still amounts to 15 million, higher than the 12.5 million in 1980. So there is a slight increase in production with a large labour force, in other words a weak growth of productivity, equal on average to 1.4 times its initial level in the region. This average conceals extreme cases, one country inter alia where the 2025 level is scarcely higher than of 1980 (this is in no way intended as a forecast, but merely a matter of extending the hypotheses to their limits).

Estimates indicate however a significant increase in yields per hectare, even for the most disadvantaged countries : by a factor of 1.7 in Morocco and 2.6 in Syria between 1980 and 2025. This increase is the result of an expansion of irrigated surface areas as a percentage of total surface area amounting, for example, to 16 % in Morocco and 12 % in Syria, combined with a strong shift towards mechanization and the use of fertilizers, more than 8 times the level per hectare compared to the base year.

Nevertheless, Tunisia and Libya display characteristics found in other scenarios, associated with the very small size of the agricultural labour force, especially in Libya, which relieves pressure on land. If the findings for these countries are compared with the former ones, it can be observed that the model leads to a substitution of capital for labour : the number of machines per 1000 hectare is 57 in Tunisia, and 66 in Libya, compared to 28 in Morocco.

Moderate trend scenario T-3 and reference alternative scenario A-1 illustrate hypotheses of distinctly higher general and agricultural production in an atmosphere of commercial exchanges which, despite their differences as regards the role of Europe, are similar in one aspect, namely a price structure conducive to trade rather than self-sufficiency. As a result, agricultural value added more than doubles or triples by 2025 compared to the base year, with a smaller agricultural labour force in the T-3 scenario than in worse trend

SOME RESULTS FROM THE MOROCCAN AND TUNISIAN MODELS

The models make it possible to explore the very dissimilar conditions in these two countries, endowed with very different natural resources, water in particular. Water is scarce in Tunisia, and the surface area under standardized irrigation reaches at most 400,000 hectares, compared to 1,250,000 in Morocco.

In these two countries the T-3 moderate trend scenario produces maximum pressure on land : about 1 hectare per agricultural worker in Tunisia, compared to 0.80 in Morocco where demographic growth is stronger. The result of the scenario is an expansion of cultivated land, although this is doubtful even it were combined with minimum agricultural employment : in Tunisia a 35 % increase in surface area under cultivation as compared to 1980, in Morocco 67 %. Clearly these are extreme cases, but on the whole illustrate the fact that, without technical progress, even a not very ambitious growth objective is inaccesible (doubling of production in Morocco, multiplying by 2.4 in Tunisia). Correlatively, it is interesting to observe that the two alternative scenarios, which have production objectives for 2025 that are 3.6 to 5.2 times higher than in 1980, require a much smaller surface area, for example, less by about 20 % to the 1980 level for the A-2 scenarios in both countries.

In view of its water resources, it is not surprising to see that Morocco achieves a much greater intensification than Tunisia, at least in absolute terms. Compared to the situation in 1980, however, output in Tunisia is 6.6 times higher, whereas it is only six times higher in Morocco.

Analysis of mechanization and fertilizer consumption indicates the price to be paid for the lack of water : the other inputs, land, fertilizer, tractors, have to increase more.

The overall evaluation brings out the fact that, excluding a stagnation which is difficult to foresee (T-2 scenario), the most important parameter -even for a country comparatively rich in water like Morocco- is the rate of technical progress.

In both countries the least favourable situation for the environment (pressure on resources and pollution), is that explored in the T-3 scenario : growth combined with technical stagnation. The most favourable situation corresponds to the most ambitious production objective, solely because the technical progress assumed in this scenario (A-2) simultaneously minimizes the use of land, fertilizers and mechanization. This objective, however, can only be achieved if irrigation approaches its maximum potential in 2025 ; this is the second conclusion to be drawn.

scenario T-2, about the same size in the A-1 scenario. Briefly, agricultural productivity, hence per worker income, is distinctly higher in these scenarios : more than double in T-3, a little less than triple in A-1 for the region as a whole.

Per hectare yields would double in T-3, triple in A-1, with peaks of three to fivefold increases for Syria. These yields are obtained either through a surge in mechanization, for example in the Maghreb, or through a considerable expansion of the irrigated surface area (Syria). An exogenous factor simulating technological progress must be added for the A-1 scenario, justified by the effect of trade combined with financing from Europe for research and training activities. The special features of Tunisia and Libya as because average yields are lower in these two countries than elsewhere because of lack of water ; high productivity per worker is then obtained partly through a reduction in the size of the labour force and, as in the previous scenario, through a more pronounced substitution of capital for labour.

In the integration alternative scenario A-2, higher agricultural output is aimed first of all at self-sufficiency. In this kind of scenario, development economic policy as a whole is assumed to be geared to encouraging small and medium-sized enterprises in order, inter alia, to establish as large a population as possible in rural areas, while waiting for the growth of industrial employment in the cities. Despite the higher level of production, productivity per worker advances little beyond the level of the reference alternative scenario A-1, because of the large number of agricultural workers.

The technological performance assumed by the model is reflected by very high per hectare yields. In Morocco and Syria they reach on average those of Italy at present, and in Tunisia and Libya are nearly double those of Spain today. This level of intensification is not only the result of irrigation and the use of industrial inputs, whose levels are indeed high, but barely exceed those of the A-1 scenario. In this case an optimization of technological progress was assumed in particular, based on training and the quality of agricultural research, oriented equally towards traditional agriculture and modern farming. This progress enables farmers to improve their use of machines and industrial inputs and irrigate more efficiently, all factors contributing to a reduction of the impact on the environment. This trend is supported by extension institutions and agricultural credit, and by a remunerative price structure for produce for both domestic consumption and export.

2. Countries north of the basin

In the T-2 and T-3 trend scenarios, agricultural production (imposed exogenously in the model) is at a standstill in the Mediterranean countries of the European Community (Spain, France, Italy and Greece) because of market constraints. In the other countries, Turkey in particular (included with the northern countries in this section), production advances strongly in the moderate trend scenario T-3, a little less in the worst trend scenario T-2.

In the reference alternative scenario A-1, in which the countries south and east of the basin exchange manufactured goods and market garden produce for cereals, the special market these countries offer for cereals and animal products could account for a doubling of European Community production. In the integration alternative scenario A-2, Community production falls off somewhat compared to the A-1 scenario. In the other countries, production triples or even quadruples in the two alternative scenarios, to reach its maximum.

COUNTRY		Agricultural value added (M $ 1975)	Yield value added/ hectare (1000 $/ha)	Percentage irrigated land %	Fertilizer per hectare kg/ha	Productivity ($ 1000/ worker)
SPAIN	1980	10,535	0.514	14.8	77	4.7
	T-2	10,637	0.780	24.4	148	15.3
	T-3	11,045	0.794	26.1	136	23.5
	A-1	35,556	1.781	22.5	299	28.7
	A-2	29,810	1.458	19.6	298	24.5
ITALY	1980	16,717	1.344	23.1	174.8	7.0
	T-2	16,717	1.478	30.4	300	29.0
	T-3	17,553	1.666	40.9	300	35.4
	A-1	33,029	3.171	43.2	350	45.2
	A-2	20,754	2.544	49.0	350	34.1
TURKEY	1980	11,400	0.399	7.2	47	1.1
	T-2	19,995	0.873	11.3	151	2.0
	T-3	22,407	2.023	28.9	199	3.7
	A-1	29,843	3.009	40.3	203	5.0
	A-2	49,389	3.846	31.1	211	5.0
SYRIA	1980	1,328	0.233	9.6	22.59	1.3
	T-2	3,617	0.612	11.6	187	1.0
	T-3	4,309	0.749	14.3	187	1.5
	A-1	5,808	1.165	20.1	234	2.1
	A-2	8,961	1.361	15.2	249	2.7
LIBYA	1980	413	0.199	10.7	34.62	3.5
	T-2	648	0.335	13.2	250	4.3
	T-3	648	0.345	13.6	250	8.5
	A-1	1,058	0.531	12.9	250	10.1
	A-2	1,613	0.899	14.3	250	10.1
TUNISIA	1980	800	0.168	3.3	14.5	1.3
	T-2	1,832	0.331	4.2	200	2.8
	T-3	1,939	0.333	5.0	200	3.1
	A-1	3,303	0.573	5.6	200	4.7
	A-2	4,203	0.932	8.9	200	5.6
MOROCCO	1980	2,008	0.251	6.4	28	0.7
	T-2	2,099	0.437	15.9	250	0.7
	T-3	4,309	0.545	12.1	280	1.7
	A-1	7,275	0.828	14.2	280	2.7
	A-2	9,635	1.291	16.7	280	2.8

Table II-2.A Countries and production functions

COUNTRY		Agricultural value added (M $ 1975)	Productivity (1000 $/ worker)
FRANCE	1980	20,072	10.17
	T-2	20,072	41.69
	T-3	21,076	49.71
	A-1	33,119	60.71
	A-2	27,097	46.63
GREECE	1980	3,555	2.44
	T-2	3,555	29.11
	T-3	3,733	35.36
	A-1	11,909	45.21
	A-2	10,665	34.05
ISRAEL	1980	765	7.17
	T-2	1,603	21.06
	T-3	1,954	26.70
	A-1	2,258	30.25
	A-2	2,371	28.30
EGYPT	1980	4,094	0.69
	T-2	8,188	1.29
	T-3	9,826	1.53
	A-1	12,282	2.04
	A-2	15,148	2.06
ALGERIA	1980	1,223	0.59
	T-2	611.5	0.39
	T-3	1,223	0.90
	A-1	4,281	1.46
	A-2	5,504	1.59

Table III-2.B Countries excluding production functions

Table III-2 SOME FINDINGS OF THE AGRICULTURAL SCENARIOS IN 2025, AND COMPARISON WITH 1980

The agricultural labour force also follows the different trends in the European Community member states and the other countries north of the basin, chiefly because of demographic features specific to the latter, especially Turkey. In the EEC member states the agricultural labour force drops from 11 % of the total working population in 1980 to 2-4 % in 2025. In Turkey, the agricultural labour force falls from 53.5 % of the working population in 1980 to 21 % in 2025 in the T-2 scenario, and to 14 % in the T-3 scenario, but accounts for 26 % in the A-2 scenario. The scale of the reduction, although significant, cannot be compared to that of the EEC countries. As a result, productivity levels still differ considerably in 2025.

The effects of technological progress are also different in the two subgroups of countries. In Spain, for instance, the Common Agricultural Policy produces a rapid contraction of the area under cultivation on the one hand, and a reduction in the size of the agricultural labour force on the other, the combined effect of which is to keep a density of 5 to 6 workers per 100 hectare. The intensification process is vast, with a quadrupling of industrial inputs per hectare compared to the base year (reaching 110 machines per 1000 hectare), and irrigated surface areas amounting to 20-26 % of arable land. In Turkey, on the other hand, potential production in the A-2 scenario could equal or even exceed that of Spain, but with four to six times more agricultural workers, hence a substitution of capital for labour -indicated by the density of machines and fertilizers per hectare- one third lower than in Spain. Factors in these proportions suggest farming practices mid-way between horticulture and the mechanized farming existing in the European Community. In other words, per hectare yields in Spain and Turkey are fairly close, but obtained with widely diverging technologies.

On the basis of these scenarios it is estimated that the consumption of chemical products (fertilizers and pesticides) in the Mediterranean coastal countries will double in 2000 compared to 1980. The southern and eastern countries, where consumption would triple or quadruple, would catch up with the northern industrialized countries, where an increase of a factor of 1.4 to 1.5. In 2025, a rough estimate would be a threefold increase in the basin, varying from five to sixfold in the least industrialized countries and doubling in the industrialized countries as compared to 1980.

Tractors, i.e. motorization, will increase by a factor of 1.5 to 2 in 2000 and by less than 3 in 2025, with considerable differences between the north, where the rise would be by a factor of 1.5 in 2000 to 2 in 2025, and the southern and eastern countries, where the increase would be in the region of three to fivefold in 2000 and five to eightfold or more in 2025. Two diagrams, one for 2000 and the other for 2025 pinpoint the growth in the rough estimates of the main variables on the scale of the Mediterranean basin (Figure III-3).

C. PROFILES OF CHANGE

Changes in the north will stem above all from increased yields, in the region of 50 %, on the basis of already significant output. Areas under cultivation will tend to contract, crop substitution or change of location taking place according to price variations and institutional provisions for marketing. In the southern and eastern countries the dynamics of domestic demand and population pressure will result in an increase in the surface area seeded and planted, and yields will also rise. Variations will depend on crops and their technical and economic performance.

Thus increase in yield and expansion of crop areas can be expected inthe south and east for dry-farmed cereals (wheat, barley) ; crop areas and yields will also grow rather fast for irrigated maize, either for fodder or grain. The development of rainfed tree-farming will be backed up by motorization in some areas and the

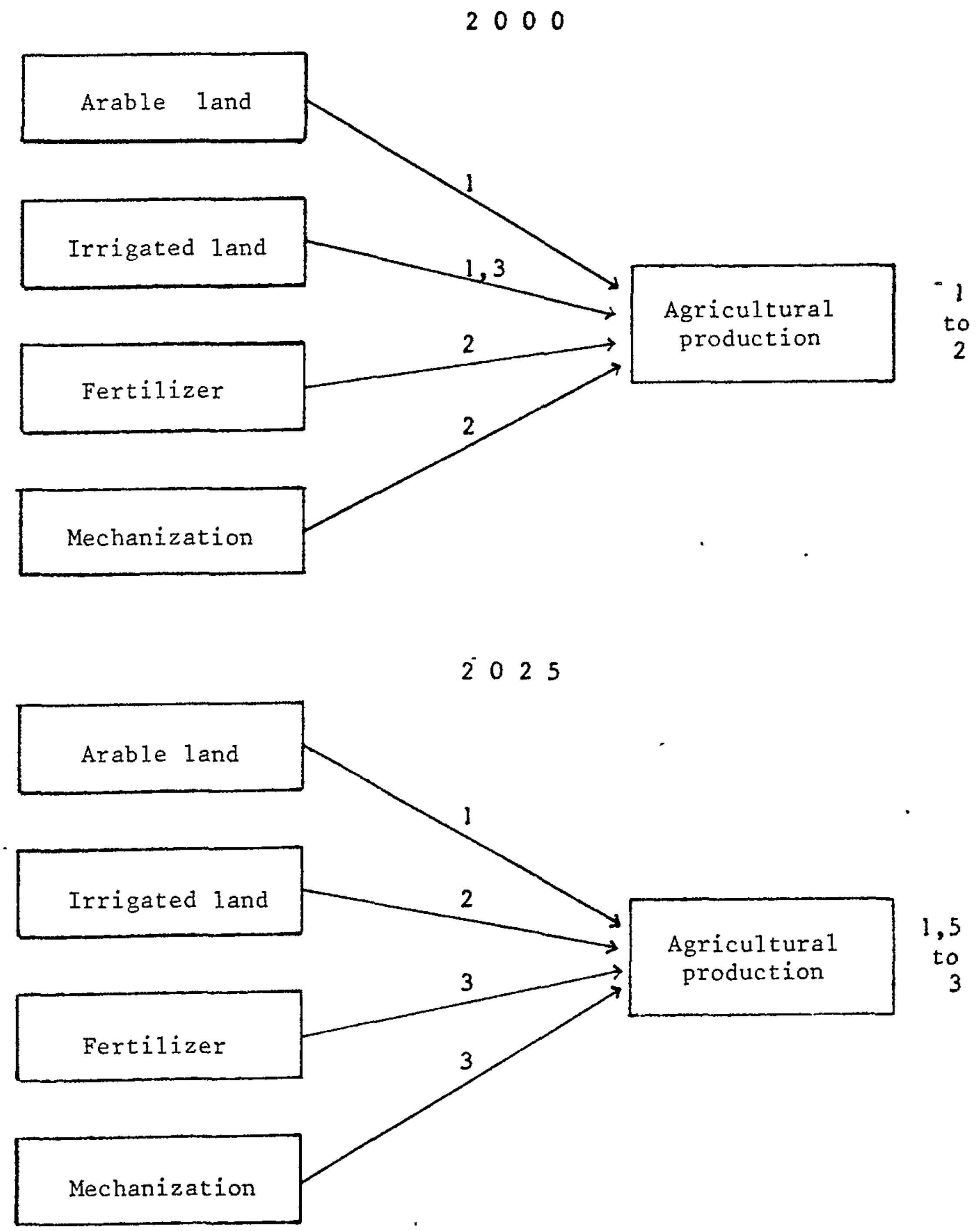


Figure III-3 Estimate of increase in use of production factors in 2000 and 2025 for the Mediterranean countries as a whole (current situation = 1) improvement of farming practices. Oil crop production will be supported by an expansion of crop areas and improved yields, particularly for oilseed. For fruit and vegetables under irrigation, growth could stem from a combination of higher domestic demand and the opening of foreign markets, with the surface area devoted to citrus fruits remaining static.

For other produce, the fact that crop areas do not expand corresponds to an adjustment to high profit produce : thus for cotton, the search for commercial quality (long fibre), prevails over the increased output of an indifferent product. After the sugar boom of the 1970s, it is likely that the surface area devoted to beetroot will not increase for a while considering possible improved yields and the price of sugar on international the market.

The contraction of grazing and fallow land will entail changes in extensive stock farming. Since demand for milk and meat becomes more urgent, stock farming will use increasing amounts of cereals or cultivated fodder (which will assume a fairly important position in crop rotation in irrigated districts) to supplement animal feed. For some breeds feed-lot farming will boost the already large market share they supply, based largely on imported feeds.

In some scenario options, particularly in the alternative scenarios, the value of production would rise rapidly because high value-added products would become important (intensively produced meat and dairy products, fruit and vegetables, competitive on the international market on account of their quality).

The profile of Mediterranean agriculture in 2000 and 2025 will therefore, in all scenarios, be one of capital, but with varying efficiency and success, and with a significant impact on the environment.

III. AGRO-FOOD AND ENVIRONMENT TRENDS

A. AGRO-FOOD INDUSTRIALIZATION

The salient factor in coming years in the Mediterranean world -as elsewhere- will be the increasing industrialization of the agro-food system. This means that agriculture itself will be making increasing use of industrial inputs, and that output will undergo various processing operations prior to consumption. The agro-food system will therefore form part of a broader industrial system, above and below the production stage, and this integration will become stronger regardless of the type of scenario. In fact, there will be a wider difference between future agro-food situations and the present situation, than among the various scenarios for a given period. The largest technological leap is likely to occur in southern and eastern countries where, in the next twenty to thirty years, industrial consumption by the agricultural sector will draw level with consumption observed at present in countries north of the basin.

Incidentally, fertilizer consumption and use of tractors, as presented for the scenarios, are in fact only two indicators of industrial degree of the penetration in agriculture. A remarkable feature is that industrial consumption is not proportional to production results ; whereas a clear progression appears in production levels, which rise from T-2 to A-2, use of fertilizer and tractors does not follow on the same scale. The technical capacity of the agricultural production system to use industrial inputs to the best advantage, and in general to adopt technological innovations, must be emphasized, as well as the efficiency of institutions organizing this sector. Mastering of agricultural development factors other than technical ones remains a major objective for progress, as any attempt at agricultural intensification, poorly mastered and executed, would result in wasted money and effort, and also probably further indebtedness among peasant farmers lacking any significant investment resources.

Industrial activity downstream of agriculture will be stimulated by changes in life-styles, mainly as a result of urbanization. Storage, packaging, processing, transport and distribution of produce will expand fast, even if agricultural policy encouraging small-scale food production near urban areas (market gardening, fruit, minor stock farming), and local trading, were energetically implemented.

All this activity will affect the environment because the energy, water and other types of consumption required, and pollution produced. A fivefold increase or more in agro-food activities by 2025, in countries south and east of the basin should be envisaged, possibly at a faster rate than overall industrial development. If insufficient, local or national supplies could be supplemented by imports.

In the northern countries, downstream agro-food industries will continue their growth, but at a slower rate than in the other countries, and tending towards greater product sophistication rather than major increases in processing capacity. The pollution caused by downstream industries in industrialized countries is unlikely to increase much.

Countries to the south and east are more vulnerable than northern ones to the increase in pollution and environmental pressures arising from development of the agro-food sector. Land-based pollution stemming from massive use of fertilizers would be the most obvious outcome, even if innovations, such as the ability of plant roots to fix nitrogen in the air directly after inoculation, lead to savings in this area. In fact, the ability to use inputs appropriately will be a determining factor in the possibility of intensification at lower pollution cost.

As regards other ways of reducing food-industry pollution, several lines of research are at present being followed up :
-use of waste as raw material for other productions, such as animal feedstuff, fertilizers, plastics, etc, (e.g. use of lactoserum, whey, cheesemaking scraps) ; -improvement of separating methods, in particular diaphragm techniques- ; use of biotechnologies.

One aspect of agro-food development that needs to be considered is "non-soil" production. This can involve both plants (tomatoes and large-scale greenhouse horticulture) and animals (poultry, milk, eggs) ; characteristic of the method is effective control of the production process, an advanced level of technology, and a completely external source of inputs, which justifies the use of the term "non-soil". Hence there can be a considerable degree flexibility in locating these activities (like food-processing industries) either near centres of supply or of consumption. And yet, in all cases they quickly become large scale and their effluent causes pollution, unless removal or re-use of waste is properly organized. When, in addition, non-soil units are concentrated around urban areas, the problem can become quite serious.

The rising demand for animal products will increasingly be met from intensive feed-lot livestock units, which may be virtually the only source of supply by 2025, relying to a considerable extent on imports. Clearly the major lines for the rational establishment of units should be planned to avoid any error, supplemented if possible, in southern and eastern countries, by the re-use of effluent .

In northern countries, demand will grow far less quickly, and non-soil production can be more dispersed, in so far as a substantial proportion of supplies will come from domestic sources.

However, information is still too fragmentary to go beyond the speculative stage. Moreover, the isolated nature of pollution sources, and problems in identifying the type of pollution (antibiotics, plastics, for instance) and volume discharged into the environment, make any nationwide or regional prospective calculation for each kind of production very difficult.

Some figures provide an idea of the volume of pollution discharges. For instance, as regards battery or penstock breeding, one bird in a battery cage produces around 20 percent of its own weight in waste matter every year.

B. VARIATIONS IN UNCULTIVATED PLANT COVER AND LAND USE

Land is a specifically agricultural production factor. In the past, the area under cultivation tended to increase overall as a result of demographic pressure, for many years absorbed mostly by the countryside. Agriculture, particularly if there is a lot of communal land or small holdings, acts as a "shock absorber" for employment. The tendency in this case is then for the development of a more intensive use of land, notably by an increase of areas under cultivation or permanent crops, to the detriment of pasture land, rough grazing and ranges, fallow land, forests and wetlands. This trend reflects population pressure on natural resources in societies where technical resources are poorly developed and increase in output comes from greater use of the land factor.

The recent past has seen a movement away from this general trend towards expansion of farmland, in countries with the capacity to use and deploy more intensive capital-based techniques to a significant extent, mainly by using industrial inputs, such as fertilizers, pesticides, machinery and specialized irrigation techniques. As already, as already emphasized, this capacity to use and produce industrial inputs has to be related to a country's general level of development, its mastery of production techniques, and its saving and investment possibilities. The methods and general level of workforce training and guidance should also be mentioned.

The possibility of using more capital in agriculture thus evolves as jobs are created in other sectors of the economy ; beyond a certain threshold, agriculture no longer needs to play a predominant role in absorbing employment : the unduly intensive farming of marginal land drops sharply.

This situation has been reached in the last few years in countries north of the basin. In France, for instance, the phenomenon has long been under way in the Mediterranean region strictly speaking, while it is very recent in Spain and Greece. Among southern countries, Libya, because of its oil income and small population, displays the same pattern as countries to the north as regard trends in areas under cultivation.

In other southern and eastern countries, the sharp increase in irrigated areas expected in the future will not prevent areas under cultivation or cropland from increasing up to 10-20 % between 1980 and 2000, depending on the country and the scenario, with the possibility of reaching 5-30 % in 2025. In general, one type of scenario does not further an increase in cultivated land more than another. The moderate trend scenario T-3 and alternative scenarios would appear to use the most land. But, on any assumption, pressure will remain high on uncultivated plant cover until 2025 in southern and eastern countries ; and yet in these countries, the area under cultivation (including fallow land) is nearly always greater than the area suitable for farming.

In addition to the risk of a spread of sterile land through soil erosion or salinization of irrigated land (see chapter on soil in the fourth part), there is the more general phenomenon of soil impoverishment and changes in water flows.

Apart from clearing new land, surface area can be extended at the expense of fallow, land left to rest in a rainfed farming system. The practice of fallowing restores some of the soil fertility. However the soil's rainwater storage capacity reaches a lower level than with true "dry farming" methods. In fact, fallow land is usually not worked, and becomes covered with spontaneous weed growth, all the more easily as weedkiller is not in general use.

Other consequences of the contraction of uncultivated plant cover involve the reduction of grazing land and a drop in quality in terms of fodder unit capacity.

Until recently, steppe-like regions with low agricultural productivity, together with fallow land, were used for extensive sheep-raising, sometimes with seasonal transhumance. These long-established practices are likely to decline at the same time as the reduction of grazing land, sometimes even faster insofar as, when a single factor in transhumance disappears, the overall capacity of the system is affected.

With the reduction of grazing land, in surface area and quality, the supply of mutton will dwindle, and it will not be easy to counterbalance this loss by more intensive methods. This means that feed-lot stock raising, particularly of poultry, will have to play a more important part, with the concomitant increase in animal feedstuff imports, mainly grain and protein-rich ingredients, a process which will swell port activities.

A final aspect that should be mentioned is loss of productive land to other uses. Clearly, different human activities are at odds over land use : among other things, urbanization and the need for land for communication routes compete with agriculture, sometimes on high-quality land, not to mention tourist and industrial developments (the problem being most acute in coastal areas).

For northern countries however, farmland will generally continue to contract. This raises a management problem, namely how to prevent the spread of wildland, unsuitable for leisure activities and prone to fire.

A few figures illustrate how acute the problem is on the southern and eastern shores of the Mediterranean :
- in Tunisia, between 1962 and 1974, land zoned for urbanization increased fivefold at Naboul, Hammamet, Sousse and Sfax. The annual urbanization rate for south Tunis in 1962 was 6 % ; by 1984 it was 34 % ;
- in Libya, urban areas covered 17.6 % of the best agricultural land in 1980, 6 % of good agricultural land, and 1.6 of land with average fertility ;
- in Egypt, more than 15 % of farmland was lost to urbanization during early five-year plans, and the crop area per capita is shrinking annually by more than 2 %.

C. FERTILIZERS AND PESTICIDES

1. Fertilizers

Fertilizers used in agriculture are not completely absorbed and spread pollutants in the environment. If concentrations become too heavy, they may make groundwater unfit for consumption and create problems for the domestic water supply. In the case of insufficient leaching, soil quality is also threatened (risk of salinization in dry climates).

The two main elements concerned are nitrogen and phosphorus, and more specifically :
- nitrates. Being highly soluble, they percolate into the soil and either accumulate in groundwater or are conveyed into rivers with runoff water ;
- phosphates. Virtually insoluble, they are carried (in the same way as potassium from potash fertilizers) with the eroded sediment to which they are adsorbed. In addition, phosphate fertilizers contain trace toxic elements (cadmium for instance), likely to accumulate in the soil or in tissue over the long term.

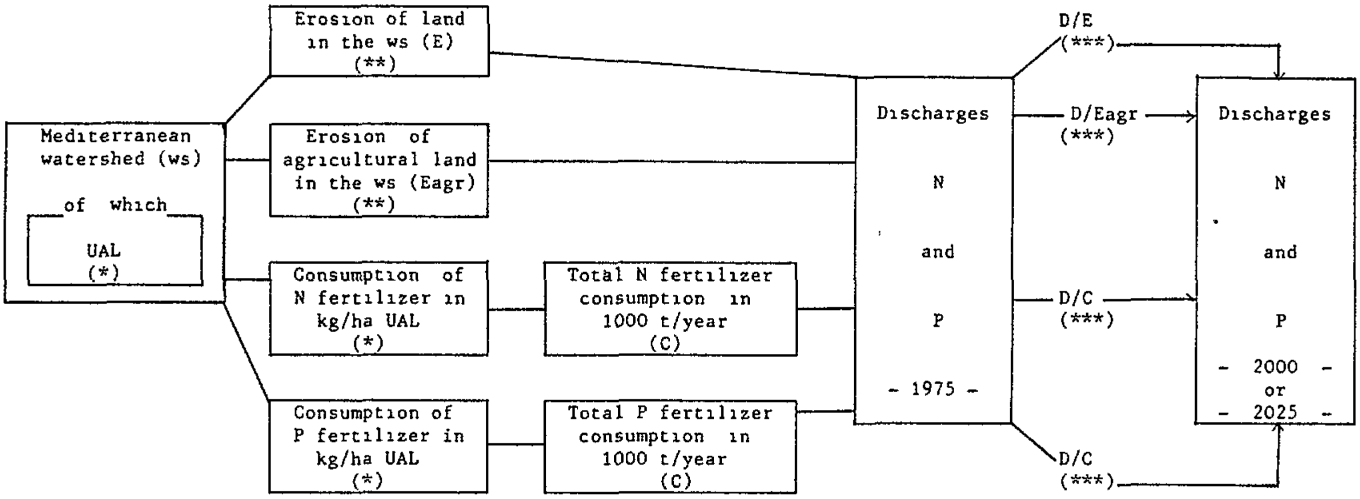
The European countries, alerted by the recent fast degradation of the drinking water resources in intensive farming and stockbreeding areas, caused mainly by the increase in the amount of nitrates in the water, start to have a better knowledge -if not complete control- of the harmful effects of fertilizers in temperate climatic conditions with heavy rainfall and runoff. In the countries south and east of the Mediterranean basin, especially those which tend to be arid, climatic features are likely to alter the appearance and development of these phenomena, and the threshold level of an environment's reaction to massive fertilizer inputs may be lowered.

The discharge of nutrients into the sea comes either from natural inputs, in dissolved or particulate form resulting from leaching and soil erosion, or from artificial inputs, fertilizer spread on agricultural land. The amount of natural inputs is higher when the use of fertilizers in a given watershed is moderate (case of the southern and eastern shores of the basin in 1980). Conversely, the amount of artificial discharge rises with the volume of runoff (the case of the north-west part of the basin). In Tunisia, for example, the discharge of nitrogen into the sea in 1975 was five times higher (in weight) than the total consumption of nitrogenous fertilizer for agricultural purposes ; conversely, in Italy, discharge during the same period was equal to only half agricultural consumption. It is therefore impossible to distinguish among the amounts of nitrates, phosphates and potash reaching the sea those of natural origin and those introduced by human activity (which could be of urban origin, such as phosphates from detergents).

An "environmental chain" covering discharges of agricultural origin (phosphorus and nitrogen) has been devised (Figure III-4) in order to understand better the influence of the various factors. It uses the following basic data :

- utilized agricultural land (UAL), including arable land, temporary crops and permanent grassland, excluding rangeland, in the Mediterranean watershed of each country ;

- consumption of nitrate and phosphate fertilizers for each country (in this case national averages, the only data available) ;



(*) variant with the Blue Plan agro-food scenarios, April 1987
(**) variant with the findings of the Blue Plan "soil erosion" scenarios, March 1988
(***) variant according to the scenarios. Ratios are : T-2 > T-3 > A-1 (to reflect the general hypotheses of the scenarios).

Note : All calculations were based geographically on the coastal countries Mediterranean watersheds (except for Egypt and Libya, not included in the exercise) , findings are grouped under three sets of countries :
northern shore : Spain, France, Italy, Yugoslavia, Albania, Greece
eastern shore : Turkey, Cyprus, Syria, Lebanon, Israel
southern shore : Tunisia, Algeria, Morocco.

Figure III-4 "Agriculture-based P and N discharge" chain and indicator used

- the ratio between nitrogen and phosphorus discharges into the Mediterranean Sea (FAO statistics, 1977) and the amounts of nitrogen and phosphorus consumed in the watershed.

The prospective exercise, based on trends of the various indicators since 1965, and especially since 1975, and using the findings of the agricultural part of the Blue Plan scenarios, involves mainly the application of multipliers to the basic data (UAL of watershed and NFK fertilizer consumption per hectare) for 2000 and 2025 for the three representative scenarios, worst trend scenario T-2, moderate trend scenario T-3 and reference alternative scenario A-1. The volume of nitrogen and phosphate fertilizer consumed is assumed to be stable.

These trends reflect the "plus" or "minus" provided by the efficiency of fertilizer management (notably as regards application) and erosion control (suspended particles in particular being "carrier agents" for phosphorus and to some extent for carbon of organic origin).

Images obtained from the scenarios correspond to two aspects of environmental problems related to fertilizer consumption :
- input of nitrogen and phosphous compounds in the Mediterranean Sea (in thousands of tonnes), contributing to land-based pollution in coastal areas ;
- the amount of fertilizing elements introduced each year into the environment.

A fairly accurate estimate could be made of total consumption, but considering various approximations and/or uncertainties discharge figures are much less reliable.

For the countries south and east of the basin, the increases in fertilizer consumption anticipated in all the scenarios are such that they overshadow all other indicators (crop area, soil erosion, etc.). Variations are introduced through the management, conservation and control of fertilizer spreading, making it possible to reduce discharge. Thus in T-2, discharges may rise by a factor of 4 or 5, whereas in A-1 they may fall.

2. Pesticides

The general term "pesticides" encompasses many chemicals, also called "pest control" products, classified by major family : insecticides (DDT, HCB, aldrin and other organochloride compounds, organophosphates, etc.), seed dressings (organomercurial compounds, etc.), herbicides (2, 4-D, MDPAZ, 2,4,5-T, triazines, carbamates, etc.), rodenticides, etc.

Used in agriculture, industry and the home, they are increasingly widespread in all environments. Some of the more chemically stable products become concentrated in the food chain, as far as man, in whose organism they accumulate (DDT is at present found in mother's milk in some parts of the Mediterranean basin).

Increasingly varied and complex insecticides can affect :
- populations (fish, shellfish, aquatic invertebrates, birds, insects, etc.),
- natural balances,
- the genetic heritage,

and vary depending on thee species and environments contaminated, application techniques, doses and frequency of use, form (granules, powder, liquid), etc..

Unfortunately, few data are available on the matter : they are published by FAO or some countries (figures, expressed in active component equivalents or in prepared product weight cannot be compared or added). Nevertheless, growth rates for the Mediterranean countries indicate a trend similar to that for the use of NFK fertilizers. On the other hand, growth in the consumption of some very stable and accumulable pollutants (DDT for instance) has slowed down, even halted in some countries (prohibition on use), after a period of steady growth from 1974 to 1980, which was particularly high because consumption levels in the countries ten years ago were low, or irrigation because more important.

It is very difficult to establish forecasts for environmental pollution from pesticides, especially because their development in the host environment is still very poorly understood. There is an overall similarity with trends of other inputs required for agricultural intensification (fertilizers, irrigation) ; but data on the consumption starting point are inadequate.

IV. MEDITERRANEAN FISHERIES

A. PRESENT SITUATION

The coastal population's requirements for marine products are high, in the region of 4 million tonnes per year. These needs are constantly changing as regards quality. Some ten years ago they were less selective and partly met by fatty fish (sardines, mackerel, tuna). Currently, consumer demand prefers certain better quality species (bass, sea bream, etc.).

From 1938 to 1955, the catches of edible species in the Mediterranean amounted to approximately 500,000 tonnes per year, and fluctuated around 700,000 tonnes per year from 1965 to 1973, according to FAO. They gradually rose to 1,047,000 tonnes in 1985, i.e. a 48 % increase since 1973.

The countries north of the basin currently take 78.5 % of the total catch, compared to 21.5 % for the countries in the south and east. In 1985 the leading producer country was Italy (420,000 tonnes), followed by Spain (140,000 tonnes), Greece, Tunisia, Turkey and Algeria, the other countries or regions each fishing less than 50,000 tonnes. Aside from a small amount of tunnies, all catches in the Mediterranean were taken by coastal countries.

Nevertheless, these data should be taken cautiously. Part of Mediterranean fisheries is still very much a craft industry and many boats, often low tonnage and based in a large number of ports and shelters, frequently unload their catch in sites lacking statistical supervision. In addition, door-to-door sales are still common, with products escaping all control. As a result, the catches may be underestimated by about 30 %, and even much higher in some cases, among others in all countries where small-scale coastal fishing is practised (North Africa, the Levant).

A more serious aspect as regards resource conservation must be stressed. The withdrawal from available stocks is not confined to the species unloaded, the only ones taken into account in official figures : it also includes the undersized or unmarketable fish thrown back into the sea. These rejects may be considerable, amounting to 40-50 % of catches, and up to 70 % in some seasons depending on the fish stock. This is a serious problem as regards the rational use of living resources (which is not specific to the Mediterranean), and which must be carefully taken into account in any development prospective study.

The catch of certain species are declining (plaice since 1974, eel and flounder since 1970, etc.). Catches of others are growing fast (bream, red tuna, albacore, swordfish, bonito, sardine, anchovy). There are various reasons for these variations : market requirements, the over-exploitation of certain species, development of fishery techniques (very noticeable for fatty fish), and their profitability.

This trend in the kind of catch varies according to the country. Thus in countries with a high economic level there is a distinct drop in their catch of low-price fatty fish, whereas the southern and eastern countries, with weak economic growth, increase their catch of this kind of fish. On the other hand, catches of better quality species such as bass or sea bream are increasing sharply in the northern Mediterranean countries.

This trend corresponds to that of fishery techniques in some countries, in turn related to investment in human and material resources. For example, tuna fishing has evolved from low tonnage boats fishing with a whiffing line to large tonnage boats fishing with swing nets and using sophisticated detection and capture equipment (aerial detection, selective sounders, etc.). The increased power of trawler engines has, on the one hand, made it possible to increase yields from zones with large demersal stocks but, on the other, produced a decline in catches in low productivity areas by depleting stocks.

On the basis of known fish stocks and their geographical location, attempts can be made to foresee trends in catches according to country, and the development of fishery techniques according to demand. Knowledge of the distribution of resources results in a preference for certain techniques which improve catch yields.

B. TENTATIVE FUTURE OUTLOOK

In view of the current situation described above, trends should be assessed in terms of the Blue Plan scenarios. Considering reference trend scenario T-1 and worst trend scenario T-2, which favour national strategies in a harshly competitive world environment, it seems that the evolution of living resources and their mostly unrestricted use, would continue in the current fashion. In the short and medium term, a relative increase is likely in tonnages taken by fishermen seeking the maximal catch in high market-value species, due to the upgrading of fishery equipment, the exploitation of new deeper fishing zones, and the improvement of detection instruments.

This increase in the productivity of fishing fleets should peak, then decline for various reasons, mainly an over-exploitation of both demersal and pelagic stock and a deterioration of the environment on account of poorly controlled pollution entailing a loss of living resources (although this deterioration of the environment could be controlled locally, as seen from the reference scenario).

On the other hand, a different trend can be anticipated in the light of reference alternative scenario A-1, and particularly integration alternative scenario A-2. Fisheries would benefit from the envisaged concertation of international or interregional efforts (as recommended by the General Fisheries Council for the Mediterranean (GFCM) at its symposium held in 1980) ; an accurate assessment of the evolution and natural recycling of nutrients ; and the definition of fishing quotas by species and by region, which would help to prevent a depletion of stocks and fierce competition as to output by suitably adjusting catches to needs.

In this kind of scenario, the causes of marine environment deterioration seem to be better controlled. It would be possible for resources as a whole to grow, leading to increased catches that would improve the balance between Mediterranean production and the population's requirements for marine products.

C. AQUACULTURE

The target of economic balance already encourages coastal countries to develop aquaculture. The current situation is as follows : Mediterranean fishfarm production in 1978 was estimated at approximately 26,500 tonnes, in particular bass, labrus, mullet and eel. The trend up to 1992 indicates a 65 % increase over the current figure. It is difficult to assess whether this initial effort will be continued, but it is possible considering that the GFCM estimates that more than one million hectares of coastal areas could be devoted to this activity and that in addition the Mediterranean coast has a large number of very productive briny lagoons which could be developed (Table III-3).

COUNTRY	Number of water bassins	Surface area in ha	Depth in m	Salinity %
SPAIN	2	28 400	2.0 - 7.0	36.8 - 52.0
FRANCE	6*	31 500	3.0 - 10.0	10.0 - 40.0
ITALY	41	137 500	0.25 - 28.0	2.0 - 40.0
YUGOSLAVIA	3	14 200	1.0 - 18.0	0.5 - 8.0
GREECE	14	400 000	0.2 - 2.0	3.0 - 40.0
TURKEY	15	45 200	1.0 - 23.0	3.0 - 50.0
CYPRUS	3	4 040	-	12.0 - 48.6
ISRAEL	*	2 400	0.5 - 2.5	0.7 - 5.0
EGYPT	8	278 880	0.5 - 3.0	1.2 - 40.0
TUNISIA	6	74 500	1.4 - 12.0	4.0 - 60.0
TOTAL	98	1 016 520		

* Lagoons deeper than 3 m.
Source : Blue Plan booklet on fisheries.

Table III-3 BRINY WATER BASSINS IN THE MEDITERRANEAN COUNTRIES
(surface area, depth and salinity)

Lagoon waters are enriched by the input of coastal rivers bearing soil extracts which fertilize the primary biomass. This process may be enhanced by the discharge of domestic sewage from neighbouring villages. The high temperatures of the lagoons, particularly in the southern-central region of the Mediterranean, is conducive to the photosynthesis which makes them areas of high primary productivity, much greater than that of the neighbouring sea. But their biological balance is extremely fragile, because of the risk of eutrophication (often fatal for living species) associated with the very abundance of nutrients, and the toxic domestic or industrial effluent that may be discharged into them.

Aquaculture was originally extensive. Semi-intensive aquaculture developed later, with the enrichment of water ftom inorganic fertilization, artificial stocking with alevins caught in the natural environment or produced in hatcheries, and the improvement of fishing in both directions of fish migration.

Finally, the Mediterranean, particularly because of its favorable climate, lends itself to intensive aquaculture, carried out in bays on the coast, floating cages in deep lagoons, or more generally in deep and sheltered areas along rocky coasts. Aside from aspects related to semi-intensive farming, this kind of aquaculture is characterized by control of the life cycle of a species, hence its reproduction, nutrition and pathology.

V. SOME CONCLUSIONS AND ISSUES FOR APPRAISAL

Intensification of agricultural production will have to be stimulated in the countries south and east of the basin, in conditions made more difficult by heavy population pressure. Ratios between agricultural labour and the industrial inputs required for this intensification vary according to the scenario. The more intensification is based on industrial inputs (fertilizer and tractors in particular) the more the production of these inputs has to be integrated into the general process of economic development and the growth of industrial production. This is certainly one of the major issues that needs to be solved, especially if the inertia related to the application of this kind of policy is taken into account.

Pressure on natural resources and the environment will be considerable in the trend scenarios, and remain substantial but better controlled in the alternative scenarios. Water requirements in some countries will be such that urban water will have to be recycled for subsequent use in agriculture, and agricultural water will itself have to be recycled. But aside from these problems of quantity and availability, water also poses the problem of quality, linked to the massive use of fertilizers and pesticides. At present the spread of these pollutants in the environment is comparatively less well known in the countries south and east of the basin than in the countries north of the basin, where they nevertheless present growing problems.

More serious yet is the pressure on soil (as examined in the fourth part), to the extent that questions arising about the long or very long term cannot be answered with palliatives.

When and how will the EEC's Common Agricultural Policy evolve? What agro-food development options will be chosen by countries south and east of the basin ? What kind of intensification ? What balance will be established between a minimum of food self-sufficiency and greater participation in international markets, insofar as these develop in an atmosphere conducive to a multipolar world ? And how can the overriding short- and medium- term production objectives be reconciled with the necessary conservation of resources, since efforts produce visible results only over a time span of decades ? Exploration of the agro-food sector of the Blue Plan scenarios clearly confirms that along with -and because of- population pressure, agricultural policy will remain a major factor of any environment/development prospective study in the Mediterranean basin.

CHAPTER III.2

THE INDUSTRIAL READJUSTEMENT

The Mediterranean countries' industrial production (manufacturing and mining, excluding energy products), which in 1950 accounted for approximately 3 % of world production, underwent spectacular development up to the early 1980s (more than 10 % of world production). Part of this production was carried out on Mediterranean coasts, the extent varying according to the country (Section I).

The major trends and economic growth hypotheses analysed in the second part of the report provided the starting point for the basic hypotheses of the industrialization scenarios (Section II). Considerable differences exist between the countries north of the Mediterranean basin which will continue their restructuration process and countries south and east of the basin whose industrialization will have to keep pace with the vigorously growing needs of populations in full expansion.

Some of the anticipated sectoral developments and their impact on Mediterranean environments are then described in more detail (Section III). From now to the year 2000, current trends are likely to continue, but the countries south and east of the basin will play an increasingly important role in traditional industry compared to that of the northern countries, as the projections for 2025 clearly indicate. The outlook for technological change in some sectors and its possible effect on environmental protection is also examined.

Forecasts are different in the capital goods industry whose technological development will long be dominated by today's industrialized countries. This prospect in no way excludes the rapid growth of this branch in the less industrialized countries with a capacity for the dynamic assimilation of technology. Nevertheless, the development factors of these industries raise some queries (Section IV).

I. RESTROPECTIVE VIEW AND PRESENT STATE OF MEDITERRANEAN INDUSTRY

A. INDUSTRY IN THE MEDITERRANEAN COUNTRIES

The period 1945-1985 was characterized by a spectacular industrialization process in the Mediterranean coastal countries. These countries now provide approximately 14 % of world industrial production (8 % excluding France), whereas this figure was approximately 5 % (excluding France) in 1929 according to a League of Nations' survey, and had fallen to around 3 % in 1950. As indicated in Table III-4, growth of the manufacturing sector between 1960 and 1980 was 6.9 % per year for countries south and east of the Mediterranean basin, compared to 5.7 % for those in the north. This growth dipped between 1980 and 1985, slightly for the group of southern and eastern countries whose average annual growth rate remained at 6.4 %, more noticeably for the northern group in which it settled at 0.9 % per year.

NORTH	1960-80	1980-85	SOUTH & EAST	1960-80	1980-85
SPAIN	7.7	1.8	SYRIA	4.5	
FRANCE	5.1	-0.3	ISRAEL	6.4*	3.8
ITALY	5.2	1.2	EGYPT	6.0	8.1
MALTA	5.1	-0.9	LIBYA	14.3	9.2
YUGOSLAVIA	7.0	2.7	TUNISIA	8.1	7.2
GREECE	8.6	0.1	ALGERIA	7.1	8.9
TURKEY	7.8	6.8			
CYPRUS	6.4	4.3	MOROCCO	7.6	0.6

* 1965-80

Sources : 1960-80, Blue Plan data base
1980-85, United Nations Statistics Office.

Table III-4 GROWTH OF THE MANUFACTURING SECTOR 1960-85
(percent per year)

If the industrialization level is measured by the percentage of manufacturing value added in the Gross Domestic Product (corrected for mining for the major hydrocarbon producers such as Libya and Algeria), the following ranking is obtained for 1985 :

- 20 % and over : Spain, France, Malta, Turkey, Yugoslavia ;
- 15-20 % : Algeria, Egypt, Tunisia ;
- Less than 10 % : Libya, Syria.

Figure III-5 gives indications on the main industrial branches in the Mediterranean countries. The total share of the two traditional industries, agro-food and textiles, is declining in the north where it only accounts for 30 %, but is growing in the south and east where it ranges between 40 % and 60 %.

This ranking nevertheless highlights the persistent imbalance between the two sides of the basin, despite the vigorous industrial growth observed in the southern and eastern countries. The northern countries (including Turkey), still accounted for approximately 95 % of total manufacturing value added in the basin in 1985, and three countries alone accounted for 85 % of the total (France, Italy and Spain).

B. INDUSTRY ALONG THE MEDITERRANEAN

If, however, industry in the Mediterranean regions alone is considered, rather than national aggregates, northern predominance is reduced, as indicated in Table III-5 and the short summary below.

- Spain With the decline of heavy industry along the Cantabrian coast, the role of Catalonia in Spanish industry has grown. The region now provides a quarter of the industrial value added, most enterprises being concentrated in the province of Barcelona. The province of Valencia is also playing an increasing role, with strong industrial expansion, and is attracting immigration from other Spanish provinces.

- France Despite physical planning efforts and a certain "heliotropism" among the French, the Mediterranean region is still under-industrialized. The industrial importance of the entire region cannot compare with that of Barcelona alone.

- Italy Italian industry is concentrated outside the Mediterranean regions as such, in Lombardy, the country's leading industrial region (the Milan area provides almost a quarter of domestic production), and in the Piedmont. The rest, about half the value added, is scattered over the coastal provinces.

- Yugoslavia Slovenia and Croatia are the two most industrialized republics. Despite physical planning efforts, the north/south imbalance persists and a large proportion of industry is found in the Danube basin, especially in the Save valley.

- Turkey Industrial production is concerntrated mainly along the shores of the Black Sea and the Sea of Marmara : Istanbul alone accounts for at least 30 % of the country's industrial activity. A small part is found in the upper basins of the Tigris and the Euphrates. Several industrial centres have developed on the Mediterranean coast : Izmir is the second largest industrial area in the country, providing 15 % of domestic production.

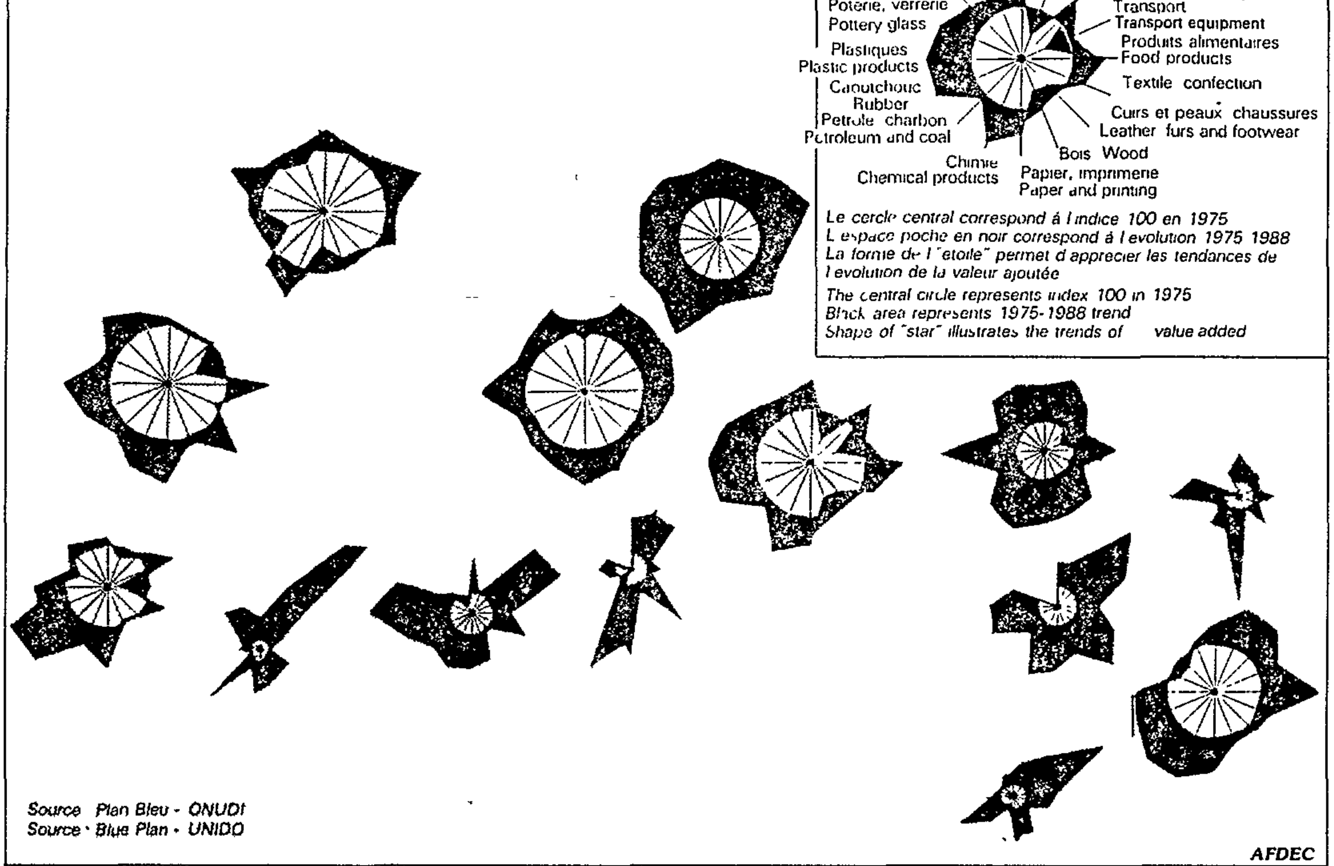
- Syria Part of industry is situated inland, in closed basins with no outlet to the sea, and another part lies in the Euphrates basin which flows into the Arabian-Persian Gulf.

- Egypt Most industrial production is concentrated on the Mediterranean coast in the Nile delta and lower valley.

- Libya, Tunisia and Algeria Most industry (except mining) is situated in the Mediterranean coastal regions.

- Morocco The industry located in the Mediterranean province is insignificant, limited to the three centres of Tetuan, Nador and Oujda. The principal area of production is in the Atlantic basin, with 55 % concentrated in Casablanca.

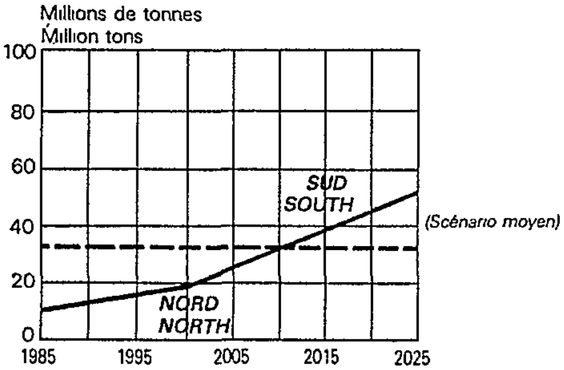
LES STRUCTURES INDUSTRIELLES Évolution 1975-1985
INDUSTRIAL STRUCTURES Evolution trends 1975-1985



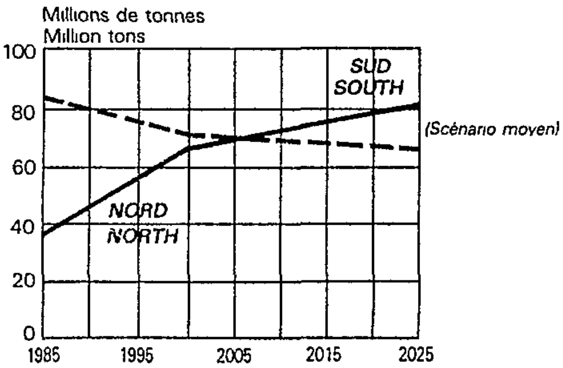
Les diagrammes ci-dessus permettent de suivre l'évolution structurelle par pays et de comparer plusieurs pays à l'intérieur d'une région. A défaut d'être modélisées avec un tel détail dans les scénarios, certaines branches, telles que la sidérurgie et la cimenterie (ci-dessous), ont été explorées par le Plan Bleu
The above diagrams help to follow structural trends by country and to compare several countries within a region As they have not been modelled with such detail in the scenarios, some branches, such as the steel and ciment industries (below), have been explored by the Blue Plan

DEUX ACTIVITÉS INDUSTRIELLES A L'HORIZON 2025
TWO INDUSTRIAL ACTIVITIES IN THE YEAR 2025

PRODUCTION DE CIMENT
CEMENT PRODUCTION



PRODUCTION D'ACIER
STEEL PRODUCTION



Source Plan Bleu
Source Blue Plan

COUNTRY	Entire country	Mediterranean area
SPAIN	56 *	18
FRANCE	173	9.7
ITALY	120 *	60 *
YUGOSLAVIA	19.51	7 *
GREECE	6.51	6.5
TURKEY	14.26	3.5 *
SYRIA	2.34	1.5 *
EGYPT	8.95	8.5 *
LIBYA	0.76	0.75
TUNISIA	1.29	1.3
ALGERIA	6.06	6
MOROCCO	3.17	0.20*

* Estimates made for the report, in the absence of available data.

Table III-5 VALUE ADDED IN THE MANUFACTURING INDUSTRY, 1983
(thousand million 1980 dollars)

To complete this review by country, some major sections are described below, chosen for their current or potential impact on the environment.

1. Mining (excluding energy)

The value of mining production in the Mediterranean countries was in the region of 3.5 thousand million dollars (1978 dollars) in the mid-1980s, i.e. less than 1 % of the Mediterranean value added, or approximately 5.5 % of world mining production. Only part of this mining production (about 40 %) involves the Mediterranean basin : bauxite in France, Yugoslavia and Greece, chromite and boron in Turkey, iron ore from the Sierra Morena in Spain.

2. Iron and steel industry

Steel production in the Mediterranean basin in 1984 was 70.9 million tonnes (62.7 Mt in the north, 8.2 Mt in the south), of which 37 Mt came from the Mediterranean regions (north 31.9 and south 5.1) (Table III-6).

Among the most important points to be noted are :

- the development of the iron and steel industry in the Mediterranean since 1950, when it had previously been limited to Italy ;
- a falling-off in production, which started in France in the early 1970s (1974 : 27 Mt ; 1986 : 17.9 Mt) and has recently affected Italy (1984 : 24 Mt ; 1986 : 22.9 Mt) and Spain (1984 : 13.5 Mt ; 1986 : 12 Mt), whereas

	Riparian countries	Mediterranean basin
SPAIN	13.5	1 *
FRANCE	18.9	3
ITALY	24	24 **
YUGOSLAVIA	5.4	3
GREECE	0.9	0.9
TURKEY	4.3	1.2
SYRIA	1	1
EGYPT	1	1
TUNISIA	0.1	0.1
ALGERIA	1.8	1.8

* 0 in 1985 after closing the Sagonte factory.
** of which 4 big complexes on the sea : Cornigliano (Genoa), Piombino, Bagnoli (Naples) and Terente ; and about 5 Mt produced in small electrical steel factories of the Brescia region valleys.

Table III-6 STEEL PRODUCTION IN 1984 (millions of tons)

	Riparian countries	Mediterranean basin
SPAIN	30.6	19
FRANCE	22.1	2.1
ITALY	38.3	38.3
YUGOSLAVIA	9.6	
ALBANIA	1	1
GREECE	13.1	13.1
TURKEY	17.6	4
CYPRUS	1.1	1.1
SYRIA	3.6	
LEBANON	2	2
ISRAEL	1.9	
EGYPT	4.1	4.1
LIBYA	0.6	0.6
TUNISIA	2.8	2.8
ALGERIA	5.3	5.3
MOROCCO	3.5	1

Table III-7 CEMENT PRODUCTION IN 1984 OR 1985 (millions of tons)

	Glogal Production	of which the Mediterranean basin
SPAIN	3,400 *	
FRANCE	4,518	74
ITALY	2,650	2,650
YUGOSLAVIA	1,300	
TURKEY	349	
EGYPT	44	44
TUNISIA	2,715	2,715

* mostly in the region of Huelva where pyrites mines are in the atlantique basin.

Table III-8 SULPHURIC ACID PRODUCTION (1984)(in thousands of tons)

production continues to grow in other countries, especially Yugoslavia and Turkey ;
- the existence of unused production capacity in three countries : France, Italy and Spain (production of 53 Mt for a capacity of 80 Mt) ;
- the fact that French and Spanish production has remained largely concentrated in the Atlantic basin despite planning efforts. The Fos complex in Mediterranean France was to produce 10 Mt/year ; it only produces 3. The Sagunto complex, set up in 1972 on the Spanish Mediterranean coast has been sacrificed in order to maintain production on the Cantabrian coast, despite the advantages of the site.

3. Cement industry

Cement production was 157.2 million tonnes in 1984/1985 (113.7 Mt in the north ; 43.2 Mt in the south) of which 94.4 million tons came from the Mediterranean regions (north 72.5 and south 21.9 (Table III-7).

To be noted are :

- the very vigorous development of this industry throughout the Mediteranean basin since 1950 :
- a falling-off in production in France by about one third in a few years. Italy has just been affected (10 % decline) ;
- the strong exporting position of Spain (12.6 Mt exported in 1984) and Greece ;
- the existence of unused production capacity not only in France but also in countries like Turkey ;
- much of the Spanish and Yugoslavian cement industry is situated on the Mediterranean coast, with factories "on the water", so as to dispatch a high proportion of their production by sea. Greece also has three large cement works on the water's-edge (Patras, Athens and The Salonika). Most of the cement works in the other countries are also close to the sea. Exceptions are France with very modest production capacities in the Mediterranean basin, and Morocco, where cement works are distributed between the Mediterranean basin (Oujda, Tetuan) and the Atlantic basin (four plants).

4. Other industries

Similar analyses of the refining and petrochemical industries (ethylene, propylene and benzene) show like concentrations in the countries in the north, although sometimes less pronounced. A few large plants for these branches are being constructed or launched (for example, a production capacity of 300,000 tonnes of ethylene and 140,000 tonnes of propylene in Izmir). The same pattern recurs with other products such as polyethylene, vinyl chloride and polystyrene, perhaps with more attenuated constrasts between north and south. The picture of industrial distribution between north and south changes if the production of sulphuric acid, superphosphates and ammonia is also taken into account :

- in 1984, the production of sulphuric acid in the Mediterranean regions (not at the national level) reached 5,483 thousand tonnes (Table III-8), 2,724 thousand tonnes in the north and 2,759 tonnes in the south. Production in the north is almost entirely concentrated in Italy, and in the south in Tunisia ;
- production figures for superphosphates amounted to 489 thousand tonnes in the north and 569 thousand tonnes in the south ;
- and for ammonia, 2,240 thousand tonnes in the north and 2,655 thousand tonnes in the south (Mediterranean regions).

II. MAJOR TRENDS AND INDUSTRIALIZATION PROSPECTS

A. MAJOR TRENDS

Some additional information is needed to complete the observations and hypotheses identified in the summary presentation of the scenarios for the major industrial development trends in the Mediterranean countries.

For the Mediterranean countries of the European Community, the major trend would be, in the best of cases, a growth in production and employment at the same rate as GDP growth for food and agriculture, primary processing (metal working, heavy chemicals) and light industry (textiles, leather, unsophisticated metallurgical products). Only the capital goods and consumer durables industries should have a growth rate higher than that of the GDP (from 1.2 to 1.5 times higher than the growth rate of the economy). In these sectors the "high technology" branches hold the most potential : electronics, informatics, telematics, and to a still minor extent biotechnologies (pharmaceuticals, fertilizers, seeds, etc.). Up-stream these industries bring about a radical and already noticeable change in the materials produced by primary processing industries (high-quality steel, specialized ceramics, processed silicium and rare elements).

The decline of the traditional industries in the north is often explained by competition from industrializing countries, more especially those where the dynamics of industry and marketing are the most vigorous. This is indeed an important factor, and it can be expected that it will become more important, contributing to competition among producers not only on the domestic market, but also on that of third countries, thus hampering exports from the north. But this factor only adds to other internal considerations concerning both supply and demand. The steel coefficient (volume of steel per unit of final product, or GDP unit) continues to diminish to the extent that in 2000 probably one tonne of steel will produce as much as two tonnes did in 1970. This development seriously affects the iron and steel industry, and derives from a number of factors including the improvement of steel quality, often stimulated by competition with other materials (plastics, aluminium), or by price trends outside the branch concerned. Oil prices in the 1970s, for example, induced the automobile industry to reduce the weight of vehicles in order to cut down on fuel consumption. Finally, a factor clearly related to demand should not be overlooked, namely market saturation for mass consumption end products. Over and above the major economic disorders occurring since the mid-1970s this phenomenon is probably at the origin of the slowdown of industrial growth rates in the major industrialized countries. Therefore the relative or absolute decline of the iron and steel, cement and heavy chemicals industries in the northern coastal countries seems inevitable, even in the case of economic recovery postulated in some scenarios. Possible shifts in this major trend will be seen in the scenarios.

Industrialization prospects for the countries south and east of the Mediterranean basin (including Turkey in this analysis) are quite different. The so-called light industries are likely, at least initially, to experience the highest relative growth, for at least two reasons : the fast expansion of domestic markets, resulting from both population growth and rising per capita income ; and comparative advantages for exports. But the size of the foreign market, which differs from one scenario to another, is likely to vary considerably, as will be seen further on. In time however, these industries will lose high growth rates to other branches (after 2000 in the Maghreb, earlier in Egypt).

Agro-food industries will no doubt reach their maximum growth rate before light industry, including those involved in cereals processing, (as expressed in Engles' laws). This comparative decline can be assessed by the share of the agro-food industry in industrial value added : 52 % in Egypt and 58 % in the Maghreb in 1980, the proportion could be closer to 40 % in Egypt and 50 % in the Maghreb in 2025, which in no way excludes absolute growth, more or less vigorous depending on the scenario.

On the other hand, industries involved in the primary processing of industrial raw materials should enjoy steady growth throughout the period, with a rate comparable to that of industrial value added. The capital goods and consumer durables industries would therefore benefit from the comparative decline of the agro-food and light industries. This hypothesis is valid, however, only insofar as conditions exist for the growth of the primary processing industry,namely a capacity for the dynamic assimulation of technology, backed up by efforts in research and development and the training of skilled labour, together with external conditions conducive to technology transfer, in turn dependent on the scenarios general hypotheses.

B. THE INDUSTRIALIZATION SCENARIOS

In the trend scenarios the countries south and east of the Mediterranean basin have to face up to international competition. Two examples of this hypothesis are given below, based on either weak world growth, as in worse trend scenario T-2, or strong world growth as in a moderate trend scenario T-3, the reference trend scenario T-1 lying midway between the two. Growth multipliers for the period 1980 to 2000, and 1980 to 2025 are compared with the multiplier observed for the period 1980 to 1985 (Table III-9).

The slowness of industrialization, especially in the worse trend scenario T-2, results from two factors. The first is that competition on the world market will require southern and eastern countries, as well as those in the north, to undertake a radical restructuring of existing enterprises, set up in the more favourable conditions of previous decades. In the trend hypotheses, export is a prerequisite for continued overall economic growth, considering limited sources of financing. The second factor is precisely the difficult search for industrial investment financing. Any possibility of external financing is linked to solution of the debt problem, which is likely to shackle industrial development, especially in Egypt and the Maghreb countries.

The original feature of reference alternative scenario A-1 is to act effectively on the two factors mentioned above. First of all, long-term agreements between the European Community and the countries south and east of the Mediterranean basin mean that market shares open up for manufactured products from the southern and eastern countries. An idea of the possible penetration of their products on north Mediterranean markets can be obtained from comparison with the penetration of light industry products from South-East Asia on the North American market since the 1970s (over 60 % of textiles for instance). It could be envisaged that these market shares will prompt northern industrialists to associate with southern exporting industries, leading to transfers of capital and technology which should facilitate the launching of new businesses and at least partly attenuate financial obstacles.

The A-1 scenario lacks however one major aspect assumed in the integration alternative scenario A-2, namely an internal network of dynamic, employment-generating small and medium-sized enterprises, which provide a basis for many sectors, notably through subcontracting from mechanical and electrical industry assembly plants. This component coincides well with two other general features of the integration alternative scenario A-2 : a physical planning policy concerned with both the development of small and medium-sized towns and a training policy oriented towards increased productivity in the rural areas.

	A. Multipliers for manufacturing value added				
	1980-1985	1985-2000		1985-2025	
	(observed)	T-2	T-3	T-2	T-3
MOROCCO	1.0	1.7	2.1	4.9	8.2
ALGERIA	1.5	1.0	1.5	2.6	6.1
TUNISIA	1.4	1.4	1.9	7.6	11.5
LIBYA	1.6	2.6	5.3	12.0	40.0
EGYPT	1.5	1.2	1.3	2.9	5.1
SYRIA	0.9	1.6	1.8	4.0	8.6
MAGHREB-3	1.3	1.3	1.7	3.4	5.8
	B. Sector multipliers for all Maghreb countries				
		1980-2000		2000-2025	
Agro-food		1.0	1.5	3.0	6.0
Heavy industry		1.8	2.3	7.1	12.3
Light industry		2.2	2.7	5.8	9.4
Capital goods		1.7	2.0	4.3	6.1
GDP		1.7	2.0	4.3	6.1

Table III-9 TREND SCENARIOS : INDUSTRIAL GROWTH

	A. Multipliers for manufacturing value added				
	1980-1985	1985-2000		1985-2025	
	(observed)	A-1	A-2	A-1	A-2
MOROCCO	1.0	2.0	2.1	8.8	11.1
ALGERIA	1.5	1.5	2.2	8.2	10.5
TUNISIA	1.4	2.1	2.2	13.2	22.7
LIBYA	1.6	5.9	5.9	38.9	40.0
EGYPT	1.5	1.6	1.8	6.4	9.4
SYRIA	0.9	2.0	2.1	14.4	19.8
MAGHREB-3	1.3	1.7	2.0	7.8	10.8
	B. Sector multipliers for all Maghreb countries				
		1980-2000		2000-2025	
Agro-food		1.6	1.9	7.5	12.2
Heavy industry		2.2	2.5	12.5	16.8
Light industry		3.0	3.5	13.1	16.3
Capital goods		2.2	2.6	15.9	23.9
GDP		2.2	2.6	7.4	9.5

Source: Blue Plan projections (see box on methodology, Chapter X).

Table III-10 ALTERNATIVE SCENARIOS : INDUSTRIAL GROWTH

Note : Heavy industry : primary processing of industrial raw materials ; capital goods : mechanical and electrical industry (processing equipment and consume durables including transport equipment).

As regards foreign trade, the previous hypothesis of a preferential market in the north for manufactured products from the south and east gives way to one of long-term economic co-operation agreements between neighbouring countries or countries with cultural affinities (Maghreb, Arab countries etc.). Growing industrial complementarity between these countries induces them to absorb reciprocally a large part of their exports, in which case the world market only accounts for a portion of their trade. It can also be assumed that the creation of these large markets will act as a strong incentive for direct investment from transnationals in the northern countries, a source of financing as well as a source of technology transfer on account of their stronger negotiating position.

The hypotheses of the alternative scenarios are depicted by the multipliers in Table III-10 ensueing from both vigorous world growth and the interplay of various economic agents. Considering the time span necessary for effects to be felt on industrial growth, results are much more evident in 2025 than in 2000.

The figures in Table III-10 could seem optimistic compared to those of Table III-9 for the trend scenarios. The case of the Maghreb is given here as an example, but the results for Egypt would be quite similar. It can be seen that from now to 2000 the agro-food industry would grow more slowly than the GDP (1.6 compared to 2.2 for reference alternative scenario A-1 for example), and that the growth rate of the primary processing and capital goods industries would be roughly equivalent to those of the GDP. For this comparatively close horizon, only light industry (textiles, clothing, leather, plastic goods, metal furniture, etc.) grows definitely faster than the GDP. For a farther horizon like 2025, all the industrial sectors grow faster than the GDP in the alternative scenarios, whereas in the trend scenarios growth of the agro-food industry lags behind that of the GDP. The primary processing industry advances at the same rate as light industry in the alternative scenarios, which is not the case in the trend scenarios. However, the strongest growth is in the capital goods industry, regardless of the type of scenario.

The logical pattern of industrial development therefore implies in the long run the construction of a capital goods industry, the only way for a country to free itself of structural trade deficits and to maintain control of its growth ; this nevertheless raises a number of questions which will be brought up in Section IV of this chapter. For a long time to come, however, exports from the countries south and east of the Mediterranean will have to rely on light manufactured goods and the intermediate goods resulting from the primary processing of raw materials.

III. DETAILED PROSPECTS FOR SOME INDUSTRIAL SECTORS

A. MINING

1. Prospects

The future of extractive industries (excluding energy) in the Mediterranean basin depends on :
1) general considerations on the world market for mineral raw materials. As mentioned above, the current period is one of overabundance due to the "crisis" in the industries of the north and the lower industrial consumption required to meet evolving needs. In the medium term (about ten years), this situation will probably not be reversed. In the longer term, the growth of needs in the less industrialized countries may bring if not a shortage, at least tension and a sustained rise in world market rates for some raw materials ;

2) specific features of the Mediterranean basin. As regards most useful metals and mineral substances, the basin is an "old" mineral region that has been prospected for 2-3 thousand years. It is likely that new large-scale undertakings will be carried out in regions of the world where there has been less exploration and also in regions where environmental problems are less acute. The only mineral for which the basin is in a privileged position is phosphates. Morocco possesses 70 % of known world reserves to date (but deposits lie on the Atlantic side of the country). Proven reserves in Tunisia are far less extensive and, unless there are new discoveries, its production should decline at the beginning of the twenty-first century.

Over the period from 1985 to 2000 Mediterranean mining is likely to remain at a standstill. After 2000, fresh expansion is more likely to occur in the countries south and east of the basin than in the northern countries.

2. Environmental impact

Recent decades have been marked by considerable advances in the mechanization of ore extraction and quarrying, both in opencast and underground mines (including coalmines, in the energy sector). Progress in excavation and conveyor machinery in particular have made it possible to use opencast mining techniques at greater and greater depths, which would have required underground work before. This trend, which is hardly favourable for the environment, seems likely to continue. The two main impacts on the environment, in addition to the extent of excavated areas, are dust emission, and exposure to the atmosphere of rocks that had been buried for millions of years under quite different physico-chemical (pH) conditions, with the concomitant risk of soil and aquifer pollution.

For very deep deposits, underground mining will remain the only possible method. Since working conditions are still generally very arduous, in spite of mechanization, the possibility of fully robotized excavation or the <u>in situ</u> processing of ores is often mentioned. Such technological changes are unlikely to come into effect before 2000.

Biotechnologies should occupy a growing place in post- extraction ore processing for enrichment, alongside existing physico-chemical technologies. It is hard at the moment to assess the consequences of these changes on pollution. Pollution caused by mechanical preparation of ore (breaking and crushing) will not be much affected. On the other hand, biological pollution could replace chemical pollution. Will it be easier to control? The answer is by no means clear.

As a reminder, the specific problem of sludges deriving from mineral processing, which on several occasions have disturbed certain Mediterranean maritime areas, should be mentioned ("red sludges" from bauxite and ilmenite processing plants).

B. IRON AND STEEL

1. Prospects for change

The decline of this industry in France, Italy and Spain has not yet come to an end. The European Economic Community has programmed further reductions in production capacities before 1990. Competition from new producers like Korea, Brazil and Venezuela is likely to continue, and Spain in turn will probably have to reduce its production to a level closer to that of its domestic consumption. In all, France, Italy and Spain will probably have to bring down their production to under 50 million tonnes/year, and their Mediterranean production to below 25 Mt/year.

A substantial recovery in the iron and steel sector at the world level is unlikely to occur before 2000. Beyond 2000, developments will depend chiefly on technology, notably on the role to be played by new materials. The range of possible futures is very broad : from a new downturn to a new acceleration. But it is unlikely that the production level of the 1970s will be surpassed. Under these circumstances, the opening of a new industrial pole for iron and steel in the Mediterranean, or strengthening of a existing one, seems highly unlikely for north of the basin before 2000 and doubtful beyond.

The situation is totally different in the other countries. Steel production for the Arab countries as a whole, for example, was about 40 kg per capita in 1986, whereas the most industrialized countries in the basin produced between 200 and 400 kg per capita for domestic consumption. Allowing for a moderate advance which would bring production to 60 kg per capita in 2000, installed capacity should reach about 10 Mt in 2000 (which, given the projects under way in Egypt and Libya, is probably a low scenario). Allowing for production-consumption of 140 kg per capita in 2025, capacities should attain 33 MT. Clearly regional co-operation, such as that envisaged in the alternative scenarios (integration alternative scenario A-2) would greatly facilitate the expansion of steel industries in this subregion, and in any event the evolution of materials has to be carefully taken into account after 2000.

Turkey produced just under 90 kg per capita in 1985. Assuming that its production will rise to 120 kg in 2000, and to 250 kg in 2025, existing installed capacity should be 8 Mt and 18 Mt respectively. Yugoslavia is in a situation similar to that of Spain : it is an exporting country and produces about 165 kg per capita for domestic consumption. Its capacity should not change scale before 2000. Beyond, as in the industrialized countries, trends will depend on technology.

Whatever the assumptions, a shift south and eastwards in the centre of the steel industry seems very probable. Up to 2000 the north is likely to predominate the industry. Beyond 2000, at a more or less distant period of time, depending on the scenarios, the situation should be reversed, with the south gaining importance. By the way of an example, a production of 100 kg of steel per capita corresponds to a low economic growth rate as in worse trend scenario T-2, whereas 200 kg of steel per capita would correspond to strong growth as in alternative scenarios A-1 or A-2. An average scenario can be constructed with these hypotheses (midway between reference trend scenario T-1 and moderate trend scenario T-3) as shown in Table III-11 :

COUNTRIES	1985	2000	2025
Italy, France, Spain Méeiterranean...........	28	24	24
Yugoslavia, Grece...........................	4	7	7
Turkey......................................	4.5	8	18
Mediterranean arabe countries................	4	10	33

Table III-11 AVERAGE STEEL SCENARIO (in millions of tons crude steel)

SELECTED ENVIRONMENTAL EFFECTS OF SELECTED INDUSTRIAL SECTORS

SELECTED INDUSTRAL SECTORS	RAW MATERIAL USE	AIR	WATER RESOURCES Quantity	WATER RESOURCES Quality	SOLID WASTES AND SOIL	RISKS OF ACCIDENTS	OTHERS: noise, workers' health and safety, consumer products
TEXTILES	Wool, synthetic fibres, chemicals for treating	Particulates, odours, SO_x, Hc	Process water	BOD, suspended solids, salts, sulphates, toxic metals	Sludges from effluent treatment		Noise from machines, inhalations of dust
LEATHER	Hides, chemicals for treating and tanning		Process water	BOD, suspended solids, sulphates, chromium	Chromium sludges		
IRON AND STEEL	Iron ore, limestone, recycled scrap	Major polluter SO_x, particulates, NO_x, HC, CO, hydrogen sulphide, acid mists	Process water	BOD, suspended solids, oil, metals, acids, phenol, sulphides, sulphates, ammonia, cyanides, effluents from wetgas scrubbers	Slag, wastes from finishing operations, sludges from effluent treatment	Risk of explosions and fires	Accidents, exposure to toxic substances and dust, noise
PETROCHEMICALS REFINERIES	Inorganic chemicals	Major polluter: SO_x, HC, NO_x, CO, particulates, odours	Cooling water	BOD, COD, oil, phenols, chromium, effluent from gas scrubbers	Sludges from effluent treatment, spent catalysts, tars	Risk of explosions and fires	Risk of accidents, noise, visual impact
CHEMICALS	Inorganic and organic chemicals	Major polluter. organic chemicals (benzene, toluene), odours		Organic chemicals, heavy metals, suspended solids, COD, cyanide	Major polluter: sludges from air and water pollution treatment, chemical process wastes	Risk of explosions, fires and spills	Exposure to toxic substances, potentially hazardous products
NON-FERROUS METALS (e g. aluminium)	Bauxite	Major local polluter: fluoride, CO, SO_x, particulates		Gas scrubber effluents containing fluorine, solids and hydrocarbons	Sludges from effluent treatment, spent coatings from electrolysis cells (containing carbons and fluorine)		
MICRO-ELECTRONICS	Chemicals (e g solvents), acids	Toxic gases		Contaminations of soils and groundwater by toxic chemicals (e.g chlorinated solvents) Accidental spillage of toxic material			Risk of exposure to toxic substances
BIO-TECHNOLOGIES				Used for effluent treatment	Used for clean-up of contaminated land		Fears of hazards from the release of micro organisms into the environment

Source OECD

There have been no technological changes in the last quarter of a century in the steel industry. Of course, there have been very important technological modifications, such as the increase in the size and automation of blast furnaces, conversion of cast iron into steel with pure oxygen, or continuous casting of steel. But these modifications have occurred within the framework of existing methods, without the appearance of any really new techniques. The steel industry in the world at present is still divided basically into :

- the conventional integrated system of coking-blast furnace -converter - continuous casting - rolling. This is the process currently used for most of the output in the Mediterranean basin ;
- the electric steel plant, using scrap iron from the steel industry itself, from the metallurgical industry or from salvage ; it is most widely used in Italy ("Bresciani").

Direct reduction of iron ore with natural gas has not yet developed to any extent (about 2 % of world steel production). Conventional steelmaking has evolved towards giant-scale operations. This trend now appears to have stopped whereas electric steel plants have developed through increasing the number of small-scale units.

Most experts consider that the period of relative immobility in steelmaking processes, if not in techniques, is drawing to an end, and that a real change may be coming in the medium term

It is unlikely that any more conventional steel mills will be built, except in special cases. New plants will be either installations using prereduction processes, and particularly direct reduction, now highly competitive, or else electric plants using scrap and sponge iron obtained by direct reduction. This process will usually involve a mixture of hydrogen and carbon monoxide, produced by reforming of natural gas. This means that countries with gas, of which there are many in the Mediterranean basin, should be well placed to use this new method. It is not impossible that a number of conventional plants might in the medium term be forced to convert to this technology in order to remain competitive. Although involving small quantities, this is an instance of the new areas of use of natural gas.

2. Steel industry and the environment

Steel production is one of the industries that cause most pollution and nuisances of all kinds. Considerable progress has been achieved in controlling pollution, particularly in conventional steel plants, by far the most polluting. This pollution comes mainly from the coking unit, responsible for much of the air pollution (emission of large quantities of smoke during changing of furnaces and removal of coke) and water pollution (phenols and heavy metals in washing water) ; but the blast furnace, converter and rolling mill also contribute. In fact progress in controlling pollution was achieved only at high and even very high cost, at present a handicap for the least polluting steel plants, which have to face severe international competition. In such plants, 20-25 % of overall investments are for anti-pollution installations, while 7-8 % of running costs are for their operation.

The technological changes mentioned above should have a positive impact on the environment :

- in the long term, coking and its accompanying pollution should disappear. This will nevertheless take time, and in the meantime pollution can be reduced notably by replacing standard coke with "moulded coke", although, as already said, this requires large investments ;
- direct reduction plants working at fairly low temperatures (900°C, non-smelted iron) should be less polluting than blast furnaces ;

- for the many remaining sources of air and water pollution (arising from reduction, the electric furnace and the rolling mill) it may be possible to scrub gas, filter dust and collect the metals in washing and cooling water. However, all this will involve significant investments and higher running costs ;
- finally, the steel industry will be moving towards manufacture of complex or even hyper-complex products and alloys. These products will entail little pollution, at least from a quantitative viewpoint. But they may lead to the release into the envirment of small amounts of dangerous substances, either continuously, or following an operating failure.

The steel industry will therefore probably undergo radical technological change, which will mean a less polluting industry than in the past, as long as the necessary heavy investments are made for environmental protection, and anti-pollution installations function, not always the case today in all countries. Finally, although the volume of "ordinary" pollution is likely to decrease, the risk of pollution by toxic substances (accidental or "extraordinary") will increase.

In the very long term, it is not impossible that an even more radical change in the steel industry may occur, with "bio-steelmaking", in which bacteria, making use of solar energy, would extract iron directly from the ore. This cold extraction would certainly be less polluting than present hot extraction methods (although the question of possible biological pollution remains open) and the Mediterranean basin could well adopt a technology of this kind. Before 2025?

C. CEMENT INDUSTRY

1. Mediterranean prospects

The position of the cement industry and building materials generally speaking is fairly similar to that of steel. In the medium term, there is little likelihood that Spain, France and Italy will be able to maintain their production at the present level of 90 Mt/year. A recovery in consumtpion is possible in France (where there has been a sharp drop). Spain will probably have difficulties in maintaining its present level of exports, whereas the southern countries will equip themselves with cement production capacities. It is fairly probable that a certain saturation of needs will occur, especially in Italy, which has a very high production level, almost 700 kg per capita (France 400 and the United States 300).

Greece (13 Mt) is the second biggest European exporter after Spain and supplies the Middle East. It may face serious problems in a fairly distant future however and may be obliged to reduce its production.
Turkey (17 Mt) has surplus capacities and is encountering increasing difficulties with exports. These surpluses will soon be reabsorbed by the rising population, and production is likely to exceed 20 Mt in 2000, perhaps reaching 35 Mt in 2025.

Compared with these countries, production for the whole of the southern countries from Morocco to Syria, is only 22 Mt/year, or slightly under 200 kg per inhabitant. Eventually, however, the balance of production should be restored. A production of 230 kg per capita should lead to a capacity of 40 Mt in 2000. Egypt, for example, where production capacity is old and inefficient and demand is increasing rapidly, plans to raise its capacity to Mt in 1980. A 40 Mt scenario may well be a low one (T-1/T-2) : in an average scenario (T-3) production should lie more between 45-50 to Mt in 2000. In 2025, a production of 300 kg per capita would lead to a capacity in the region of 70 Mt, which would doubtless also enter into an average scenario (Table III-12).

COUNTRIES	1985	2000	2025
Spain, France, Italy......................	(90)	(75)	(75)
of which Mediterranean basin..............	60	50	50(*)
Yugoslavia................................	9.6	12	10
Greece....................................	13	8	5(**)
Turkey....................................	(17)	(20)	(35)
of which Mediterranean basin..............	4	5	9
arabe countries...........................	22	45	70

(*) a lower scenario, about 40 Mt is envisageable
(**) only if Greece can keep a relativ. advantage and maintain, at least partialy, its exports.

Table III-12 AVERAGE CEMENT PRODUCTION SCENARIO (in millions of tons)

The cement industry, like steel, has not undergone any profound technological change in recent decades. The upright batch kilns still common after the Second World War have gone. Production is now carried out entirely in continuous rotary kilns.

Contrary to the steel industry, no technological change is at present envisaged for the cement industry. Cement is very cheap: production of course requires a large amount of energy, but the raw materials, limestone and clay, are in plentiful supply and inexpensive to extract. No new process seems able to compete with the present way of processing materials. The "fluidized bed" technique has been used in a few works (Japan and Australia), but it is suitable only for very small plants, producing about 50,000 tonnes a year. It is hard to imagine the development of such plants in the Mediterranean basin, where markets are much larger. Research into the use of plasma flares seem unlikely either to come to fruition quickly, and its outcome is uncertain.

The real technological change, in fact, would be to use new materials in concrete (such as fibres) to improve its mechanical properties and substantially reduce the quantity of cement needed; or the development of a completely new binder, which could compete with conventional cement in the manufacture of building materials. A tonne of concrete at present contains from 300 to 350 kg of cement. Is there any hope of a new product, such as a resin, which would be almost certain to cost more per kilo than cement, but of which perhaps only 100 to 150 kg would be enough for a material with similar properties to concrete, or even better? In the medium term, the answer to this question appears to be negative. In the longer term, any forecast is uncertain, in a field where the cost price of any new material is the predominant factor.

2. The cement industry and the environment

The cement industry used to be highly polluting, mainly because of the clouds of dut that it emitted. Many cement works have become far less polluting in recent years. Preparation of the kiln load, the actual kilns, cooling and crushing of the clinker caused large amounts of dust to be emitted, and this used to cover the whole area around the cement works with a grey coating. The use of electrofilters has reduced this considerably. In France, for instance, pollution has gone down from 3 kg of dust (or more in the absence of any anti-pollution device) per tonne of cement manufactured in the 1950s to less than 0.5 kg in the 1980s. Despite this progress, the cement industry in France is still responsible for approximately 30 % of dust emitted by the whole of industry.

Considering the hypothesis of a status quo in production techniques, the prevention of pollution is possible in this industry, but future enforcement will depend on the standards laid down by governments. In northern industrialized countries, levels will probably be further lowered, and great attention paid to the very fine dust and fluoride dust produced by firing, the exact effect of which on the human body is poorly known.

Similar remarks could be made about other building material industries, in particular tile, brick and ceramic making, which also emit fluorides.

D. REFINING AND PETROCHEMICALS

1. Prospects

Installed refining capacity along the Mediterranean is in the region of 280 Mt of crude per year, a drop of 35 Mt compared to the early 1980s. The decline is basically in three countries, France, Italy and Spain - although they still possess more than half the Mediterranean refining capacity. On the other hand, several countries in the south and east have increased their production capacity: Algeria, Egypt and Turkey. Despite the overall reduction in capacity, refineries installed along the Mediterranean are under-utilized (220 Mt processed in 1985).

Several major petrochemical complexes linked to refining are located along the Mediterranean, such as Tarragona in Spain, Lavera and Berre near Marsailles, Prialo and Gala in Sicily, Porto Marghera near Venice, Porto Torres in Sardinia, Ras Lanuf in Libya and so forth.

A distinction should be made between :
- the heavy chemicals industry, using large installations to produce basic molecules, particularly ethylene, propylene, vinyl, chloride, etc. monomers for subsequent polymerization and production of numerous plastic products ;
- the fine chemicals industry, using basic molecules to manufacture increasingly complex products.

The Mediterranean contains nearly 7 % of world capacity for ethylene and propylene production, and 5 % for benzene (but nearly 8 % of refining capacity).

Future geographical distribution of petrochemicals in the Mediterranean basin poses far more complex problems than in the case of either steel or cement. The production of the major industrialized countries in the north is unlikely to increase in the medium term, and there may even be fresh reductions in capacity. On the other hand, two new types of industrial activities could eventually be implanted in the countries south of the basin :
- conventional petrochemical complexes using naphta and possibly other products of the refineries situated close to the places of consumption (like the one that has just come on stream in Izmir) ;

- complexes based on so-called C2 to C4 hydrocarbons (ethane, propane, butane) associated either with either oil or gas deposits (like those that have just come on stream in Saudi Arabia).

The following scenario may be outlined :
- production of ethylene on the Mediterranean shores of the three major industrialized countries in the north remains at a ceiling of 3 Mt/year, although a considerable, even sharp, drop is not to be excluded in the long term, if gas-based plants definitely prove more profitable than naphta-based ones ;
- production capacities in the south and east in the region of one million tonnes in 1987, taking into account the projects now being completed, will develop :
. either in the currently under-equipped consumer countries : Greece, Turkey, Egypt, Algeria ;
. or in the countries possessing oil and gas resources : Algeria, Libya, perhaps Egypt.

By a date which would be hard to fix, production in the south and east should attain the same level as, or even outstrip, that in the north. A South-South co-operation scenario, such as integration alternative scenario A-2, should speed up this trend.

As regards technological prospects, most experts consider it unlikely that there will be any major modifications in the list of basic molecules manufactured by heavy chemistry. More specifically, polymerisable molecules are now known, and nothing new is to be expected in this field. This in no way means that plastics chemistry will not advance. On the contrary, there is expectation of :
- a major development of new technical plastics, made from known but little-used molecules, such as polycarbonates, polyphenylene oxides, polyvinylidenes, etc., the volume of which in manufactured goods is likely to rise from 3 % to 10 % before 2000 ;
- a considerable growth of new materials, designed for highly specific uses and made from basic polymerizable molecules, combined with one another or with a varied range of fillers (such as mineral fibres to reduce the relative number of carbon and hydrogen atoms and increase the fire-resistance of materials), or else combined with other products, such as carbon fibres, glass fibre metal alloys etc. In the long term, there could be a kind of partnership between metallurgy and polymer chemistry, producing a specific industry.

2. Organic chemicals and the environment

Both kinds of organic industry - heavy chemicals and fine chemicals - cause pollution. The heavy chemicals industry is a nuisance because of the volume of discharges, which can seriously pollute surface and groundwater. Discharges from the fine chemicals industry are smaller in quantity but can be extremely toxic - as the cases of Seveso (dioxine) and Bhopal (methyl isocyanate) clearly show.

How will pollution connected with all these production processes evolve?

As regards heavy chemicals, substantial advances have been made towards controlling pollution in large complexes. During the last two decades, awareness of the nuisances caused by chemical plants has spread, and major efforts made to develop less polluting installations, discharging less products into the air or water. One example is vinyl chloride monomer, the basic material for PVC, of which 2 Mt are produced annually in the Mediterranean basin. European standards are now 0.2 kg of discharge per tonne produced (as plants are virtually hermetically closed), compared to a previous level of 30 kg.

Diverging developments are expected in the future : some new production methods will release very little pollution, others will involve high risks. On the other hand, it seems virtually inevitable that the subsoil of major chemical sites will be polluted to a greater or lesser extent by water, oil and sludge, whatever the precautions taken and the increasingly effective control measures used (super-absorbent products, discharging at depth, etc.).

On the whole, though, the heavy chemicals industry - experiencing limited growth - will improve its control of pollution, as long as standards aimed at both ordinary pollution and the risk of accidental pollution are set and observed.

In the fine chemicals industry, manufacture of the toxic products or intermediate products will certainly not disappear. However, more efficient methods will become available to remove the polluting agents from effluent, for example by using semi-permeable membranes and, later on, biotechnologies. Moreover, research chemists are now aware of pollution, and take it into account in the design and development of processes for manufacturing new products. The trend towards avoiding the use of solvents by turning to aqueous emulsions, hydrodilutable techniques, or reagent diluents in the manufacture of inks, paint and adhesives, etc. is one example. The fine chemicals industry, expected to develop vigorously in the Mediterranean basin, should therefore be less polluting in general, except for a small number of products that could cause accidental pollution.

As regards "pollution" by used plastics, it is likely that in future packagings will become biodegradable, but many products designed for specific use may remain non-biodegradable and not very heat-degradable at low temperature, therefore difficult to eliminate. No doubt provisions will have to be made for the separation and processing of these used materials in special plants.

E. INORGANIC CHEMICALS INDUSTRY

1. Prospects

In tonnage, fertilizers represent an important part of this industrial sector. Fertilizer consumption is close to saturation in the most industrialized countries (where certain soils are even oversaturated with inorganic fertilizers), whereas the prospects in the less industrialized countries are immense, as shown in the Blue Plan scenarios. In the medium term, it seems likely that production on a world scale will enter into a new phase of growth, lower however than that of the decades from 1950 to 1980.

In the Mediterranean basin, the production of ammonia is already well into its shift south and eastwards. Installed capacity in Turkey and Algeria is more than 2.6 Mt/year, far more than the installed capacities on the Mediterranean shores of France, Italy and Spain (1.85 Mt/year). Capacities are expected to increase considerably in Syria (Homs), Turkey (partly in Istanbul, partly in Izmir), Egypt (but in Suez, on the Red Sea), in Algeria and Israel, so that the overall capacities installed in the Mediterranean regions of these countries should soon exceed 3.5 Mt/year, and 4 Mt/year in the 1990s. In the longer term it is likely that - barring an unexpected technological development - the production of ammonia will be concentrated in the oil and gas producing countries as the level of production depends closely on the consumption of nitrogenous fertilizers.

The production of superphosphates will also probably be concentrated in the countries possessing large deposits of natural phosphates.

Major developments in this industry should not be expected along the shores of the Mediterranean ; a decline seems likely in the long term. This decline will have repercussions on the productionof sulphuric acid, which is widely used by the fertilizer industry.

Finally, there is the production of chlorine, both an inorganic chemical product and a basic product of the organic chemicals industry. The chlorine industry is still mainly concentrated on the north shore of the Mediterranean, but it should experience the same shift south and eastwards as petrochemicals.

The inorganic chemicals industry will probably not evolve technically as quickly as the organic chemicals industry with respect to products or manufacturing processes. But minor technological change is to be expected in many sectors, some of which will have considerable effects on pollution.

2. Inorganic chemicals and the environment

The chlorine industry is currently the biggest consumer of mercury (mercury cathodes for the electrolysis of saline solutions) and is also responsible for the largest discharges of mercury as regards weight.

Technological change is expected involving cathodes made from titanium, platinum and other metals. Until these new technologies are operational, mercury discharges can be recuded substantially by treating the water used to cool and wash regenerated mercury.

In the fertilizer industry, three processes cause most of the pollution :
- ammonia. Pollution from the production of ammonia and ammonitrates comes from the release of ammonia, mostly into water. Discharges can be reduced considerably by altering processes for purifying synthesis gas ;
- sulphuric acid. Pollution in the contact process in general use at present comes mainly from the cooling water ;
- phosphoric acid. In addition to producing mineral salts and ammonia, the manufacture of phosphoric acid generates very large amounts of gypsum powder (4.75 tonnes of gypsum per tonne of P205) ; it is usually not used and has to be stored.

In addition, all natural phosphates also contain fluorides, and their conversion into simple or triple superphosphates releases fluorinated products, which must be prevented from spreading.

A real change would be the general introduction of direct fixing of nitrogen by bacteria living in symbiosis with cultivated plants, something that would call for a reappraisal of the nitrogenous fertilizer industry. However, potash and phosphate fertilizers will still be needed to compensate for the removal of minerals contained in crops.

Might a change which replaces present chemical processes (making natural phosphates, usually almost insoluble, soluble and thereby capable of assimilation) by other processes, mainly biological, affect the phosphate fertilizer industry? This question cannot yet be answered.

Chemistry, Biotechnologies and Environment

Apart from the possibility of replacing chemical processes with biological ones, biotechnologies could play a major role in controlling pollution downstream of the inorganic and organic chemicals industries. Several laboratories are studying specific enzymes, which could transform pesticides, chlorine compounds (mainly dioxines), phenols, nitrogen oxides, cyanides, etc. into non-toxic molecules. Other enzymes could extract the mercury or chrome ions to include them in non-dangerous or easily separable complex molecules. None of this research may come to fruition, but in the medium and long term, vast possibilities seem to be opening up for the depollution of industrial effluent by biological methods.

F. PAPER PULP

1. Prospects and state-of-the-art

Signs of saturation in the consumption of paper pulp have begun to appear in some industrialized countries. In developing countries, on the other hand, demand will become very strong, whereas growth of this industry has so far been moderate.

Owing to the lack of plentiful raw materials in situ, the chances of expansion for this sector in the Mediterranean basin are poor (a large part of Spanish production is located in Galica, and French in the Aquitaine).

Virtually all paper pulp produced in the world is made from plant fibre. Two main groups of processes are used for pulping :

- mechanical processes. The new process of crushing with rotary grinders supplies good quality pulp, but not very strong. Since the 1970s two variants, the thermomechanical process and the thermo-chemical-mechanical process provide higher grade pulps, suitable for newsprint.

- chemical processes, increasingly common : bisulphate processes and in particular the kraft process, which provide very strong paper for packaging.

2. Relations with the environment

The rotary grinding process causes little pollution. New mechanical processes are unfortunately more so : water pollution and air pollution deriving from volatile woody components created during processing.

Chemical processes pollute both water and air to the extent that the paper pulp industry has long been considered as one of the most polluting industries. But in the face of mounting awareness of the public since the early 1970s, a considerable effort has been made to reduce pollution in existing plants (easier for air pollution than for water pollution), or to build a new, less polluting plant. Currently and in the medium term pollution control in this sector is a matter of deployment of resources.

In the long term it seems that vegetable fibre will remain the raw material for paper pulp, since it is difficult to compete with its very low cost (as in the case of cement). On the other hand it is not unlikely that less polluting processes will be developed and disseminated.

G. OTHER INDUSTRIES

Observations will be confined to three fairly different examples, by way of an example.

1. Aluminium industry

Electroysis releases fluoride compounds which have disastrous effects on vegetation within a radius of several kilometres around a plant. There does not seem to be any hope of a medium-term technological change in this field : work undertaken to extract aluminium from clay seems unlikely to lead in the near future to any method that would be economically competitive with the present process. The slower growth of aluminium consumption worldwide will indeed make it less urgent to make use of ores other than bauxite. On the other hand, fluoride pollution can be reduced considerably :

- by using prebaked anode tanks ;
- by retaining fluoride dust; not only in the tanks, but in workshop ventilation circuits, either by electrofilters, or by more efficient dry-purification processes.

2. Tanneries

Leather industries are traditionally important in Spain - the leading world exporter of leather and leather goods - in Catalunia and the provinces of Valencia and Alicante ; and in Italy, in Tuscany, Lombardy, Marche, etc. They are less important, but not insignificant in Turkey, in the region of Izmir, in Greece, around Athens and Thessalonia, in Egypt, in Alexandria, etc.

Tanning has always been a highly polluting industry, discharging large amounts of effluent, which is of course biodegradable, but is slow to be degraded and gives rise to many nuisances. Modern tanning processes, such as chrome tanning, have considerably reduced tanning time, but have added chemical pollution to biological pollution. In several countries use is made of automated processes, "short baths" to reduce the volumes discharged, or effluent treatment, in order to combat this pollution.

3. Industries manufacturing electronic products

Handling minute quantities of materials compared to those used in many traditional industries, keeping a severe watch on any impurities incompatible with product quality and reliability, these "white-coat" industries would at first sight appear to be less threatening for the environment. And yet the example of Silicon Valley in the United States, where the microchip industry has produced problems of toxic waste, shows that this is not always the case.

This example illustrates the concerns aroused by the "new pollutions" and/or trace substances (micropolluants) in the air or water, whose effects on human health are still not fully grasped, and which are not yet subject to systematic regulation. However, this example and the above analysis of relationships between the various industrial sectors and the environment, clearly show the difficulties in carrying out a prospective study in this field.

In conclusion, quite a widespread tendency seems to characterize relationships between industry development and the Mediterranean environment over the coming decades :
- in industrialized countries north of the basin, routine, "ordinary" pollution produced by traditional industries has probably passed its peak, and will be better controlled and reduced, provided that the authorities impose increasingly strict standards and make sure they are observed, and that the necessary investments are available. On the other hand, the risk of accidental "extraordinary" pollution will probably increase in many industries, whether old or new : fine metallurgy, fine chemicals, biotechnology industries, electronics,etc. ;
- in the less industrialized countries south and east of the basin, where certain production capacities will increase considerably, as indicated, the problem of investment will be fundamental. In some cases, choices will be made easier by the competitiveness of new "environment-friendly" processes, as with natural gas in the steel industry. North-South co-operation, as envisaged in the alternative scenarios, could also play a major role.

IV. CONCLUSIONS AND ISSUES FOR APPRAISAL

A. TOWARDS A NEW SPATIAL DISTRIBUTION OF INDUSTRY

Emphasis has been laid on growth discrepancies between the north and south for the three major industrial branches : agro-food, primary processing industries producing intermediate goods, and light industry producing most non-durable consumer goods (including textiles). Since the countries south and east of the Mediterranean have far higher growth rates for these industries than the northern countries, spatial distribution will inevitably be inverted between these two groups of countries in the fairly long run.

Basically this shift is linked to the differing dynamics of domestic markets. It will occur through the creation of new enterprises in the southern and eastern countries, which in this case cannot be described as a "delocation" of industry. Another reason for the shift however, which differs according to the scenarios, is changes in foreign trade, the northern industries losing ground either on their home markets or those of third countries, to the benefit of southern and eastern Mediterranean industries. Term "delocation" is then more suitable, especially since the establishment of enterprises would be financed partly by northern transnationals banking on southern exporters, thus setting up a true North-South transfer of activities. Even in the scenario most favourable to this kind of transfer (reference trend scenario T-1) this would be a minor cause compared to the slow erosion of the northern position due to the continued advance of southern industries under the pressure of population growth and rising standards of living.

In many cases this geographical shift in industrial siting will occur beyond the Blue Plan horizon, but it will certainly be under way by 2025. This shift should be stressed espcially because its impact on the environment and spatial distribution and organization of populations will be crucial : concentration in the major urban agglomerations or an even distribution between these and small or medium-sized towns (as in integration alternative scenario A-2 for instance). At the local or regional level, the choice of industrial sites and the possibility of planning suitable waste and effluent treatment facilities on them offer ways to limit pollution and its effects.

B. THE CASE OF CAPITAL GOODS INDUSTRY

Possible trends in capital goods industries is not as easy to foresee as traditional industry and leads to a number of queries.

Among these industries, those which involve the use of high technology are the source of a continuous renewal of techniques, a movement which spreads by degrees throughout the capital goods and consumer durable industries, in fact even to all industries. The textile industry for instance (considered here as a light industry) is undergoing radical transformation with the automatic control of machinery and workshops ; the new materials industry in fact belongs to the raw materials primary processing sector, and so forth.

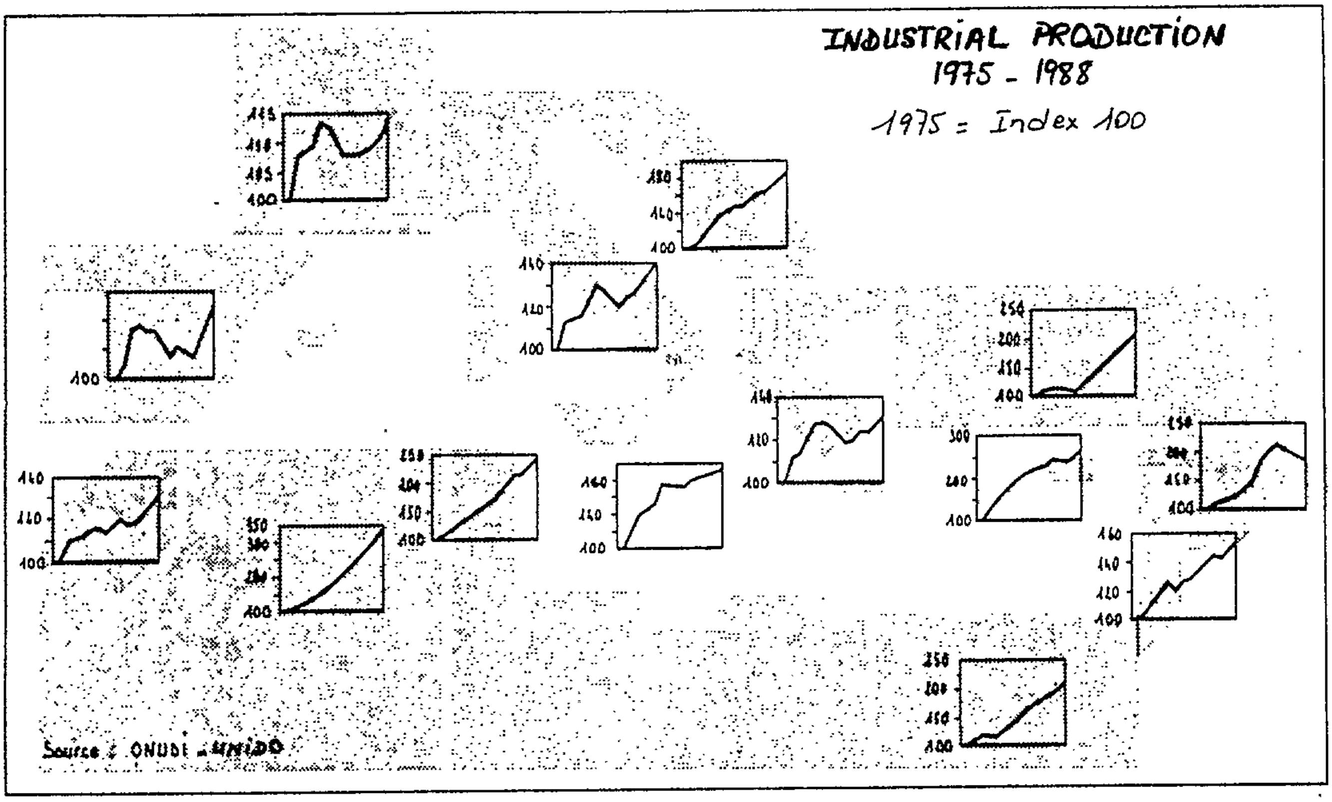
The first query is therefore : is it correct to assume the rapid growth of these industries outside the most industrialized countries on the basis of the demand for capital goods? Do not the features of the high technology industries create obstacles to the construction of new capital goods industries outside a small group of countries? In fact it can be observed that high technologies quickly spread to other industrialized countries, and this diffusion is already under way in industrializing countries with a capacity for the dynamic assimilation of technology, as can be seen by computers manufactured in Brazil, Korea, Taiwan, etc. So there is no reason to think that this spread of knowledge will be constrained. In the future, however, its prerequisites will be more difficult to meet than at present :

- accumulation of know-how concerning enterprise creation and management ;
- sufficient concentration of skilled labour (workers in the Japanese automobile industry are at secondary education level) ;
- well-organized R&D ;
- link-ups with transnationals for technology transfers.

The geographical distribution of capital goods industries would therefore depend on the capacity of countries to master these factors. The general hypotheses of the alternative scenarios facilitate the access of the countries south and east of the Mediterranean basin to technology but other conditions would also have to be met.

A final query is worth considering. Snce new technologies save on raw materials and so are fairly independent of natural resources and also existing transport networks, does this not offer a fresh opportunity to the under-industrialized Mediterranean provinces of both the northern and southern coastal countries, such as eastern Andalusia, the French Midi and the Italian Mezzogiorno, remote from major European industrial centres?

These considerations lead back to the harsh conditions already mentioned for the establishment of new poles of industry, illustrated moreover by the fact that few new poles of capital goods industries have been created in Europe since the end of the First World War. This kind of pole cannot be established by individual action, but by an overall policy and the dynamism of a network of enterprises working together and interrelated over the long term.


INDUSTRIAL PRODUCTION
1975 - 1988
1975 = Index 100
Source : ONUDI - UNIDO

CHAPTER III.3

ENERGY OUTLOOK

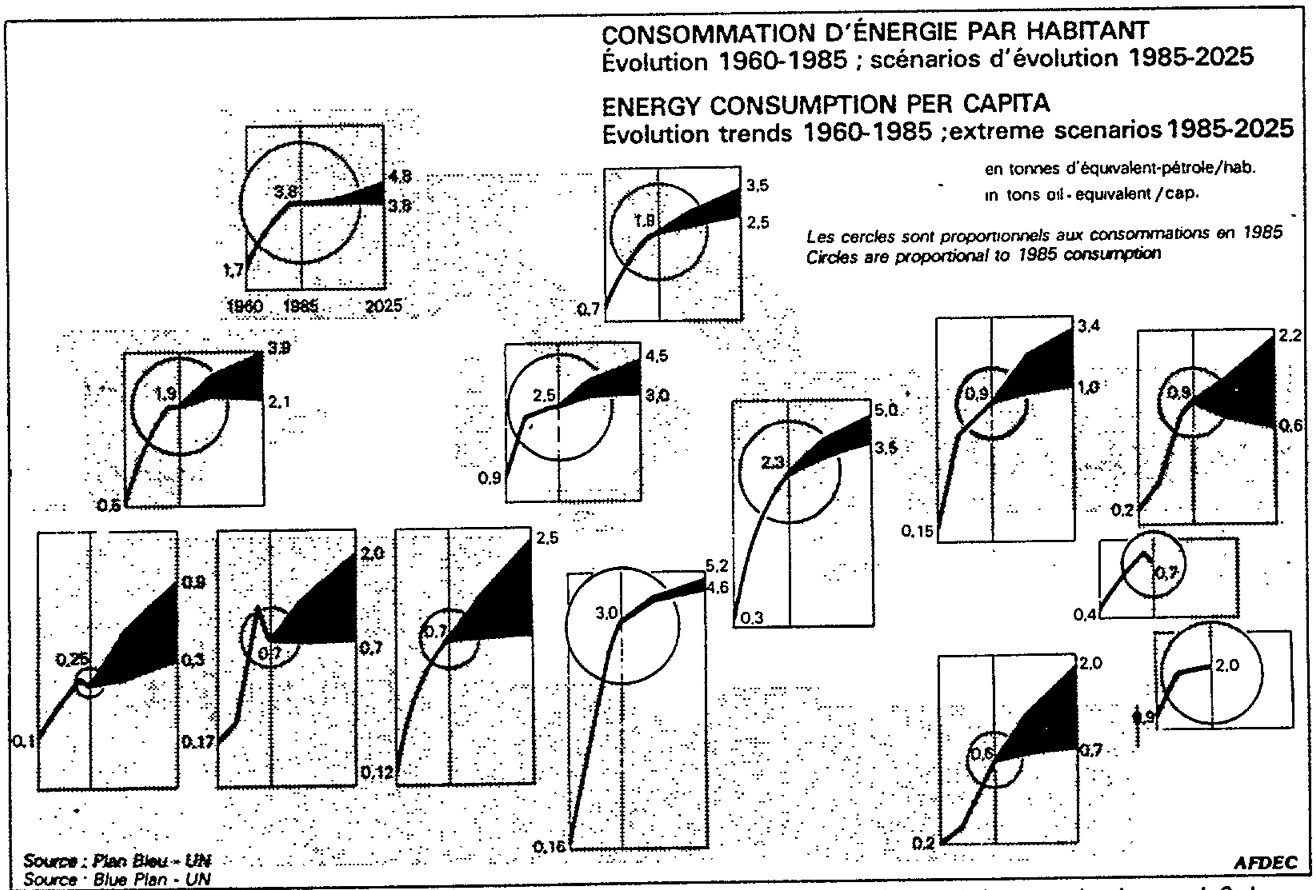
Both consumption and production of commerical energy in the Mediteranean countries have evolved considerably over the past few decades, peaking in the northern countries, while continuing to grow in the south, admittedly from fairly low levels after the Second World War (Section I).

The scenario hypotheses for the energy sector (Section II) include both the range of national strategies and possible trends in the international context for supplies (especially fossil fuels). The international market is particularly important as regards energy, and this chapter contains a number of references to it.

On the basis of these hypotheses, a number of trend and alternative scenarios have been established (Section III) related to the general economic hypotheses.

Relationships between the energy sector and the Mediterranean environment have been broken down into the hydrocarbon sector (Section IV) and electricity generation (Section V), concluding with potential impact on the climate ("greenhouse effect"). Clearly it is preferable to have knowledge about polluting emissions and the directly destructive effects of the energy sector than about the indirect and/or distant effect, and in fact it is very difficult to compare two totally different processes, such as the use of coal or of nuclear energy for electricity generation, on the basis of their environmental impacts alone.

Whatever the scenario, a number of fundamental issues remain. These are briefly reviewed at the end of the chapter (Section VI).



L'éventail des accroissements de la consommation d'énergie par habitant selon les différents scénarios est très important dans les pays du Sud et de l'Est du bassin.
Range of increase in per capita energy consumption is much larger in the southern and eastern countries of the basin, depending on the scenarios.

I. ENERGY IN THE MEDITERRANEAN BASIN

Both consumption and production of commerical energy throughout the Mediterranean basin have changed radically in the past decades and, among other factors, have been deeply marked by the oil crises of 1973, 1979 and 1985.

A. CONSUMPTION

Energy consumption for the Mediterranean basin as a whole developed remarkably since the end of the Second World War : over sixfold between 1950 and 1985 (i.e. an average annual growth rate of 5.3 %). In 1950, total consumption of the Mediterranean basin countries was virtually equivalent to that of Spain alone at present.

Nevertheless, there is a very large difference between the countries in the north (from Spain to Greece) and the countries in the south and east of the basin (from Morocco to Syria, together with Turkey), although this difference is gradually being effaced. Up to the end of the 1960s, consumption in the northern countries accounted for more than nine tenths of the total. It is currently less than 80 % (for a total of a little less than 600 million tonnes oil equivalent (toe).

The growth of consumption in the chief countries in the north has tended to peak (especially in France, the largest consumer in the region, where the value for 1984 was still 3 % below the maximum reached in 1979), whereas that in the countries in the south and east has continued. Between 1970 and 1985, the increase in total commercial energy consumption averaged only 2.8 % per year in the countries in the north of the basin, and 7.2 % per year for the countries along the southern and eastern shores, admittedly starting from far lower values.

Very significant structural differences in consumption exist between the two shores in addition to these quantitative differences. Almost all the coal produced, for example, is consumed by the countries in the north, where it still represents about 20-25 % of energy consumption (nearly 50 % for countries like Greece and Yugoslavia) and by Turkey. It is usually less than 5 % in the southern and eastern countries, although this situation could change shortly because of electricity generation requirements.

In both the north and the south, oil remains the chief energy source. Some countries which import the greater part of their supplies have made considerable efforts, particularly since 1979, to reduce their oil consumption. Between 1979 and 1985 for instance, France reduced its oil consumption by more than 27 % (oil imports now account for less than 50 % of total energy consumption), Italy 18 %, Spain 10 %, and Greece 6 %, in a context of stabilization or decline in total energy consumption. In the southern and eastern countries where oil consumption remains paramount, it nevertheless dwindled from 90 % to approximately 75 % of the energy balance, despite the strong growth of total energy consumption.

Except for France where uranium has largely replaced heavy fuels for the thermal generation of electricity, the shift - absolute or relative - from oil has generally been towards natural gas. The consumption of natural gas has increased sharply throughout the basin, rising from roughly 20 million toe in 1970 to nearly 80

COUNTRY	1960-1980 G.D.P. ($1975)	1960-1980 Energy consumption	1960-1980 Electricity consumption	1980-1985 G.D.P. ($1975)	1980-1985 Energy consumption	1980-1985 Electricity consumption
SPAIN	5.71	7.76	9.11	1.37	0.65	2,80
FRANCE	4.62	4.86	6.32	1.12	0.60	5,84
ITALY	4.14	5.77	5.84	0.92	-0.23	-0,27
YUGOSLAVIA	5.78	5.62	9.94	0.66	2.23	4,41
GREECE	6.30	9.98	11.82	1.31	3.71	3,87
TURKEY	5.32	10.8	10.83	4.78	5.87	7,29
SYRIA	7.70	10.14	12.44	3.54	7.52	13,78
LEBANON	5.60	5.45	7.53	0.00	-1.64	-5,52
ISRAEL	6.93	6.59	8.47	0.00	3.52	5,94
EGYPT	6.40	6.37	10.36	7.44	8.72	4,16
LIBYA	17.90	18.28	20.71	-5.12	11.72	11,07
TUNISIA	6.41	10.53	11.52	4.06	5.03	7,53
ALGERIA	3.73	12.72	8.77	4.67	-6.03	11,50
MOROCCO	6.84	7.62	8.23	2.56	0.45	7,14

Source : Blue Plan

Table III-13 RELATIONSHIPS BETWEEN AVERAGE ANNUAL GROWTH RATES OF GROSS DOMESTIC PRODUCT, TOTAL ENERGY CONSUMPTION AND ELECTRICAL ENERGY CONSUMPTION

COUNTRY	Total-1960 consumption (Mtoe)	Total-1985 consumption (Mtoe)	Per capita consumption 1985 (koe)	Per capita electricity consumption 1985 (kwh)	Total production 1960 (Mteo)	Total production 1985 (Mteo)
SPAIN	16.04	73.93	1,920	3,100	11.0	32.29
FRANCE	77.09	205.20	3,760	5,978	43.10	89.99
ITALY	46.23	140.32	2,450	3,015	19.58	29.11
YUGOSLAVIA	13.48	40.84	1,760	3,085	12.02	25.61
GREECE	2.78	22.38	2,260	2,605	0.79	12.31
TURKEY	4.12	42.68	855	395	2.88	25.28
SYRIA	1.01	9.97	860	588	-	9.63
LEBANON	0.74	1.97	738	507	-	-
ISRAEL	1.98	8.43	1,980	3,694	-	-
EGYPT	5.12	26.76	571	495	3.45	52.73
LIBYA	0.22	11.0	3,050	2,263	-	55.53
TUNISIA	0.50	4.73	668	568	0.02	6.73
ALGERIA	1.86	14.93	688	566	8.93	73.53
MOROCCO	1.21	5.38	246	317	0.52	0.97
MED. TOTAL	157.89	603.37			102.29	413.21

Source : I.A.E.A. and Blue Plan

Table III-14 ENERGY CONSUMPTION AND PRODUCTION IN THE MEDITERRANEAN COUNTRIES million toe in 1985, in other words a growth of almost 9.5 % per year despite the fact that consumption is still comparatively weak (or nil) in some countries (Malta, Greece, Turkey, Syria, Lebanon, Israel). It should be noted that the share of hydrocarbons - oil plus natural gas - was comparatively stable between 1970 and 1985 : in the region of 65-70 % for the Mediterranean basin as a whole but over 90 % for the south), slightly higher than the world average (about 60 %).

One of the major trends over past decades has been the strong growth in electricity consumption in all countries : growth rates usually higher than those of energy in general, in turn higher than the economic growth rate for most countries (Table III-13), except in the most industrialized countries where the energy growth rate plunged spectacularly after 1979 (effect of the growing importance of the tertiary sector in the economy and energy-saving efforts). Thus between 1970 and 1985, electricity consumption growth rates in France and Spain were over 5 % (but about half in Italy for institutional reasons), nearly 8 % in Egypt, 9 % in Morocco and Turkey, 11-13 % in Tunisia and Algeria (equal to doubling every five or six years), over 15 % in Syria, and nearly 22 % per year in Libya (doubling every three-and-a-half years). Libya in fact holds the Mediterranean "record" as it increased its electricity consumption by a factor of more than 200 between 1950 and 1985. In the southern and eastern oil- and gas-producing countries in particular, electricity consumption, very low after the last war, increased rapidly after 1970.

Non-commercial energy consumption is currently estimated at between 25 to 30 million toe per year, with little fluctuation.

B. PRODUCTION

Total commercial energy production in the Mediterranean basin increased nearly ninefold between 1950 and 1985, but unlike the steady growth in consumption, production rocketed in the 1960s (Libyan oil production for instance soared from 0 to more than 160 million tonnes in a few years) followed by decline in the 1970s. Between 1970 and 1985 total energy production rose from 344 million toe to 412 million toe (but dipped to 290 toe in 1975).

This trend results mainly from a significant reduction in oil production (above all Libya), an increase in the production of gas and primary electricity and virtual stagnation in coal production. Mediterranean production represents only 4.8 % of total world production. The difference of more than 150 million toe (1985) between consumption and production is covered by imports from non-Mediterranean countries (Arabian-Persian Gulf, Nigeria, North Sea, etc.).

Roughly 70 % of coal production (about 77 million toe in 1985) is concentrated in the countries north of the basin : France (falling sharply), Yugoslavia, Spain and Greece and also in Turkey (increasing in these last countries but often with low-grade coal).

Approximately 90 % of primary electricity generation is concentrated in the countries north of the basin, contributing nearly 50 % of their total energy production balance. Hydroelectric power is produced in France, Italy and Spain, followed by Yugoslavia. In the south, the only country which counts is Egypt, with the Aswan Dam. Commercial geothermal energy is produced in Italy (installed capacity 519 MWe, with 43 power plants) and Turkey (20 MWe and two power plants). Nuclear power is produced in four countries : France (50 plants in 1987, or more than 85 % of total nuclear power in the Mediterranean), Spain, Italy and Yugoslavia (one 660 MWe plant).

In 1985 oil and gas accounted for nearly 56 % of all the energy produced in the Mediterranean basin (43 % for oil, 13 % for gas).

In 1986, the southern and eastern countries produced more than 90 % of Mediterranean oil. The main producers - and exporters - in the south are Libya, Algeria (both with about 50 million tonnes in 1986) and Egypt (41 Mt), followed by Syria (nearly 10 Mt) and Tunisia (5 Mt). However, the comparative positions of these countries differ as regards reserves : at 1986 levels Libya (in fact producing at a very reduced capacity), with a reserves/production ratio of more than 60 years, is one of the major oil producers in the world, whereas Algeria and Egypt only have each some 15 years of production left. In the north, Spain, France, Italy, Yugoslavia, Greece and Turkey are all producers, but very minor, 1-4 million tonnes per year ; and the north as a whole represented less than 9 % of the Mediteranean total in 1986.

The situation is somewhat different for natural gas, with 30 % of total production coming from the northern countries, where production usually started earlier and has the advantage of proximity to consumer markets. In 1986, 70 % of Mediterranean gas was produced by the southern countries. In fact a distinction has to be made between gas associated with oil (the case of Libyan gas for instance) and "dry" or unassociated gas (the case of Algerian gas). In the north, Italy is the main producer (nearly 15 thousand million cubic metres in 1986), followed by France, where production (Lacq) is falling. The largest gas producer is in the south - Algeria, seventh largest producer in the world in 1986 with 35 thousand million cubic metres.

Table III-14 summarizes a number of data on energy consumption and production in the countries of the Mediterranean basin.

II. THE SCENARIO HYPOTHESES

A. THE INTERNATIONAL SUPPLY CONTEXT

In order to meet their energy requirements, most countries supplement their domestic resources with purchases of oil, coal, natural gas, uranium, and even more recently, electricity, on the international markets (Italy, for instance, currently imports approximately 10 % of its electrical consumption, sold to it by France and Switzerland among others). Overly strong growth of energy consumption at the world level could lead to tension on these markets, considering limited resources or the time needed to install additional production capacity, as was the case of oil in the 1970s.

Unlike mineral resources, for which supply prospects are quite promising because of technological progress and geological abundance (as stressed in the chapter on industrial development), questions are regularly raised about the life span of some energy resources, starting with oil, but also uranium and natural gas. So regardless of prices and their impact on economic development, because either imports are a burden or exports represent a source of financing, it is important to explain the energy resources hypotheses used in the construction of medium- and long-term development scenarios at the international, regional or national levels. National or regional scenarios cannot be formulated without specifying these hypotheses. And the scenarios naturally have to take into account interchangeability of resources. The possibilities for substitution vary according to the end use ; automobile or aviation fuel for instance currently has no commercial substitute ; conversely, electricity or heat can be produced from virtually any source (hence occasionally fierce competition on some markets).

In 1985 world commercial energy consumption was approximately 7,400 million toe. Oil provided about 38 % of it, ahead of coal (nearly 31 %), natural gas (20 %) and primary electricity (hydraulic, geothermal and nuclear, 11 %). World energy consumption rose by an average of 4.2 % per year between 1965 and 1975, and by 2.2 % per year from 1975 to 1985, a particularly disturbed period for the world economy. Assuming an average growth of no more than 1 % per year, the world consumption level would exceed 11,000 million toe in 2025 ; with a growth rate of 2 % per year (comparable to the population growth rates given in the chapter on population), it would exceed 16,000 million toe, i.e. more than double the current amount. These figures provide an idea of the scope of the energy supply problem as from early next century.

1. Oil

According to most experts, oil will stay in first place at least until 2000, providing 30 % or more of the world energy supply. Proven reserves are in the region of 95-100 thousand million tonnes (98.2 thousand million in 1986), or slightly more than 30 years of current consumption. The Mediterranean countries possess some 5,000 million tonnes, i.e. 5 % (Table III-15). About 11,000 million tonnes are found in the socialist countries, comparatively autonomous. A little over half, 53 million tonnes are located in the Middle East.

Beyond the reserves, in any event globally insufficient to reach 2025, potential resources are very poorly known : nevertheless these are the resources that will make it possible to reach or go past 2025, or, in the final analysis, will determine the length of the "oil era" (along with non-conventional oils, even worse known and usually very expensive). As regards the quantity of oil remaining to be discovered, the following values were selected for the Blue Plan scenarios, although they are somewhat arbitrary, combining physical and geopolitical assumptions (figures for some Mediterranean countries are given in Table III-15).
- 36,000 million tonnes, or a dozen extra years (2030) for the reference trend scenario T-1 and worse trend scenario T-2), as the international situation is adverse to oil prospection and production ;
- between 55-60 thousand million tonnes for moderate trend scenario T-3.
- between 80-120,000 million tonnes for the alternative scenarios (although probability of reaching the latter figure is in the region of 50 %) as international co-operation furthers oil prospection and optimal production.

Two possible levels of world production have been associated with these different estimates for oil reserves and resources :
- 3,000 million tonnes per year, somewhat higher than production over the past few years, but slightly lower than the maximum production of more than 3.2 thousand million tonnes in 1979. With a world population of roughly 8.2 thousand million in 2025, this hypothesis of stagnating world production means declining average per capita "availability", in the order of 370 kg per year in 2025, compared to a little over 580 in 1985. This sort of hypothesis corresponds to reference trend scenario T-1 and worse trend scenario T-2 ;
- 3.5 thousand million tonnes per year, or about 20 % more than in 1985. This hypothesis corresponds to moderate trend scenario T-3, and alternative scenarios A-1 and A-2, with stronger economic growth and a better atmosphere of international co-operation.

Whatever the scenario, virtually all Mediterranean countries will have to face the major issue of oil supply. And whatever the hypothesis on resources, the potential reserves and resources of most Mediterranean oil producers, with the exception of Libya, are likely to become depleted during the second period of the

COUNTRY	OIL			NATURAL GAS			COAL	
	Reserves (Mt)	P/R years	Potential resources (Mt)	Reserves (Gm3)	P/R years	Potential resources (Gm3)	Recoverable reserves (Mtce)	Potential resources (Mtce)
SPAIN	4.7	2.6	n	22	64	n	883	542
FRANCE	31	10.6	n	35	8.1	n	381	–
ITALY	130	50.6	n	225	15.2	n	39	n
YUGOSLAVIA	36	8.6	n			n	16,570	n
GREECE	3.2	2.6	n			n	3,000	n
TURKEY	19	8.1	n	13	28.6	n	4,857	3,138
SYRIA	201	20.8	n	118	875	n		
LEBANON								
ISRAEL								
EGYPT	616	15.1	135-270-1650	250	56.5	200-600-1700	52.9	n
LIBYA	3,120	15.1	500-800-2000	595	127.9	200-500-1500		
TUNISIA	238	43.4	135-270-1200	90	44.3	100-300-1000		
ALGERIA	660	13.2	70-200-700	2,978	85.6	200-500-1500	43	
MOROCCO				4	50	n	45	n
MEDITERRANEAN TOTAL	5,065	29.7	900-1600-5600	4,329	65.55	700-1900-5700	27,871	n

n : not known

Sources : World Oil for oil reserves
Oil and Gas for gas reserves
(USGS) for potential oil and gas resources
WEC for coal.

Table III-15 ENERGY RESERVES AND POTENTIAL RESOURCES IN THE MEDITERRANEAN BASIN

scenarios, i.e. between 2000 and 2025, an event which will greatly affect their economic development prospects in the medium and long term.

2. Natural gas

Overall, natural gas came into use much later than oil (after the Second World War) and some Mediterranean countries, like those mentioned above, have not started to use it yet. With 100 million million cubic metres, or about 60 years' worth of consumption, world and Mediterranean natural gas reserves (Table III-15) are steadily growing. Considering that this fuel is flexible to use and has environmental advantages, it is likely that there will be vigorous development in this sector during the coming decades. The energy scenarios have started to explore this possibility.

3. Coal

Coal reserves and resources are considerable : several million million tonnes, equal to several hundreds of years' worth of current consumption. Since coal is also a low-priced product nowadays owing to highly sophisticated techniques (the United States, Australia, South Africa, Colombia, etc.), it may play an increasing role at the world level, particularly in thermal power production for which it is or will be in competition with nuclear energy. There is not much coal in the Mediterranean : virtually none at all in the southern countries ; more, but low grade in the northern countries (Spain, France, Yugoslavia, Greece) and Turkey. Solutions have not yet been found for all its environmental impacts, and it requires rather large-scale transport infrastructures which are currently more than necessary, but would need considerable future investment in the case of strong growth. Some scenarios explored the steady growth of coal use in the world and in the Mediterranean basin, of coal trade, and consequently of its maritime transport, as well as its impacts on the environment.

4. Nuclear energy

After an impressive start in the 1960s, the production of nuclear energy has slowed down considerably with regard to commitments (if not to the opening of plants commissioned five or ten years ago). With an installed capacity of a little over 50 MWe, France has become the second biggest nuclear country after the United States, and the Rhone is doubtless one of the most "nuclearized' rivers in the world. In the Mediterranean, Spain lags quite far behind France (6.5 MWe). The other countries have adopted a "wait and see" attitude, above all since the accident at Chernobyl.

World reserves and resources of uranium seem to be quite sufficient for the coming decades. In the longer term, after 2000 or 2010, the need may arise to adopt other production techniques, such as super-generators. Assuming an acceptable, and accepted, solution can be found for the permanent storage of nuclear wastes, some experts mention the possibility of a "second nuclear age" which might start after 2000.

5. New or renewable energy sources

Despite a considerable world potential sometimes estimated at 7-8 thousand million toe a year, or the equivalent of current world energy consumption, and undeniable advantages for the environment, renewable energies (geothermal, wind energy, biomass, solar energy with its different exploitation possibilities, etc.) are finding it hard to make a breakthrough, although they regularly arouse interest. The drop in oil prices has placed a curb - which is not quite rational - on research and development efforts in most countries.

There is still hydraulic potential in many countries, including Turkey, Greece, Yugoslavia, Italy and Spain, but only to a minor degree in the other countries east and south of the Mediterranean basin. Geothermal power is already exploited in Italy, as well as Turkey (where it has interesting potential), Greece, France and Yugoslavia.

Solar energy has considerable potential in the countries south and east of the Mediterranean basin (due to a combination of abundant sunshine and vast desert regions not too far from inhabitated areas), but its exploitation on a significant scale in relation to energy needs requires, under present conditions, interventionist policies, such as those partly assumed in the alternative scenarios. Moreover, it should be noted that the major trend towards urbanization (analysed elsewhere) is more conducive to concentrated forms of energy production rather than dispersed or decentralized forms. On the other hand, decentralized production could offer attractive solutions for scattered dwellings. Some Mediterranean countries, such as Israel, have achieved remarkable results in specialized sectors, using solar energy for hygienic purposes (65 % penetration rate), Crete for tourist requirements, etc.).

The trend envisaged by FAO for instance, for the consumption of fuelwood is a worrying problem as regards energy and the protection of soil and water resources (see box). The energy scenarios have tackled this aspect (the evolution of forest is studied in the fourth part of the report).

B. NATIONAL STRATEGIES

The hypotheses first focus on national energy consumption growth rates in relation to the economic growth and industrial hypotheses, then on the possible structure of supply in terms of the international context described above and national strategic choices : supply cost in the light of the market situation, a fairly high degree of international dependency, choices between growing dependency and low-cost supply or between the medium and long term, and advantages or disadvantages as regards the environment.

The overall assumption of weak energy growth for the most industrialized countries in the Mediterranean basin, which already attained comparatively high energy per capita consumption levels (between 2,000 and 4,000 kg oil equivalent (koe) per year, the case in France and Italy) allows these countries little margin for manoeuvre, especially up to 2000, considering the equipment programmes under way. The scenarios for these countries therefore diverge little and will only show marked differences after 2000.

The future is more open for the other countries north of the basin with comparatively low per capita energy consumption, between 1,000 and 2,500 koe per year, such as Spain, Yugoslavia, Greece and Cyprus, where development requirements and possibilities are still fairly high with a wider range of choice.

The countries south and east of the basin, except Libya, have fairly low per capita consumption levels, varying between 300 and 1,000 koe per year (compared with the world average of about 1,300 koe per year), since their consumption is largely based on hydrocarbons, as mentioned above. Whether they are consumers or producers, their future trends depend considerably on the world market for oil and gas. The scenarios can therefore be very open and very contrasted, and explore a wide range of different possible futures.

In all cases, in the north and in the south and east of the basin, it has been assumed that the trend towards electrification would continue, average to strong in the north, strong to very strong in the south and east. This assumption is very significant for energy development in the Mediterranean countries, as regards both required investment and possible supply structures. Its importance is such that several extreme variants of the scenarios have been explored in order to study the consequences of virtual concentration on a single source for electrical generation (nuclear or coal).

Whether for energy consumption or for electricity development, the growth rates chosen could seem modest compared to the performances of many countries during the past decades, even in comparison with the rates of some socio-economic plans under way or in preparation. But it should be recalled that the rates used are average rates over long periods (15 and 25 years successively).

III. SCENARIO FINDINGS

A. TREND SCENARIOS

The trend scenarios reflect a certain degree of continuity as regards consumption and supply trends, with low penetration of new and renewable energies, which nevertheless increase from worse trend scenario T-2 to moderate trend scenario T-3 (the T-1 trend scenario usually lying midway between the two diverging scenarios T-2 and T-3).

In the worst trend scenario T-2, weak economic growth means low energy growth, and limited investment resources curb electricity growth. Total energy consumption rises from a little over 6 million toe to nearly 900 million toe in 2025, i.e. an annual average growth of 1.02 % for 40 years (compared to an average growth of 5.3 % between 1950 and 1985, that is during 35 years). The countries north of the basin consume about 65 % of total energy in the region but their growth rates were lower than average (0.48 % per year only), and some countries make virtually no progress. At this rate per capita consumption rises little, and even falls in some countries south and east of the basin, with an energy consumption growth rate lower than the population growth rate (this rate is assumed to be the highest in the T-2 scenarios).

Total electricity consumption grows faster than energy consumption, with an average annual rate of 1.6 %, reaching 1770 Twh. Per capita consumption rises in all countries (except one). Consumption increases much more in the southern and eastern countries (nearly 300 %) than in the northern countries (where the increase is only 75 %).

Supply structures change little. Oil consumption, which in 2025 still accounts for about 40 % of the total energy supply, rises for the basin as a whole from 300 million to 360 million tonnes, peaking or falling in the northern countries. World production is at a standstill, with irregular prices, not very conducive to energy planning, and with a tendency to rise ; towards 2010 - 2015 the "bottom of the barrel" becomes visible for some Mediterranean producers (Tunisia, Egypt), which induces the consumer countries able to do so to turn to other sources. As this scenario is not conducive to international trade, countries with domestic coal resources, such as Spain, Yugoslavia, Greece and Turkey, continue to develop them. Total coal consumption, supplemented in the southern countries with coal imports, for electrical generation among

ENERGY STATISTICS AND METHODOLOGY

On account of consistency, and availability for the Mediterranean countries as a whole, the United Nations energy statistics series were chosen as the starting point, despite some inconvenience caused by the fact that they are published three years later. As regards consumption, these statistics give final forms of energy source (except for losses and non-energy uses), indicating the thermal equivalent (1 kWh = 84.5 goe*) of primary electrical energy (hydraulic, nuclear, geothermal). This convention was adopted for the scenarios calculations (production equivalence : 1 kWh = 222 goe). In some cases, and when there was no apparent contradiction, specialized statistics were also used (e.g. for reserves, resources, etc.).

A small model was constructed in the macroeconomic scenarios to explore possible energy trends, on the basis of the growth rates of total consumption by country and of electrification (with a ceiling when necessary for the share of electricity in national energy balances). The distribution of consumption -then production- by source were calculated by logical trend extrapolations and/or by hypotheses on growth and expected availability based on reserves and potential resources, taking into account additional determining factors usually derived from other sectors (such as the development of iron and stell and cement industries, major energy consumers ; trends for the automobile stock and transport ; specific fuel consumption,refining structures, etc.).

* grams oil equivalent

other things, rises from 100 million toe to 175 million toe, but antipollution devices are not always installed (partly because of their cost). Use of natural gas grows slowly, virtually at the same overall Mediterranean rate as coal, but this time to the benefit of southern and eastern producers. The growth of primary electricity is hampered by the cost of investment : maximum hydraulic potential is far from being achieved in the north and in Turkey. The nuclear energy programmes under way are completed ; programmes start up again slowly after 2010 (commissioned after 2000).

Overall, this scenario at first sight is not very conducive to the use of renewable sources of energy : weak economic growth, low energy growth, irregular oil prices, inadequate international scientific and technological co-operation, few incentives on the part of governments, etc. The main use of solar energy is hot water for hygienic use, fairly widespread in the Mediterranean basin (households, hotels and lodgings, hospitals, etc.) ; there are a few applications of photovoltaic cells (for instance, in communication relay stations).

Conversely, moderate trend scenario T-3 postulates strong economic growth, bringing about high energy and electricity consumption. This scenario also assumes that more attention is paid to the environment, on the one hand facilitated by the renewal and/or development of the productive sector but, on the other, curbed to some extent by an economic dynamism which tackles the most urgent matters first or postpones consideration of some constraints till later.

Energy consumption grows strongly, at an annual average rate of nearly 2.2 %, to reach close on 1,500 million toe in 2025, almost 2.4 times the current level. In fact, growth is stronger during the first half of the period, weaker after 2000 for the countries north of the basin, and weaker in general after 2010. With an average annual growth rate of 4.4 % throughout the period (compared to 1.25 % for the north), the southern and eastern countries virtually catch up with the north in 2025, with 47 % or so of the total energy consumed (a similar catching up process to that depicted for heavy industry, moreover linked to it to some extent). Electricity consumption also surges forward for the basin as a whole (level approximately of 2,800 Twh). At the end of the period the south and east consume more than one third of the total.

Per capita consumption of both energy and electricity increases, and for many countries south and east of the basin nears, in 2025, the current consumption of the northern Mediterranean (2,800 kwh per year for Greece in 1985, 3.228 for Spain, 6,700 for France, compared to 10,000 to 20,000 for north European countries). The gap narrows, especially as consumption in the north rises more slowly or reaches a ceiling.

This kind of growth naturally resorts to all sources of supply, under constant pressure. Although the share of oil in Mediterranean supplies would be reduced to 33 % in 2025, its absolute value would rise by nearly 60 %, to approximately 490 million tonnes. This is made possible by increased world production (in turn deriving from much more intense prospection), a widespread improvement of on-land and offshore techniques, also use of some domestic sources such as oil shale existing in several Mediterranean countries, and better co-ordination between the countries of the Mediterranean region and those of the Arabian-Persian Gulf.

Increased oil production and technological advance leads to the strong growth of production and consumption of natural gas, associated with and dependent on oil production, or not. The increased number of oil pipelines enables some non-producing countries or small producers to benefit from transit through their countries inter alia for natural gas. Natural gas consumption rises by a factor of 4.5 in 40 years (average annual growth rate slightly under 4 %), taking over from oil which peaks, and also enjoying particularly advantageous conditions in the Mediterranean basin.

In this scenario primary electricity reaches virtually its maximum level, as hydraulic potential is exploited more than 60-70 %, geothermal energy is developed from Yugoslavia to Turkey, and nuclear energy starts up in the southern and eastern countries after 2000 in the context of international co-operation agreements.

Coal demand for electricity production and industrial needs is such that domestic production reaches its highest level, and even then imports are required as total consumption exceeds 300 million tonnes.

Solar energy enjoys more favourable conditions (without yet reaching the optimum ones in the alternative scenarios), inter alia on account of the industrial climate conducive to innovation : hot water for hygienic and industrial purposes, greenhouses for intensive agriculture, crop drying, incipient use of photovoltaic cells in isolated locations, spread of solar units (electricity and heat) for dispersed dwellings.

B. ALTERNATIVE SCENARIOS

The strong economic growth and North-South and South-South co-operation assumed in the alternative scenarios, as well as incorporation of the environment in decision-making procedures and in the choice of technical processes, are reflected in different ways in the energy sector :

- preference given to apparently less polluting sources of energy such as natural gas and renewable energies, starting with solar, hydraulic, wind, etc. energy. These scenarios rely heavily on gas : gas benefits from efficient and constantly advancing technology, which tends to diverge from oil technology. Renewable energies assume increasing importance in these scenarios but would probably not realize their full potential until after the 2025 horizon. Their development is furthered by North-South technological co-operation in the case of the A-1 scenario, and by the activity of small or medium-sized enterprises in the A-2 scenarios ;
- these "gas-oriented' scenarios are based on a high level of trade, North-South in the A-1 scenarios, and South-South in the A-2 scenarios, "South" being understood in broad terms, including in some cases the Arabian-Persian Gulf region or sub-Saharan Africa (gas pipeline networks) ;
- this option on natural gas, especially for countries south and east of the basin, partly constraints the development of nuclear energy, which starts off more slowly in this region, as a "wait and see" attitude is assumed ;
- oil remains important in absolute terms, especially because of the prevailing atmosphere of international and intra-Mediterranean co-operation ; its days are numbered, but its decline can be planned and optimized ;
- the biggest difference with moderate trend scenario T-3 concerns coal, whose consumption would be scarcely higher than that for the worst trend scenario T-2 (i.e. about 200 million toe, a large part of which for industrial purposes). When it is used for electricity generation, power stations are equipped with the most efficient depolluting devices, or use new combustion processes such as fluidized beds or resort to gasification. But this does not solve the problem of $C0_2$, considered sufficiently alarming to elicit international measures for controlled coal use, without going to the point of banning it altogether.

These hypotheses lead to overall Mediterranean consumption of a little under 1,600 million toe in 2025, and to electricity consumption very similar to that in moderate trend scenario T-3, per capita consumption being a little higher because of the population hypotheses, with smaller populations in the southern and eastern countries in this kind of scenario (up to 10 % lower than in T-2), as these two trends co-exist. Natural gas, with 580 million toe, outstrips oil (510 million toe). The two sources combined still equal 68 % of the total, the southern and eastern countries consuming a little under half.

The alternative scenarios assume that co-operative and very interventionist solar research programmes will have borne fruit by 2000, contributing to increasing penetration after this date, with possible variations depending on whether it involves decentralized thermal solar energy, decentralized electrical solar energy (small autonomous units), or centralized electrical solar energy, the latter required for significant penetration in the very large-scale electrical generation sector.

Decentralized solar energy (thermal and electric) is widespread in the two alternative scenarios, and serves most of the dispersed dwellings in southern and eastern countries not linked to distribution networks (5-10 % of the total population) ; it is also widely used in agriculture (water pumping, crop drying, etc.), and in small decentralized enterprises that are fairly low energy consumers. This penetration of solar energy in the rural world contributes to solving the fuelwood problem, along with the distribution of LPG (liquified petroleum gas) at the beginning of the period.

Since environmental needs and very large co-operative research programmes foster the production of large-scale photovoltaic solar energy (third generation photocells) it progresses vigorously in the southern and eastern countries, with huge technological and financial backing from the northern countries, but not excluding future energy imports. However, achieving 7 % of 3000 Twh or 10 % of 2000 twh by 2025 requires growth rates in the region of 25 % per year as from 2000, a considerable pace that can only be envisaged in the context of particularly goal-oriented programmes.

IV. RELATIONSHIPS BETWEEN OIL DEVELOPMENT AND THE ENVIRONMENT

Between the crude oil or gas field and the consumer of fuel oil or another other oil or petrochemical product, lies a long chain of operations, which can extend physically over several thousand kilometres, whose main links are prospection/exploration, production, transport, processing, possible further transport, distribution, and end use. Since the products handled are fluid, often inflammabe, sometimes explosive, and of variable toxicity, the risk of loss and/or environmental contamination exists to varying degrees at each step. Much of the amount lost or spilt in coastal regions returns to the sea through infiltration or run-off, and contributes to hydrocarbon-related pollution. However, serious efforts are made to prevent accidents or reduce their consequences, and risks are minimized under normal operating conditions.

Only two significant aspects for the Mediterranean sea and its coastal regions will be examined here : offshore exportation/production and refining. Maritime transport will be reviewed in the chapter on transport.

A. MEDITERRANEAN OFFSHORE EXPLORATION AND PRODUCTION

Offshore oil operations in the Mediterranean are not very extensive, contrary to what might be suggested by a quick look at a map of the concessions granted (involving 115 companies). Depending on the year, a score of mobile drilling rigs are in operation, i.e. 3 % of the total number in the world, compared with 13-14 % in the North Sea. In 1984, for instance, approximately 95 wells were drilled off nine Mediterranean countries (excluding work in the Gulf of Suez in Egypt), more than 60 % of them on the Italian continental shelf. The main areas of activity are the Adriatic, the Ebro shelf, the plateau between Sicily and Tunisia, the Gulf of Gabes, the Nile delta and the Aegean Sea. Offshore oil production was around 5.5 million tonnes in 1984 coming from Spain 42 %, Tunisia 30 % and Greece 28 %.

The three operations that have the greatest potential effect on the environment are exploration, production and removal of extracted oil (for natural gas - non-toxic - operations are somewhat different) :
- Exploration drillings are made from installations (self-elevating, semi-submersible) or drilling ships which use mud during operations. Drilling muds are combinations of inert substances and chemicals such as corrosion inhibitors, biocides, etc. dispersed in water, oil or refined mineral oils, and handled in such a way as to cause no environmental damage under normal conditions. Excavated material can amount to 300 tonnes a day : discharged into the sea beneath the drilling rig, they usually suffocate the demersal organisms living there, and toxic effects are detectable to a distance ranging from 500 metres (water muds) to 3,000 metres (oil muds), depending on the degree of treatment prior to discharge. The most serious risks arise from blowout. These risks are estimated at one blowout for every 500 exploratory wells drilled, and the consequences can vary considerably, from slight and brief to very serious.
- Production. The difference between production and prospection operations is that production installations remain in position (20 to 30 years or more), and there is no drilling mud. One problem arises from the water accompanying the oil, extracted at the same time and reinjected to maintain oilfield presure, or discharged into the sea after treatment on the platform (reduction of oil content to a monthly average of 40 ppm), or conveyed by pipeline to the coast. In addition to oil contamination, this water may contain chemical additives to increase production performances, some of which (biocides, corrosion or oxidation inhibitors) are quite toxic. The risk of blowout still exists, but less than during exploration, estimated at one blowout (with widely varying consequences) per 3,200 well-years. Risk is greatest during maintenance or repairs, after temporary shutdown of production. According to some experts, a well delivering 1,000 tonnes per day produces, under normal conditions, seepage of approximately 100 ppm, i.e. 100 kg of oil per day.
- Removal. This is usually done by pipes to the mainland or by tanker, depending on the size and conditions of the field. With pipelines, the most serious environmental pollution risk arises from the possibility of a small leak which remains undetected for a long time because of safety device tolerance margins, or of pipe breakage caused for instance by a ship's anchor in cases when the originally buried pipe has been uncovered by the erosive action of currents. Risk of accidental leakage is slightly higher during transfer operation when tankers are used for oil removal.

Once production is over, installations have to be removed (under the 1958 convention on the continental shelf, and the United Nations Convention on the Law of the Sea, the clauses of which have been adopted by all Mediterranean countries. Once abandoned, however, no one retains any responsibility for proper maintenance of a pipeline (although the absence of tides and associated currents in the Mediterranean considerably reduces the risk of it being uncovered).

As well as these three operations, and their possible impact on the marine environment, there are associated installations on land for services and management, and the terminal where the oil or gas arrives. These installations are usually located on the coast, are either completely new or based on existing ports, and their size depends on the scale of prospection and exploration operations.

These operations and similar ones concerning minerals are the subject of a draft protocol being reviewed by the Contracting Parties of the Barcelona Convention "Protection of the Mediterranean Sea against pollution resulting from the exploration and exploitation of the sea-bed and its subsoil".

How are prospects likely to evolve in the Mediterranean basin in coming decades, against the background of the economic development scenarios? Three facts have to be taken into account : the geological potential, the international context and national energy and oil development strategies.

As regards geological potential, oil and natural gas have certainly been found on the Mediterranean continental shelf, but in small deposits, and for the moment there is no question of a major oil field. Some experts consider that the particular configuration formed by salt domes represent a deep-sea potential. Since costs increase faster than depth, giant oilfields would have to be found to justify such operations at great depth, very much dependent on technological progress. The possibility of a "Mediterranean Texas" or "Mediterranean North Sea" seems remote, unless a major discovery changes the picture some day. An attractive discovery quickly has a multiplier effect, and can transform a fairly inactive area into a major oil region with a large increase in the number of activities both at sea and on shore.

The international context operates through world oil prices (there are thresholds for technical costs), overall demand for hydrocarbons, the "atmosphere" conducive or not to prospection, and the possibilities of technological co-operation. As regards prices, for instance, the effect of the fall in 1986 was to reduce the number of offshore drilling operations in the world by more than half. National strategies face choices, partly political, on whether to develop and use certain domestic resources or not, and whether to resort to internal financing or open up to international oil companies, etc.

Worse trend scenario T-2 is on the whole quite unfavourable to amplification of prospection efforts in the Mediterranean, even less than reference trend scenario T-1, in which activities continue roughly at present levels, without any significant change in technologies.

Moderate trend scenario T-3 is associated with a significant increase in energy demand in countries in the Mediterranean basin, particularly to the south and east, hence the need to make optimal use of all available energy resources, beginning with oil. In this scenario, Mediterranean offshore exploration expands in the 1990s through the efforts of international companies. Technology continues to advance, mainly in three areas : prospection (where measurements taken during drilling and the use of information technology increasingly reduce the risk of "dry" wells), production equipment installed directly on ever deeper seafloors, served by robots, and all technologies related to gas on sea and land, which are developing continuously and contribute to the increasing penetration of gas.

The alternative scenarios display a higher level of technical and financial co-operation among all coastal countries : many joint enterprises actively explore the Mediterranean, searching for oil and, increasingly, natural gas too, which undergoes spectacular development, based on the most efficient techniques, designed to protect the marine environment. At the peak of activity, 100 to 120 annual drillings could be carried out, both on the continental shelf and in the high seas.

B. REFINING

Refining is an essential link in the oil chain. It is a complex operation culminating in a range of very different products, from LPG to heavy oils and asphalts, and including various fuels and major petrochemical intermediate products (ethylene, propylene, benzene, etc.). Each product requires specific physico-chemical

	1970	1973	1975	1978	1980	1981	1982	1983	1984	1985
SPAIN	34 800	43 700	59 600	76 100	78 100	76 100	76 100	76 100	68 900	64 400
FRANCE	116 500	153 900	169 500	169 040	166 050	158 282	140 970	118 390	109 600	108 800
ITALY	150 200	188 670	200 125	211 600	195 600	196 100	172 200	149 300	145 300	135 800
YUGOSLAVIA	12 500	11 900	12 500	20 200	20 200	20 200	20 200	14 800	14 800	14 800
ALBANIA	1 800		2 100	3 200	3 700	3 700	3 700	3 700	3 700	3 700
GREECE	4 625	7 125		20 470	21 310	21 260	21 020	18 400	19 500	19 500
TURKEY	7 375	14 475		16 830	16 830	18 300	23 280	23 620	23 600	23 600
CYPRUS		600		750	750	800	770	770	770	800
SYRIA	2 950	2 950		11 100	11 100	11 610	11 390	11 390	11 390	11 390
LEBANON	3 000	3 000		2 640	2 590	2 590	2 590	2 590	850	850
ISRAEL	5 600	6 000		9 710	9 460	9 460	9 460	9 460	8 500	8 500
EGYPT	8 500	9 000	9 000	12 500	14 540	14 540	16 960	18 500	18 500	21 200
LIBYA	500	500	3 450	6 500	6 500	6 500	6 500	6 500	15 200	17 000
TUNISIA	1 000	1 000	1 250	1 690	1 690	1 690	1 690	1 690	1 690	1 690
ALGERIA	2 875	5 790	5 790	5 790	21 900	21 900	2 900	21 900	21 900	21 900
MOROCCO	1 650	2 900	3 500	3 590	7 700	7 700	7 700	7 700	7 700	7 700
TOTAL	353 875	451 510	466 815	571 710	578 020	570 732	536 430	484 810	471 900	460 830

Source : C.P.D.P. Oil industry statistics

Table III-16 REFINING CAPACITY (thousands of tonnes)

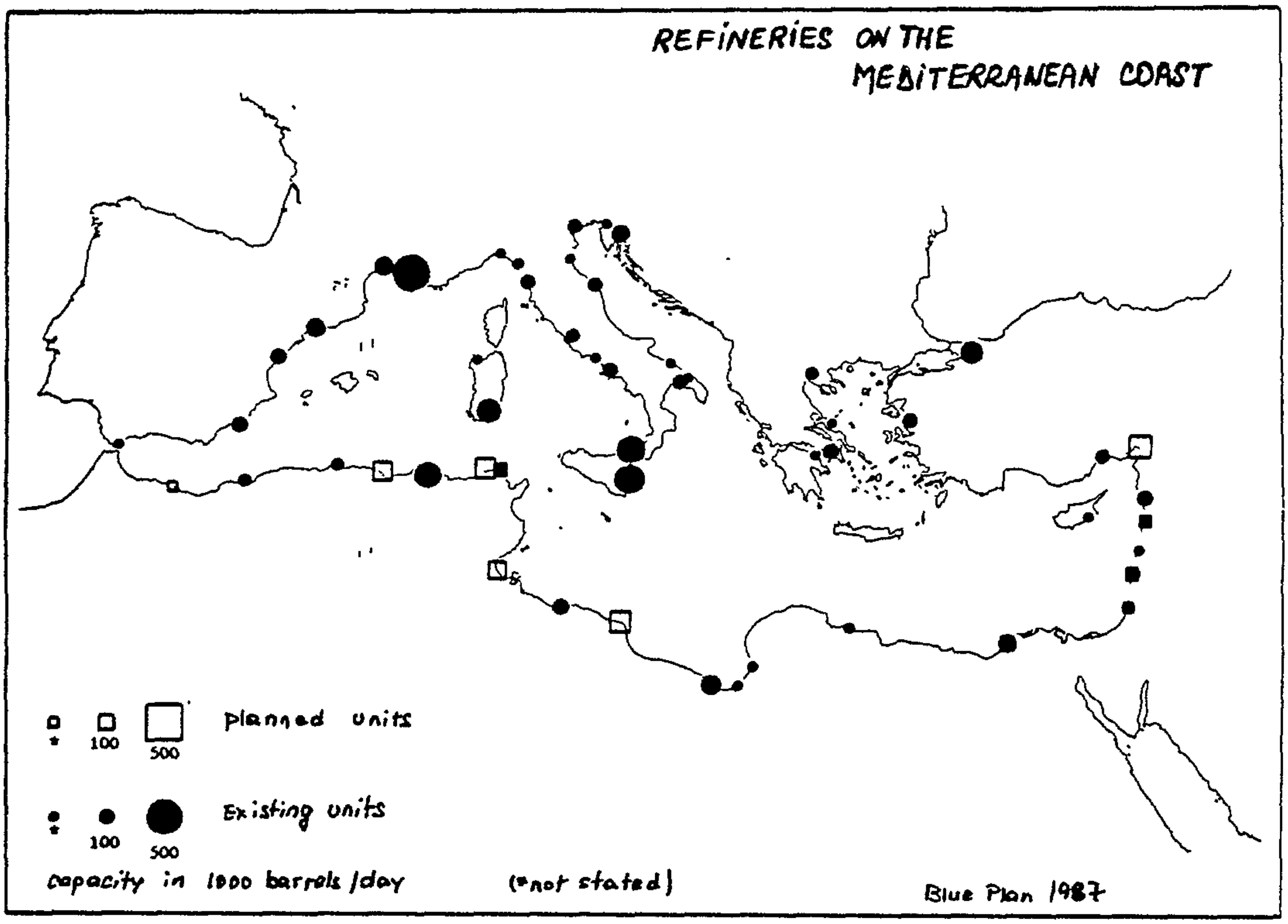


Figure III-6

operations, carried out in industrial plants that can handle millions of tonnes a year and incur the risk of routine or accidental pollution, and of accidents (explosions, fires, toxic substances, etc.).

World refining capacity in 1986 was about 3,650 million tonnes of crude per year, down by about 11 % on the 1980 peak. A little more than 12 %, i.e. 461 million tonnes, was located in Mediterranean countries (Table III-16), down on average by about 20 % on 1980 (43 % drop in France, 38 % in Italy, 18 % in Spain, these three countries still accounting for 67 % of the Mediterranean total). This capacity was well in excess of requirements, since the amount of oil refined was less than 300 million tonnes.

Installed refining capacity on the Mediterranean shoreline was around 280 million tonnes (Figure III-6) also down on what it was in the early 1980s (over 315 million tonnes, but only 220 million tonnes of oil refined). Whereas Italy, France and Spain have reduced their refining capacities, several countries south and east of the basin - Algeria, Turkey and Egypt - have increased theirs. These refineries are usually located on the coast, linked to the arrival of crude oil by sea or the re-dispatch of products (often by inland pipelines in the countries north of the basin).

Existing surplus capacity and the peaking of oil consumption expected for countries north of the basin in the various scenarios suggest that refining capacities should continue to contract at the same time as refining structure changes, with an increase in (expensive) conversion of heavy products into light products, fuels and fillers for petrochemicals.

South and east of the basin, refining capacities are likely to increase considerably and could more than double by the start of the next century, both for domestic market needs and for product exports, gradually replacing crude exports. Much of this increase in capacity will probably be obtained by extending existing plants; the demand for new coastal sites could be confined to a few large complexes (refineries, petrochemicals, harbour dispatching installations, for example, in the event of large offshore discoveries).

Considerable efforts have been made to reduce and/or eliminate environmental impact. According to a CONCAWE survey for instance, the weighted average volume of liquid effluent discharge was reduced by a factor of twenty between 1960 and 1970 (from 6.37 % to 0.38 % cubic metres per tonne of crude processed) in European refineries, and their weighted average hydrocarbon content was reduced by a factor of sixty in the same period (from 56 to 0.92 % kg of hydrocarbon effluent per 1000 tonnes of crude processed). In addition to hydrocarbons, waste water contains oils and fats, phenols, ammonia, dissolved or suspended solids, sulphur, chromium, etc. and may be acid or basic; after treatment effluent contains only very low concentrations of these various pollutants.

UNEP estimated (1975) that the 60 refineries located on the Mediterranean coast discharge about 20,000 tonnes of oil per year into the sea. This figure has no doubt to be consequently scaled down, since the discharges were usually linked to old refineries with high water consumption and no advanced effluent treatment.

Even though there is no such thing as a "typical refinery", since plants differ in scale, crudes processed, their sulphur content, processes used, and the specific processing units installed depending on the required product range, UNEP provides the following scales for atmospheric effluents per million tonnes of crude processed: 820 tonnes of sulphur oxide, 700 tonnes of nitrogen oxide, 170 tonnes of carbon monoxide, 1200

COUNTRY	Bituminous coal (MT)	Lignite (MT)	Equivalent (M Toe)	Difference 1986/1985
SPAIN	15.9	23.7	17.8	+12.6 %
FRANCE	14.4	1.9	10.2	-15.7 %
ITALY		2	0.3	-
YUGOSLAVIA	1.4	68.1	20.8	+35.9 %
GREECE		35.9	4.9	+39.4 %
TURKEY	3.5	33.5	14.0	+94.4 %

Source : Blue Plan statistics

Table III-17 DOMESTIC COAL PRODUCTION IN THE NORTHERN MEDITERRANEAN COUNTRIES, 1986

COAL IN SPAIN

Spain possesses anthracite reserve, mainly in the north and black and brown lignite (these can be excavated in opencast mines). Coal output supplies 24 % of primary energy production and 65 % is used to generate electricity (40 % of electricity is generated from local or imported coal). Ash contents are usually quite high, between 30 and 50 % and will reportedly increase further with mechanized underground mining, raising serious problems for washing operations, which losses their effectiveness ; this is one of the factors encouraging research into new methods of use.

To replace or increase present electricity capacities of nearly 11,000 MWe, it is estimated that between 600 and 1,000 MWe of coal fired generating capacity (part of which will have to used coal imports) need to be installed each year from 1995 to 2020.

A major study programme has been launched, concerned among other things with the possibilities of using various fluidized-bed combustion process (circulation of hig-pressure). There are plans to turn an old conventional power station, an Escatron, in Teruel, into a testing station for these fluidized bed processes.

(Source : 1986 World Energy Conference)

tonnes of organic substances, 90 tonnes of ammonia and 100 tonnes of dust (figures based on a 200 million tonne per year refinery).

Site coverage may vary between 1.5 and 35 hectares per million tonnes of crude processed ; these figures could be twice as much if safety zones are taken into account. Water requirements vary between 100 and 2000 cubic metres per million tonnes of crude processed, as equipment cooling is usually carried out in closed circuits.

V. ELECTRICITY GENERATION AND THE ENVIRONMENT

In the Mediterranean basin electricity is generated from a wide variety of sources : chiefly coal, oil, gas, nuclear, hydraulic and geothermal. Several quite different processes can be used with the same power source : steam turbine, gas turbine, combined cycle, etc. With the same process, the degree of concern for environmental protection and pollution control can range from a minimum to the adoption of the most sophisticated techniques (dedusting, smoke treatment, etc.), which are currently in full development. This illustrates the difficulty of any prospective study on the environment over 15, and even more 40, years. Work has therefore to be confined to drawing attention to some trends, identifying possible major changes, and reflecting on a few figures.

The two main sources of electricity generation in the Mediterranean basin are :
- coal, often replaced by fuel oil (especially in non-producer countries), but which is making a "comeback" because, among other factors, of its low price compared to fuel oil (less true since 1986) ;
- fuel oil, which has considerably declined since the oil price increases in the 1970s ;
- natural gas, still little used except in two countries (Algeria and Italy), but which could be considerably developed (envisaged among other things in the alternative scenarios) ;
- nuclear energy, concentrated in a few countries for the moment, but an option which remains open after 2000 ;
- hydraulic power, which still has development potential in some countries.

The accent here would be on thermal generation in particular, on the basis of coal or uranium.

A. COAL

All scenarios foresee the continued expansion of electricity in many countries, based partly on coal, at least up to 2000, a trend which will grow stronger after 2000 in the trend scenarios (competing with nuclear energy in some countries), and give way to other sources (natural gas and renewable energies) in the alternative scenarios. Coal requirements for electricity generation add to industrial needs (the iron and steel industry in particular, cement works, etc.). As Mediterranean total coal production capacity is lower than demand, part of the coal consumed will have to be imported, entailing the development of specialized infrastructure.

Domestic production of most coal producing countries in the Mediterranean (except France) are increasing and should continue to grow during the coming decades. But as indicated in Table III-17, this usually involves medium- or low-grade coal (lignite), with high ash or humidity content, sometimes produced in open-cast mines that may have a serious impact on the landscape (before possible rehabilitation when seams are exhausted), and on groundwater resources (the case of Greece for example).

LIGNITE IN YUGOSLAVIA

With hydroelectric power, Yugoslav lignite reserves are one of the country's main resources. Deposits, which slope slightly, vary in thickness from a few metres to a hundred metres, so that opencast mining is possible, using powerfull machinery. Present techniques produce approximately 19 millions tonnes a year of lignite containing up to 54 % humidity, high ash content, only about 0.6 % sulfur, and with low heating capacity (6.3 to 11.3 MJ/kg). Future opencast mines could produce between 15 and 30 million tonnes per annum.

More than 86 % of present output is used in thermal power stations, and the rest, from the Kossovo. basin, is gasified (producing 450 million Nm^3town gas, using the Lurgi process), or dried (Fleisner process) for domestic use.

At the end of 1985, 40 turbines had a total installed capcity of 7,670 MWe. 52 % of these were 200 to 300 MWe turbines, but they comprised 74 % of capacity. Some 2,500 MWe extra capacity was under construction using 350 to 614 MWe units. These were to be fitted with anti-pollution devices, to meet the requirement of an average 0.15 mg SO_2 per cubic metre (peaking to 0.5 mg SO_2 per cubic metre per hour). Electric filters, with a smoke dedusting efficiency of 99.5 to 99.8 % are already being manufactured in the country.

(Source : 1986 World Energy Conference)

Coal can be imported either to each power plant, or at the national level, possibly through one or more break-bulk ports carefully sited on the Mediterranean (projects in Turkey, Malta, etc.). This solution would encourage the use of large bulk carriers (200,000 tonnes or more compared with 50,000 - 150,000 tonnes today). After 2000, within the context of the trend scenarios, tonnages of coal carried by shipping in the Mediterranean could gradually exceed those of oil. Coaldust emitted during various handling operations and storage is estimated at approximately 1 per thousand of the tonnage shipped.

Coal-fired power stations are at present the major source of atmospheric pollution : CO_2, SOx, NOx, CO, hydrocarbons, dust, trace heavy metals, radon, etc. They also produce large amounts of polluted liquid effluent (sulphuric acid, organic matter, chlorides, phosphates, borons, etc.), and solid waste, ash and recovered flying ash. Considerable efforts are now being made in the United States, the United Kingdom, Sweden and also in Spain, Yugoslavia, Turkey and elsewhere to reduce such pollution, and develop "clean" ways of turning coal into electricity.

A certain degree of priority has been given to dedusting, to the reduction of sulphur emissions, and now to the problem of nitrogen oxides (the largest second source of pollution after the automobile). Regardless of the preference for low-sulphur coal, processes can be divided according to whether they aim at :
- cleaning coal before use ;
- dispersing gaseous affluent in high chimneys (in the region of 200 metres), a sulphur-reduction method now considered outdated (Stockholm Conference in 1982 on acidification of the environment) ;
- desulphurizing flue gases, with the transfer of sulphur into another medium to remove it (over 100 processes known today using dry or wet methods). The wet processes, requiring large amounts of water, may pose problems in countries where this is scarce, as in the south and east of the Mediterranean. In addition, the annual production of sludge (about 100,000 cubic metres for a 600 MWe power plant), without lime treatment, may be unacceptable in densely populated regions ;
- eliminating nitrogen oxides

Dust and particle elimination techniques are at present fairly well mastered (except perhaps for the problem of micrometric dust), with the use of four processes : cyclone separators, hydraulic dedusters, electrostatic precipitators (yields over 99.5 %, even 99.9 %), and bag filter devices.

The most promising processes are based on either fluidized bed combustion, in which sulphur compounds are fixed by lime, or prior gasification of coal.

The main problem is related to the production of solid waste deriving from the extraction and use of coal, especially in densely populated regions. The extent of the problem can be grasped by observing that the European coal industry produced 205 million tonnes of solid waste in 1980, of which 170 million tonnes of coal residue and 35 million tonnes of ash, compared to 90 million tonnes of urban waste.

It is possible that "clean" processes will gradually be marketed during the 1990s. The future of coal for electrical generation may even depend on it to some extent. OECD experts currently estimate that these processes increase the investment for a coal-fired thermal power station by 15-20 %, and the price of the kwh generated by 20-25 %. These costs are high, and give rise to hypotheses or different choices in the light of the various scenarios.

If depolluting processes are not developed, 12.5 million tons of SOx, 3 million tonnes of NOx, 900 tonnes of dust and 46,000 tons of hydrocarbons would be released every year into the Mediterranean skies, if 1,000 TWh of the 2000-3000 TWh of electricity consumed in 2025, within the context of the scenarios, were to be generated by present-type power stations. Whatever the case may be, 1,100 to 1,300 million tonnes of CO_2 will be released into the atmosphere every year.

Figures would be somewhat different for oil-fired stations, but without changing orders of magnitude ; they would be much less for natural gas, which is a major argument for its increased use.

B. NUCLEAR ENERGY

Of all the uses envisaged for nuclear energy when it was first developed (from seawater desalinization to "peaceful" explosions to build canals or increasing hydrocarbon production from low permeability formations), only electrical generation has become a reality, and on a large scale : some 60 plants in the Mediterranean countries (about half on the Mediterranean coast and in its watershed), equal to an installed capacity of about 50,000 MWe, out of a world total of 380 plants and 280,000 MWe.

The nuclear cycle, from uranium in the soil to the end consumer of electricity is, like oil, rather complex : mining of uranium and ore processing (often low grade, hence considerable amounts of solid waste), enrichment in isotope 235, manufacture of fuel assemblies, reactor operation and, depending on the case, very long-term storage of the spent fuel or, in the event of recycling, radio-chemical reprocessing, reconditioning of the fuel and storage of waste. Such a cycle involves risks of pollution and/or accidents of two kinds : "conventional" (and safety performances are in most cases among the highest in all branches of industry), and radioactive. In normal operation, radioactive pollution at each stage of the cycle is below - often well below - the very strict standards laid down. In fact, nuclear energy can be given as an example of an industry that has endeavoured to incorporate all environmental contraints into its development (whether public opinion considers this to be sufficient or not is another matter).

There is still the question of accidents, the most serious of which can involve (in order) : reactors, reprocessing plants, carriage of radioactive material, and storage facilities. the most serious accidents fall under a new category of accidents with very low probability (even infinitesimal but not completely nil) and large-scale potential consequences, comparable to some extent to natural disasters. As regards very long-term storage of radioactive waste, technical solutions have been proposed, but have not yet been adopted on an industrial or market scale, or as a definitive solution.

Nuclear electric power plants produce the largest amount of solid radioactive waste compared to other stages of the nuclear cycle. There are two kinds :
- so-called "process" waste linked to operations, such as filters and traps, mainly ion-exchange resins, by far the most active and perhaps containing caesium (which means planning for a 300-year storage period, i.e. six times its half-life). Resin radioactivity varies considerably depending on the circuit in which the resins are used, between 800 curies and a few tenths of a curie per cubic metre. In volume resins amount to only 8 % of waste, but 80 % of radioactivity ;
- so-called "technological" waste, deriving from maintenance work, which can usually be compacted to some extent ; radioactivity is in the region of 0.04 curies per cubic metre, rising to 0.2 curies per cubic metre after compacting in 200 litre drums.

Average waste production for a 900 MWe plant with a pressurized water reactor is estimated at 173 cubic metres (volume) and 1150 curies (radioactivity).

Scenario hypotheses assume a total of about 100 nuclear plants of 1000 MWe on average in worse trend scenario T-2, and 150 plants in the moderate trend scenario T-3 with strong economic and energy growth (125 or so 1000 MWe plants in the intermediate trend scenario T-1) for all the Mediterranean countries. About half these plants are on the coast. The amount of uranium required has been estimated at 21,000 tonnes per year (intermediate case), i.e. the equivalent of 57 % of world production in 1986, equal for instance to 28 million tonnes of 0.1 % U3O8 uranium oxide ore, which means considerable extraction activity. Without reprocessing, 3,000 tons a year of spent uranium - containing 27 tons of plutonium - will have to be stored. Reprocessing of the spent fuel would produce some 350 million curies a year of long-life fission products (figures taken from UNEP).

A simple exercise would be to assume that all electrical power stations commissioned from 2000 would be nuclear in order to estimate the pressure on uranium resources, the number of plants needed, total amount of radioactive waste produced, etc. ; this means roughly tripling the above figure.

In contrast, a "Swedish" solution (freeze on nuclear energy and no replacement of decommissioned stations) was also explored, in order to assess possible impacts on other sources, including coal, oil, gas and renewable energies. For instance, if coal had to meet the requirements of virtually all electrical generation in reference scenario T-1 in 2025, consumption (excluding industrial and/or household needs) would be close to 1,000 million tonnes. This is another way of looking at the acute problem of electricity growth in the Mediterranean basin.

C. RENEWABLE ENERGIES

Observations will be confined to a few comments on the environmental impact of renewable energies, as their stage of development - hence acquired experience - cannot be compared with that of the two previous energy sources, and is insufficient for accurate estimates in the case of significant use.

Hydraulic power Some countries like Yugoslavia, Greece and Turkey still have a large potential for hydraulic installations, which has been taken into account in the scenarios. Dam construction could lead to the flooding of agricultural land, sometimes even entire villages ; it also disturbs the migration and reproduction cycles of some fish species, may further increase soil erosion, and may cause the erosion of beaches through sediment retention ; finally, it deteriorates the quality of water in the reservoirs.
As regards accidents, a bursting dam is also a low-probability hazard, but with disastrous consequences. With "small-scale" hydraulic power generation based on the installation of micro power-stations, a careful comparison should be made between the low amounts of electricity generated on the one hand, and the risk of site alteration and impact on wildlife and plant life on the other. Ecologist have often stressed - even as regards to climate - the disadvantages of a series of micro power-stations.

Solar energy A distinction has to be made between :
- passive solar energy : its nuisances are more aesthetic than otherwise ;
- active solar energy : occasionally some risk of leakage and/or of the fluid used catching fire (especially in industrial installations) ;

Type of unit	Open circuit cooling Consumption 1/kWh	Open circuit cooling Evaporation 1/kWh	Closed circuit cooling Consumption 1/kWh	Closed circuit cooling Evaporation 1/kWh
Classic 600 MW	145	1.00	10 to 20 without purifying	1.35
Nuclear 900 MW	165	1.55	3 with purifying	2.10

Source : EDF

Table III-18 AVERAGE SPECIFIC WATER CONSUMPTION OF POWER STATIONS

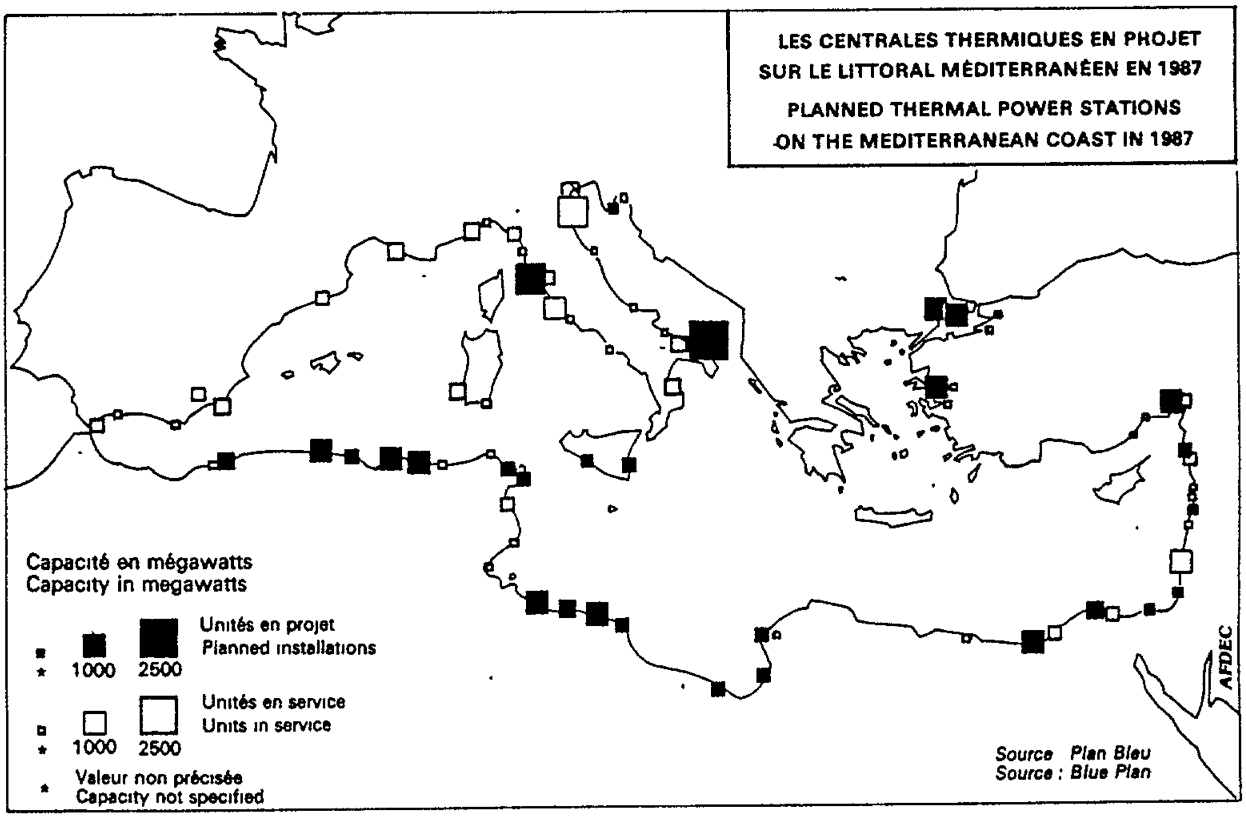


Figure III-7

- thermal solar electricity (types of power station at Adeillo, Targassonne and Corsica in France, Almeria in Spain and other installations in Italy, Turkey, Israel, etc.). One feature is the extent of the area needed to collect sunrays, which could have an impact on the biotope or the local micro-climate. Hazards may be related to the high-temperature fluids used (pressure, temperature, toxicity). Water requirements for the conventional thermo-dynamic cycle may also cause problems in the countries south and east of the Mediterranean basin ;
- photovoltaic solar electricity : it seems to be the most promising process for fairly large-scale use and it would also have fewer environmental impacts, although these are difficult to assess at present because of lack of experience on a large scale and over a long period.

In the scenarios, a comparison was made for example for Egypt, between six 1000 MWe nuclear power stations in 2025, and "solar ponds" (a technology now available, and attractive for its integrated storage system, enabling electricity to be produced as and when needed, not only during strong sunshine, though unfortunately with low output). To produce the same annual amount of electricity, a solar pond of about 2,250 sq km would be needed, roughly half the size of Lake Nasser at the Aswan Dam. The use of photovoltaic cells could reduce this area by a factor of 2 to 5. As regards domestic use, and even if the overall figure is not very meaningful, solar energy offers clear advantages, particularly for areas of scattered dwellings, not connected or poorly connected to the electrical distribution network.

<u>Wind energy</u> This energy source is a very attractive proposition for small islands. It is already widely used for pumping in Sicily, in the Balearic islands, etc. Nuisances are essentially related to noise, in necessarily exposed (and windy) sites, especially for major installations. Rotor disintegration, or loss of part of the airscrew, may also be a hazard.

D. IMPACTS ON WATER AND SITES

As regards thermal power stations (conventional or nuclear), there should be no confusion between water consumed by evaporation and water removed, to be restored to the cold source (at a temperature some ten degrees higher), since they vary considerably, depending on the method of cooling used, as shown in Table III-18.

Application of these coefficients to the conditions of reference trend scenario T-1, for countries south and east of the basin (from Morocco to Turkey, where development of electricity generation will be greatest, comparatively speaking, but where water resources are scarce), in the case of open-circuit power station cooling, suggests that removals in 2025 will be in the region of 120,000 million cubic metres per annum, slightly more than 100 million of which will evaporate ; with closed-circuit cooling (towers), removals will be 7-13,000 million cubic metres per annum, nearly 15,000 million of which will evaporate.

Comparison of these figures with the amounts of water potentially available on the one hand, and with the requirements of other sectors, but also with the geographical distribution of populations (coastal urbanization) and industrial and tourist activities on the other, suggests that most electrical power stations south and east of the basin (only Turkey, and Egypt to some extent, possess a certain margin for manoeuvre) will be established on the Mediterranean coast, already the case for most existing power plants (Figure III-7).

Incidentally, in the general case, of coal-fired stations, north or south, they are located either on coalfields or nearby, especially for low-grade coal which is difficult to transport, or near the point of import by sea, i.e. on the coast.

Although a number of existing sites will be extended to house more powerful plants (several units per site), the problem of choosing sites will become increasingly difficult, and have many impacts on the coast and the Mediterranean environment, since the average surface area of a thermal power station can range from 50 to 150 hectares.

The average temperature increase for the Mediterranean as a whole is equal to about 2000 to 3000 thermal Twh for 1000 to 15000 electric Twh, which would naturally be negligible. However, the effect could be significant at a regional level : on some sections of coast, up to 2-3 m offshore, the sea could be heated by 1-2^{o}, with possible repercussions on fish reproduction and nurseries.

In addition, in order to prevent the attachment of organisms (such as mussels) inside the cooling-water circuit, chlorine (stored in a liquid form) or bleach has to be continuously injected into the discharge circuits during certain periods of the year. To avoid cumbersome transport and storage, hypochlorite can also be produced through electrolysis of sea water (a process systematically used in France for nuclear power stations). The optimal injection rate can only be established on a site-by-site basis after in situ studies lasting a year or two. The amount of organic and ammonia components in the sea water is in fact a predominant factor. The optimum solution is attained when the risk of plancton and micro-organism mortality is minimized while complying with set objectives.

E. CLIMATIC IMPACTS OF ENERGY

The climatic impacts of energy production and use may be felt at various levels. They may be local (altering microclimates, smogs), regional (acid rain, heat releases), or global ("greenhouse effect" of flue gas). As energy production and consumption increase, some of these effects may shift to another level. In addition, at each of the levels considered, environmental effects can produce feed-backs, usually negative, on development (effects of acid rain for instance on plant cover, and thereby on the water cycle, or on soil composition and micro-fauna, and thereby on its fertility).

As for the possible effects of heating-up of the world climate by the greenhouse effect, because of CO_2, other industrial gases, whose importance are increasingly recognized (such as freon), or methane, whose origin is till not completely understood, the Mediterranean basin will of course be only a modest contributor. The repercussions felt in the region could, on the contrary be considerable, and a study on the matter was initiated by UNEP at the beginning of 1987. First among these effects would be a rise in the ocean level, whose consequences on the Mediterranean are examined in the chapter on the coast.

At the Villach Conference in October 1985, it was estimated that other impacts had probably been considerably underestimated. As regards the Mediterranean basin, other risks exist :
- spread northwards of zones with irregular and unpredictable rainfall, with impact on agricultural productivity (drought does not depend only an annual rainfall, but also on its frequency and volume, the level of evapotranspiration, and the moisture-retaining capacity of the soil) ;
- lower rates of production of organic matter and changes in water/salt balances in soils (increased salinization of coastal aquifers due to the rise in sea level) ;

- silting-up (through increased soil erosion) and reduction in the flow and/or level of certain water courses ;
- increase in forest fires, because of drought ;
- radical ecological changes in coastal aquatic systems (ponds, lagoons, etc.).

Confirmation of the hypotheses of a heating up of the world climate because of the greenhouse effect due to CO_2 could lead to reassessment of the conditions in which fossil fuels are used, and to restrictions or ceilings on their use. Along these lines, it should be recalled that the ratios among the amounts of CO_2 emitted are in principle 75 : 65 : 43, depending on whether coal, oil or natural gas is used. This could be a major additional argument in favour of natural gas, helping to gain several decades in tackling the problem, considerations which partly led to the strongly "gas-oriented" hypotheses in the alternative scenarios. But it could also put forward an argument in favour of a nuclear "comeback", which the scenario also explores.

VI. CONCLUSIONS AND ISSUES FOR APPRAISAL

It should be stressed that the exercise does not involve forecasting, nor even all possible futures, but an exploration of contrasting situations from which conclusions can nevertheless be drawn and a number of queries raised.

At a constant per capita consumption level, with no appreciable improvement in standards of living, the mere population effect leads to an overall Mediterranean consumption of between 800 and 900 million toe in 2025 (compared to 600 million in 1985). These are roughly the values of the worst trend scenario T-2. Any improvement in standards of living is reflected by overall higher consumption levels for the Mediterranean basin as a whole. In any event, fairly significant amounts are involved, which raises many questions.

One of the first is to know at what point could "energy-savings margins" in some countries facilitate stronger growth in others. In fact the European countries of the Mediterranean can not be compared to the north European countries or other major industrialized countries. So this is no more than a contribution,

The inertia of behaviour, and durability of installations and processes have led to hydrocarbons being attributed a continuing role in the scenarios, while stressing some of their special features in the Mediterranean basin. As regards oil in particular, rather than analysing annual consumption levels, it is perhaps more important to examine cumulated consumption between 1985 and 2025 : 13-16,000 million tonnes, compared with 5,000 million tonnes of current reserves in the Mediterranean coiuntries, and their 2-6,000 million tons of potential resources. This will give rise to an acute supply problem considering the difficultles of finding a substittue for this energy source. During the first quarter of the next century the world will without doubt pass through a true "energy transition" period, but it is very difficult to envisage what it will be like : this is the second question mark.

Will coal prevail? On the one hand it would be hazardous to extrapolate on the basis of the current favourable situation of plentiful cheap low-sulphur coal ; knowledge of reserves and resources is in fact insufficient to make a valid estimate of potential over half a century. On the other hand, environmental problems (including that of CO_2) cast a shadow over the medium- and long-term future.

Hence the possible interest of natural gas.

The central problem of electricity consumption and generation remains. Considering the levels anticipated, the question of which energy sources will be used is a major one. Bearing in mind construction time (five to ten years) and the life-span of installations (30-40 years or more), this indeed calls for a 50-year prospective view. No doubt all possible sources without any exception will be resorted to for several decades yet. But what happens aferwards?

As regards environmental impacts, paradoxically and making due allowances, the less energy available the less efficiently it is used : poor output from installations, often accompanied by strong impacts. The example of fuelwood is well known : output/consumption ratio of a few percentage points, smoke emissions, and forest degradation as a result of overexploitation (this subject is examined further on).

The scenarios and the study on water availability indicate that power station cooling requirements will increasingly lead to the location of these plants on the coast in the southern and eastern countries. At the anticipated production level, it would not be easy to install some 200 thermal power stations (average size 600 MWe) on a 400 m strip of coast suitable for development (and highly desirable), and calls for the integrated planning of all national coastlines.

Finally, the disturbance of biophysical processes caused by the cumulative effects of energy consumption could be a more serious treat for the well-being - even long-term survival - of mankind than the direct toxic effect of effluent.

It is therefore clear that meeting long- and medium-term energy needs in the Mediterranean basin will require the mobilization of all efforts :

- financial. Some studies (IIASA) have shown that in the next decades the industrialized countries will have to devote between 2-3 % of their GDP (direct and indirect investments) to their energy system, as new techniques (nuclear, offshore drilling, deep gas, non-conventional oil, "clean" fossil-fuel electricity generation, renewable energy) are increasingly capital intensive. In the case of the less industrialized countries, about 6-7 % of GDP will be devoted to energy development ;
- institutional and organizational, to deploy the resources for a kind of development which, irrespective of the processes chosen, can only be on a large scale ;
- finally, technological. Advances since the end of the Second World War have indeed been spectacular, but the possibilities for progress and innovation remain widely open.

CHAPTER III.4

THE FUTURES OF TOURISM

The first part of this chapter reviews the past and current situation of tourism in the Mediterranean basin.: the development of international tourism has made this region into the world's leading tourist area and domestic tourism is constantly evolving ; both are concentrated largely on the coast. Section I also analyses the economic impacts of tourism, and suggests a classification of tourists in order to help understand the impact of this activity on the Mediterranean environment.

The study revealed that all the Mediterranean countries were envisaging the development of their tourist activities. Section II examines growth potential up to 2000 in the context of the macro-economic development scenarios, while Section III extends this analysis up to 2025, making the simplification required by this more distant horizon.

Whatever the scenario, tourist "pressure" is likely to be increasingly strong, chiefly on the Mediterranean coast. Will tourism know how to treat the environment, considering that harmony with surroundings is vital for tourist development? This aspect is studied in Section IV, by analysing in turn site coverage and use of the coastline, water consumption, and physical and socio-cultural pressures. This section concludes with a semi-quantitative consideration of the medium- and long-term tourist potential of Mediterranean countries. Finally, Section V draws a number of conclusions from the scenarios, and pinpoints some of the issues that may occur to Mediterranean officials and decision-makers.

PAYS	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPAIN	15.320	17.330	20.430	22.000	19.400	19.800	18.500	21.000	24.600	24.000	22.500	23.800	25.300	25.583	27.100
FRANCE	18.130	19.280	21.520	23.510	23.580	25.710	26.960	26.265	26.846	28.763	30.100	31.340	33.467	34.018	34.812
ITALY	14.188	14.418	15.111	14.670	14.200	15.500	16.505	18.500	19.193	21.918	22.087	20.036	22.297	22.140	22.855*
MONACO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MALTA	171	179	150	211	273	335	340	362	478	618	729	706	511	491	480
YUGOSLAVIA	4.749	5.243	5.142	6.149	5.454	5.834	5.572	6.116	6.387	5.966	6.410	6.616	5.955	5.947	7.224
ALBANIA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GREECE	1.407	1.981	2.436	2.846	1.956	2.840	3.672	3.961	4.532	5.233	4.796	5.034	5.033	4.778	5.523
TURKEY	446	494	595	807	387	1.201	1.336	1.268	1.222	1.057	865	997	1.026	1.178	1.533
CYPRUS	127	179	228	264	150	47	180	178	217	297	353	421	547	621	737
STRIA	409	547	429	441	504	678	723	970	823	914	1.204	1.043	831	836	976
LEBANON	900	1.242	1.281	1.070	1.606	1.555	100	122	109	118	118	-	-	-	-
ISAREL	419	618	680	604	570	559	733	894	959	1.009	1.116	1.090	949	1.043	1.095
EGYPT	348	406	528	512	440	730	984	1.004	1.052	1.064	1.253	1.376	1.423	1.498	1.560
LIBYA	77	133	166	258	296	241	145	126	164	118	126	126*	126*	126*	126*
TUNISIA	411	608	780	722	716	1.014	978	1.016	1.142	1.536	1.602	2.151	1.355	1.439	1.580
ALGERIA	236	226	237	250	249	296	185	242	260	266	290	320	280	285	410
MOROCCO	747	823	1.062	1.341	1.205	1.242	1.108	1.428	1.477	1.436	1.425	1.567	1.815	1.877	1.936
MEDITERRANEAN	58.085	63.707	70.785	75.655	70.986	77.582	78.021	83.452	89.459	94.313	94.974	96.683	100.916	101.855	107.947
WORLD	160.000	172.000	182.000	191.000	197.000	214.000	221.000	238.000	256.000	269.000	279.000	288.000	285.000	287.000	312.000

* Estimation
Source Blue Plan

Table III-19 NUMBER OF INTERNATIONAL TOURISTS
(in thousands)

I. PAST AND PRESENT SITUATION

Long reserved for an elite disposing of time and money, tourism in the twentieth century has become a social phenomenon of the industrialized countries, entailing the migration of increasing numbers of holiday-makers each year. The factors which have encouraged the development of mass tourism are chiefly :
- growing urbanization, calling for periodical escape from this particularly restrictive environment ;
- the rise in living standards, meaning that a smaller share of household income is devoted to basic needs and more can be spent on leisure ;
- the development of transport, whether individual (automobile) or collective (trains, aeroplanes, boats) ;
- the social organization of labour, recognizing workers' rights to paid holidays, the reduction of working hours and the increase of free time, etc.

Many features have contributed and still contribute to the tourist attraction of the Mediterranean, in particular : the geographical proximity for tourists from northern Europe, the climate, especially linked to bathing, the beauty of landscapes and natural sites, the exceptionally rich cultural heritage left by the great civilizations of antiquity - the very foundations of the present Western world - and more recent historical ties which have fostered the habit, even created a tradition of interregional and international exchange and travel.

A. DEVELOPMENT OF INTERNATIONAL TOURISM 1970-1984

International tourism involves travellers who cross one or several borders for leisure purposes. Data from countries about tourism are not usually homogeneous, and statistical data from the World Tourist Organization (WTO) have been used as much as possible. WTO provides information communicated to it by national tourist offices in the different countries. A few definitions and units of measurement are given in the box.

The world market grew from 160 million to 312 million international tourists from 1970 to 1984, i.e. an increase of 95 % in 15 years, with an average annual growth rate of 4.88 % (Tables III-19). This last figure masks considerable differences depending on the year :

. during periods of very strong expansion, growth rates reached 8 % (1971, 1977 and 1978) and even 9 % (1975 and 1984) ;
. during period of low growth, the number of tourists increased by only 4 % (1980), 3 % (1974, 1976, 1981) or just 1 % (1983) ;
. in 1982, tourism fell by 1 %.

These figures, for a fifteen-year period in which an economic slow-down and two oil shocks occurred, already elicit two comments :
- the international tourist market varies greatly from one year to another ;
- the need for or habit of tourist travel is such that even major economic difficulties have no lasting effect on the sector.

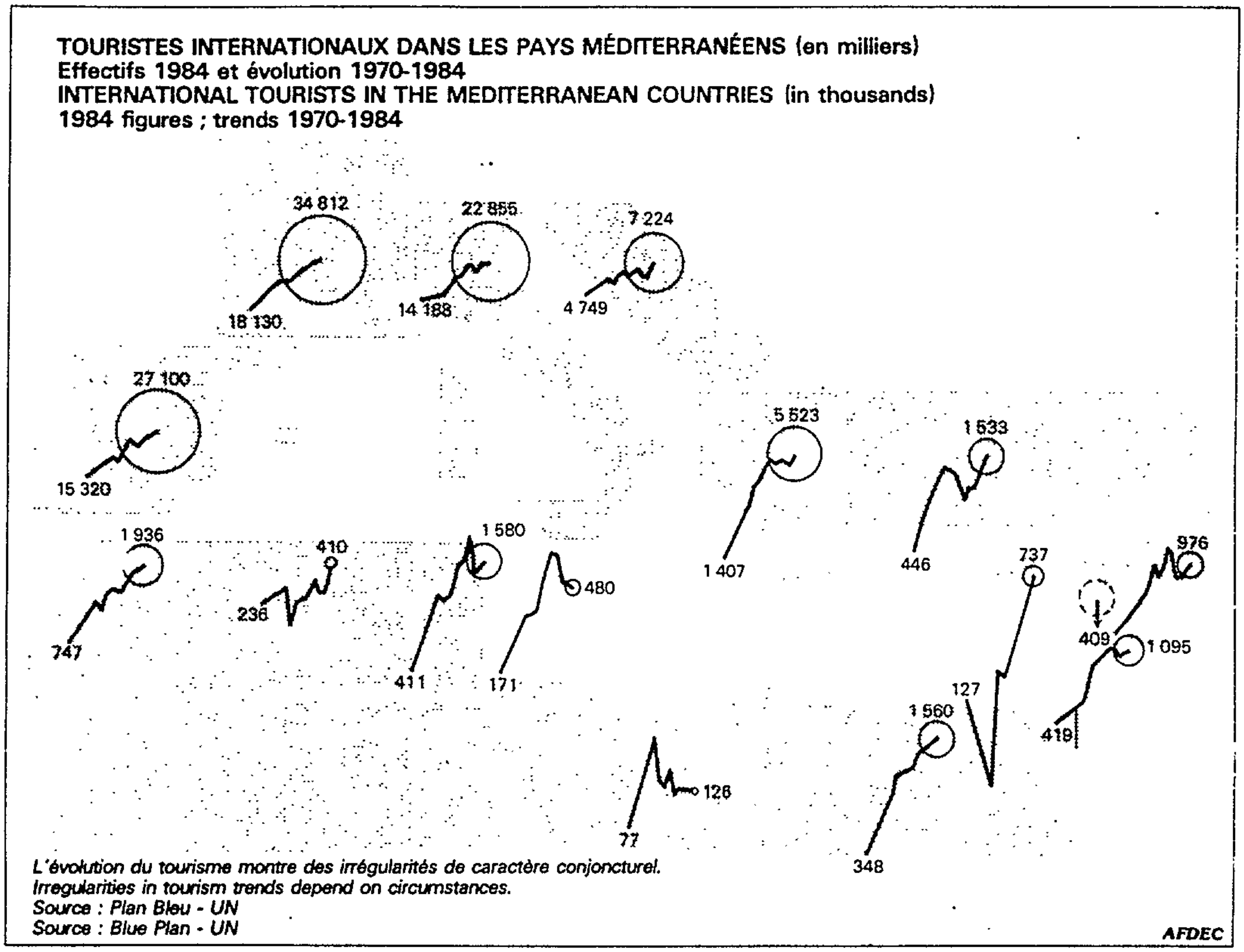


Figure III-8

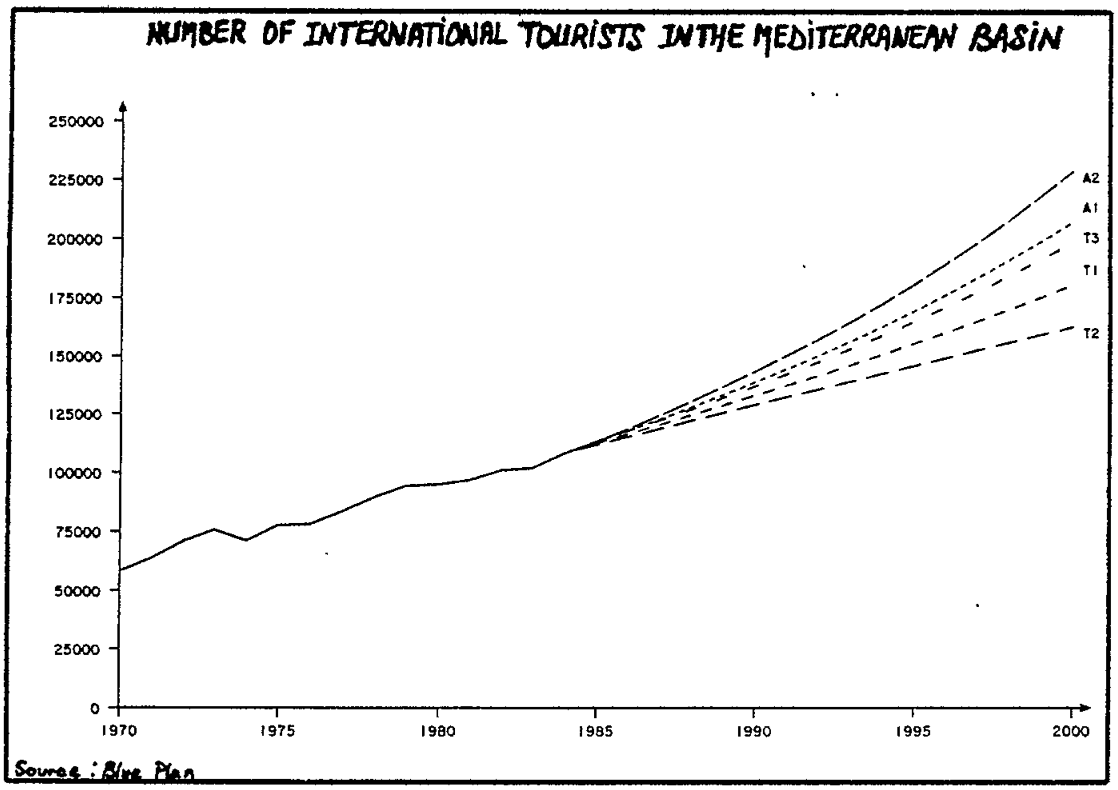


Figure III-9

The countries in the Mediterranean basin, taken globally, accounted for nearly 35 % of the world tourist market in 1984 and it was the leading "tourist basin" in the world. In the fifteen years under review, the share of the coastal states fluctuated between roughly 33.5 % and 39 %.

In numbers of tourists, the Mediterranean market rose from 58 million in 1970 to 107.9 million in 1984, i.e. an annual average growth rate of 4.52 %, slightly lower than that of the world market. Interannual variations were sharper : 11 % increase in 1972, 6.2 % drop in 1974 (whereas the world market rose by 3 %). Fluctuations in the Mediterranean market do not follow those of the world market too clearly.

The country by country analysis (Table III-19 and Figure III-8) of the number of foreign tourists shows, in addition, that between 1970 and 1984 all countries experienced an increase :

. the average annual growth rate was above or equal to 10 % in four countries (Cyprus, Egypt, Greece and Tunisia), denoting very strong expansion for this sector of activity ;
. five countries experienced steady growth in this sector, with an average annual rate ranging between 5 % and 10 % (Turkey, Malta, Israel, Morocco and Syria) ;
. only six countries had a moderate rate of growth for foreign tourism, ranging between 3 % and 4 %). These are either countries which had experienced a period of very strong tourist expansion in the 1960s, (France, Spain, Italy, Yugoslavia), or countries which had no active tourist development policy (Algeria, Libya).

Over the years, some Mediterranean countries went through periods of very sharp acceleration (up to nearly 300 % for Cyprus in 1976) and deceleration, which in no way alters the overall result. It would nevertheless be interesting if these divergences could be expressed in terms of jobs and income in order to form an accurate idea of their possible repercussion on the economy of the country concerned.

In addition to the number of tourists, a guest night is generally regarded as the basic unit of measurement that lends coherence to statistics and analyses of tourist demand. The number of guest nights is also used to measure the average stay per tourist. It is estimated that the 108 million international tourists in 1984 "consumed" approximately 890 million guest nights in hotels and other lodgings in the Mediterranean countries. The length of stay varied between twelve days (Malta) and two days (Syria), the average length being 8.2 days.

Table III-20 provides a structural analysis, by country of origin, of international tourists visiting the Mediterranean countries as a whole for the years 1975, 1980 and 1985. It can be observed that the main country of departure is Germany, that the United Kingdom and the Benelux countries vie for second place, and that the share of France, a country of both departure and destination, is comparatively high. Northern Europe, (Germany, Benelux, the United Kingdom and the Scandinavian countries) account for between 50 % and 60 % of the Mediterranean tourist market.

As regards host countries, the three north-western countries (Spain, France and Italy) receive between 70 % and 80 % of international tourism (this percentage seems to have stabilized recently), followed by Yugoslavia and Greece. The remaining 10 % is shared among all the other countries, some of which, moreover, experienced spectacular growth.

destination / Origin	MEDITERRANEAN COUNTRIES					
	1975 thousand	%	1980 thousand	%	1985 thousand	%
GERMANY	11,595	19	22,753	24	26,687	22.9
BELGIUM	3,297	5.4	7,913	8.3	5,012	4.3
SCANDINAVIAN COUNTRIES	2,949	4.8	3,295	3.4	4,465	3.8
SPAIN	2,691	4.4	3,304	3.5	3,805	3.3
FRANCE	6,924	11.4	8,876	9.4	9,751	8.4
NETHERLANDS	3,319	5.5	6,237	6.6	6,535	5.6
UNITED KINGDOM	6,975	11.4	11,014	11.6	15,524	13.3
ITALY	2,685	4.4	3,248	3.4	6,594	5.6
SWITZERLAND	2,150	3.5	4,543	4.8	6,450	5.5
OTHER EUROPEAN COUNTRIES	5,273	8.6	8,622	9	9,969	8.5
CANADA	624	8	819	6	1,275	8.3
U.S.A.	4,274		4,956		8,368	
OTHER AMERICAN COUNTRIES	821	1.3	1,655	1.7	1,759	1.5
ARABE COUNTRIES	2,550	4.2	3,520	3.7	5,033	4.3
WORLD OTHER COUNTRIES	4,809	7.8	4,019	4.2	5,257	4.5
TOTAL	60,936		94,774		116,484	100

Table III-20 INTERNATIONAL TOURISM FLOW IN THE COUNTRIES OF THE MEDITERRANEAN BASIN (in thousands of tourists and in % of the total)

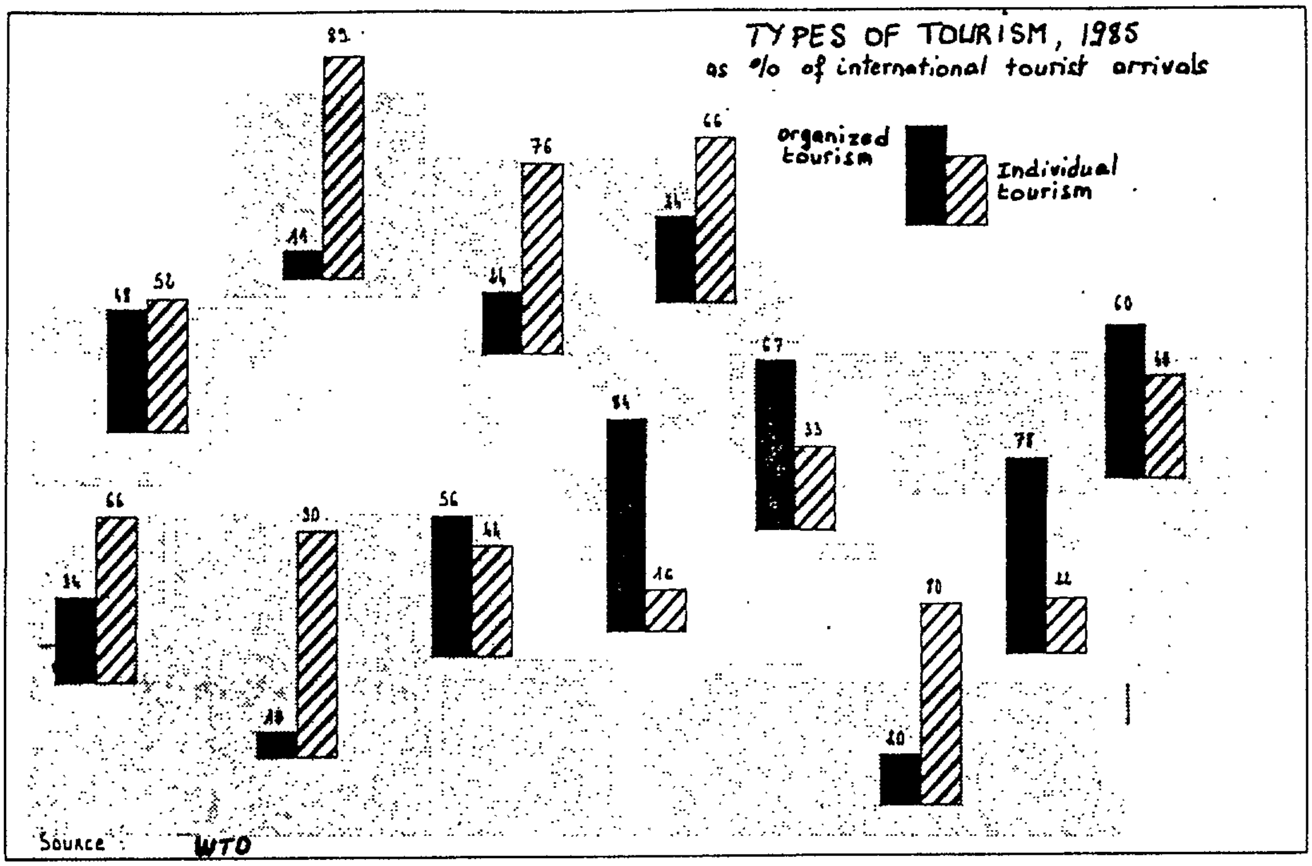
The seasonal nature of tourist frequentation, which poses a very important problem as regards employment, accommodation and effect on the host population, is more or less pronounced, depending on the country, with its impact on investment and management. Apart from Algeria, Israel, Egypt and to a lesser extent Syria, most of the Mediterranean countries are affected by a high concentration of tourist visits during the summer quarter (up to 70 % of international tourists in Yugoslavia, for instance). Furthermore, during the high tourist season, there are peak periods lasting from a few days to one or two weeks, when the inflow is greater and can even exceed total lodging capacity by 20-30 %.

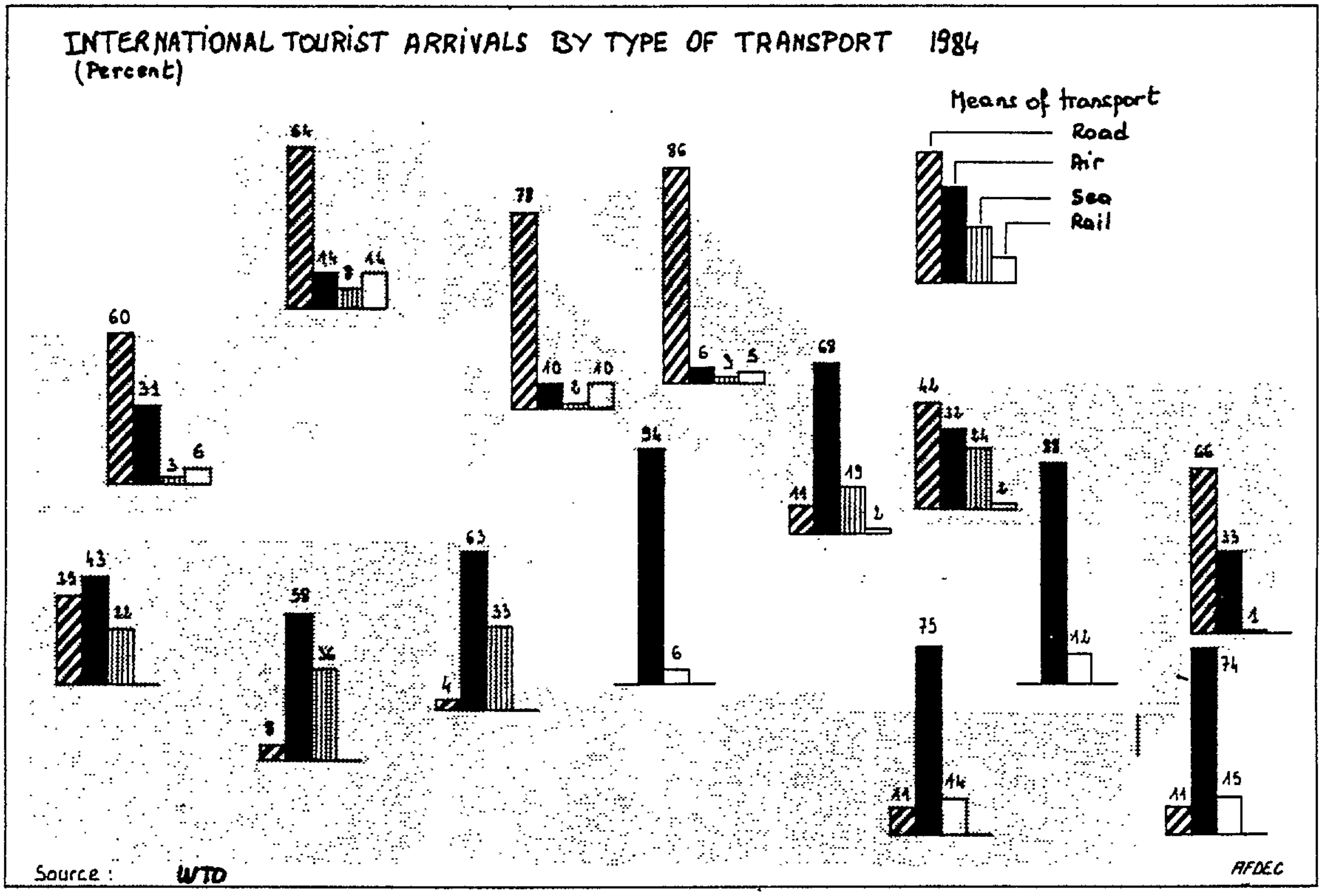
The emergence and development of organized tourism have been both a factor and a cause of the growth in mass tourism, with the introduction, among other things, of all-inclusive rates and the setting-up of dynamic distribution channels. Organized travel currently represents a large portion of international tourist arrivals in some countries : in the region of 80 % for Malta and Cyprus, 67 % for Greece, 50-60 % for Tunisia and Turkey, 48 % for Spain, etc. (1985 figures).

Means of transport / Destination countries	AIR			ROAD			RAIL			SEA		
	1970	1980	1984	1970	1980	1984	1970	1980	1984	1970	1980	1984
SPAIN	22	24	31	63	67	60	8	5	6	7	4	3
FRANCE	9	17	14	-	64	64	-	13	14	6	6	8
ITALY	8	9	10	76	75	78	15	14	10	1	2	2
GREECE	52	62	68	18	16	11	6	3	2	24	19	19
CYPRUS	91	94	88	-	-	-	-	-	-	9	6	12
YUGOSLAVIA	2	5	6	94	86	86	3	6	5	1	3	3
MALTA	94	96	94	-	-	-	-	-	-	6	4	6
ISRAEL	87	81	74	2	8	11	-	-	-	11	11	15
SYRIA	7	25	33	93	72	66	-	-	-	-	3	1
TURKEY	46	24	32	44	35	42	4	8	2	6	33	24
EGYPT	75	79	75	20	13	11	-	-	-	5	8	14
ALGERIA	58	67	58	37	-	6	-	-	-	5	33	36
TUNISIA	77	69	63	16	26	4	-	-	-	7	5	33
MOROCCO	31	46	43	29	30	35	-	-	-	40	24	22

Source : WTO statistics.

Table III-20 bis EVOLUTION OF THE INTERNATIONAL TOURISTS ARRIVALS BY MEAN OF TRANSPORT (in % of total international tourists)


TYPES OF TOURISM, 1985
as % of international tourist arrivals
organized tourism
Individual tourism
Source : WTO


INTERNATIONAL TOURIST ARRIVALS BY TYPE OF TRANSPORT 1984
(Percent)
Means of transport
Road
Air
Sea
Rail
Source : WTO
AFDEC

Finally, changes in transport methods, with the rapid expansion of the private automobile and commercial aviation, have made a decisive impact on international tourism. Table III-20bis indicates the trend, since 1970, in international tourist arrivals in the Mediterranean countries in terms of principal means of transport. Air tourism rose sharply ; growth in recent years has exceeded all expectations and caused the congestion of air corridors, considerable routing delays and the saturation of a number of airports, reproducing the overloading of some major road routes.

B. DOMESTIC TOURISM

As regards data and information, domestic tourism raises more problems than international tourism, and the estimates of national experts have been used when homogeneous data, from the international viewpoint, were unavailable. Thus, in the following analysis, more importance should be given to proportions and rough estimates than to absolute figures.

In 1984, departure rates within national borders for the populations of the various Mediterranean countries ranged from 8 % (Egypt and Turkey according to Blue Plan estimates) to 64 % (France). This rate, or the number of persons travelling at least once compared to the total population (persons travelling several times are only accounted once), depends quite clearly on several factors, such as a country's level of development, per capita income, the importance of the public sector, social measures and benefits, etc. But it also depends on social and cultural factors, as illustrated by Yugoslavia and Israel (approximately 30 % of holiday departures). In some countries, like Algeria and Morocco, holiday travel to family and friends is apparently not taken into account in the data supplied to the Blue Plan, so the number of domestic tourists has probably been systematically underestimated.

The total number of domestic tourists was estimated at 105 million in 1984 for the whole of the Mediterranean countries, and the corresponding guest nights, 2,310 million.

The seasonal nature of domestic tourism is extremely clear in France (73 % of domestic tourism occurs in the summer quarter), Italy (64 %) and Yugoslavia (56 %), with its consequences (congestions, over-equipment, etc.).

Although domestic tourism is particularly hard to delimit, it offers substantial development potential, as only two Mediterranean countries seem to have had a departure rate above 50 % (France and Italy) and half the countries (in the south and east) had rates apparently under 20 %.

C. TOURISM IN THE MEDITERRANEAN COASTAL REGIONS

Efforts were made to calculate the number of domestic and international tourists staying in Mediterranean coastal regions, the proportion of which varies enormously from one country to another. In France, for example, 18 % of international tourism and 19 % of domestic tourism concerns the Mediterranean coast. In Tunisia, both these figures seem to exceed 80 %, whereas in Yugoslavia apparently over 90 % of international tourists take holidays on the coast. The attraction of the Mediterranean coast seems to depend on the geographical origin of the tourists, their motivations and the tourist appeal of the rest of the country.

For 1984, it was estimated that 51 million foreigners and 45 million nationals spent their holidays in Mediterranean coastal regions, equal to about 1,400 million guest nights.

One of the basic features of Mediterranean coastal tourism is its concentration in zones devoted largely or almost solely to tourism, and for the time being there are no signs of either decline or incipient saturation. The Italian and French Rivieras (Liguria and Côte d'Azur) where tourism virtually came into being, are still regions of prime importance. In the past forty years, other coastal regions have joined these precursors and tourism now concerns virtually all Mediterranean countries :

- in Spain, a succession of tourist zones, the Costa Brava, Costa del Sol, Costa Blanca, Costa Dorada and of course the Balearic Islands, the leading Spanish tourist region ;
- in France, the Languedoc-Roussillon coast, which changed into a major and highly structured tourist region in twenty years ;
- in Italy, the Costa Smeralda (Sardinia) and, inter alia, Rimini, virtually the architypal tourist resort ;
- in Yugoslavia, where tourism has spread along the entire coast, with a heavier concentration in Istria near Rijeka, in Dubrovonik and on the Montenegro coast ;
- in Greece, the Athens region and some islands which have become powerful poles of attraction ;
- in Cyprus and Malta, almost entirely devoted to tourist activities ;
- in Turkey, the region of Izmir and Antalaya, and the Bodrum peninsula ;
- in Syria, the Tartus region ;
- in Israel, where all coastal regions unoccupied by industry or ports are intended as leisure areas ;
- in Egypt, Alexandria and the west coast, the country's leading coastal tourist region ;
- in Libya, the region of Tripoli and Cyrenaika ;
- in Tunisia, where Djerba, Nabeul-Hammamet and Monastis rank among the famous tourist destinations ;
- in Algeria, Zeralda, Tipaza and Andaluses, poles of tourist development ;
- finally in Morocco, where (Mediterranean) tourist activity is concentrated in the region of of Saida, Alhoceima, Tetuan and Tangiers-Malabata.

D. THE ECONOMIC IMPACTS OF TOURISM

Tourism plays a sometimes important role in both the balance of payments and employment. In 1984, the contribution of international tourism to GDP averaged 6.5 % in the Mediterranean countries as a whole. This contribution exceeded 10 % in some countries like Israel, Cyprus and Malta, and approached this level in Spain, Italy and Tunisia. It was more modest for heavily industrialzed countries like France, or where development has been fairly recent.

Revenues from tourism covered a considerable part of imports : up to 27 % in Spain, between 10 % and 20 % in Cyprus, Malta, Tunisia, Greece, Israel, Morocco and Italy. In this last case, the tourist balance would offset 80 % of the food deficit or cover one third of hydrocarbon imports. In Morocco, tourism is the second most important source of foreign exchange.

Employment in the tourist sector is particularly hard to pinpoint. According to the findings of a specific model, the share of the labour force working in tourism was over 10 % in Israel, and varied between 6 % and 3 % in countries like Malta, Italy, Spain, Tunisia, Yugoslavia, Greece and even France. Moreover, the large share of the underground economy in the tourist sector should be stressed, unfortunately almost impossible to quantify. Undeclared activities chiefly concern lodgings (furnished rooms or bed and breakfast), some services like catering, small building trades, without forgetting currency exchange in certain countries.

E. QUALITATIVE ASPECTS OF TOURISM : HOLIDAY STYLES

Efforts have been made to arrive at a qualitative distribution of tourists in the Mediterranean, by attempting to pinpoint their favourite activities, usual choice of accommodation and general attitude towards organization of their holiday period. The purpose was to link each kind of tourist to specific impacts on both their natural and their social and cultural environments.

The six "typical portraits" of holiday-makers are those looking for :

- **adventure**, the oldest kind of tourist, who travels for discovery and self-discovery, off the beaten track, but not necessarily outside organized groups;
- **relaxation**, who prefer to stay in a chosen spot rather than visit a region, and seek sun, sea and sand;
- **culture**, who enjoy touring a district or country and give priority to culture in the broad sense (communication, discovery, encounters, learning, etc.);
- **congresses, whose tourism is a matter of meetings, conferences, symposia or incentive travel;**
- **health,** the sporty type of tourist who chooses to stay in a place to practice sport intensively, to follow a course of treatment, or to get back into shape;
- **recreation**, a tourist who comes, goes and also stays in places, but with a spirit of initiative, aware of nature, looking for dynamic, organized activities and entertainment.

A Delphi survey was carried out among Mediterranean experts to test the validity of this approach and to verify assumptions as regards the distribution of holiday-makers for 1985 and possible trends up to 2000 and 2025. The first findings indicated that the proposed distribution for 1985 was, overall, likely, and would be :

	Mediterranean countries	
	in the north(1)	in the south and east(2)
Adventure	10 %	4 %
Relaxation	40 %	80 %
Culture	25 %	8 %
Congresses	1 %	1 %
Health	7 %	2 %
Recreation	17 %	5 %

(1) from Spain to Greece inclusive, plus Israel.
(2) from Turkey to Morocco, excepting Israel.

This distribution gives only a general idea of holiday styles and the societal analysis should be carried out more thoroughly (as in other sectors). It already indicates, nevertheless, that it is necessary and important to reflect on the diversification of supply so as to respond in the best way possible to the different holiday styles adopted.

A few definitions

- Visitor : any person travelling to a country other than the one where he normaly resides, for any reason other than that of exercizing a remunerated profession. This definition covers two categories of visitors : "tourist" and tripper.

- Tourist : temporary visitor spending at least 24 hours in the country visited for purposes of leisure (pleasure, holiday, health, study, religion, sport) and/or business (mission, meeting, family).

- Tripper : temporary visitor spending not more than 24 hours in the country visited.

- Hotel lodgings : hotels, motels, boarding-houses and inns.

- other lodgings : (or extra-hotel) youth hostels, camping sites, children's homes, holiday villages, rented rooms, villas or apartments, spas.

Units of measurement :

- Arrivals : the date refers to the number of arrivals of travellers and not to the number of persons. The same person paying several visits to a particular country over a given period will be counted as a new arrival each time.

- guest nights : the number of nights spent in the different types of lodgings. If two persons travel to a country and stay five nights in that country, this corresponds to ten night's accommodation. These data refer to hotels and assimilated institutions, i.e. hotels motels, boarding-houses and inns, or to accommodation as a whole, hotels and assimilated institutions and other lodgings (camping sites, holiday villas, apartments, etc).

- Average length of stay : this is expressed in number of days or nights.

- receipts from international tourism : these are difined as the receipts a country derives from payments made in currency by foreign tourists for consumer expenses, i.e. goods and service. They do not include receipts from international transport.

- Expenditure of international tourism : this expenditure is defined as consumer expenditure i.e. related to goods and services, incrurred by the persons residing in the country concerned. They do not include payment of international transport costs.

- Number of beds : this refers to the total capacity in beds of the different types of lodgings (hotel and other)(1 bed = 1 person lodged).

Source : W.T.O.

II. TOURISM IN THE SCENARIOS - HORIZON 2000

The prospective study of tourism in the Mediterranean was carried out country by country, then globally, (all Mediterranean countries) for the five Blue Plan scenarios. Findings were sometimes aggregated for four regions :

- "north-west" : Spain, France and Italy;
- "southern Europe" (and assimulated) : Yugoslavia, Greece, Israel, Cyprus and Malta;
- "eastern Mediterranean" : Turkey, Syria, Lebanon and Egypt;
- "Greater Maghreb" : Libya, Tunisia, Algeria and Morocco.

An attempt was also made to identify as far as possible findings concerning the coastal regions of countries bordering the Mediterranean.

Estimated average annual growth rates for the number of tourists vary from 1.45 % to 4.1 % a year depending on the country. It should be stressed that these estimates are comparatively modest compared to the hypotheses selected for other studies for 1990 or 1995, which vary from 4-9 % per year for international tourism.

The overall results by major region are given in Tables III-21 for 2000, III-22 for 2000 and 2025 aggregated, and III-23 for coastal zones. Figure III-9 illustrates the findings for international tourism.

A. THE TREND SCENARIOS

Reference trend scenario T-1, based on the hypothesis of a continuation of the present trend in an unfavourable economic context, shows an imbalance in tourist development for the various Mediterranean countriès, and between international and domestic tourism.

With an average annual growth rate of 2.3 %, this hypothesis gives 308 million tourists in 2000 in the countries as a whole. International tourism increases faster (3.3 % per year) than domestic tourism (1.17 %). In addition, this economic context does not permit improving the balance of international tourism among the different regions of the basin. The three countries in the north-west still absorb just over three-quarters of foreign tourists. Only southern Europe substantially increases its share of the market, receiving 16.4 % of foreign tourists, whereas the number of domestic tourists doubles in the eastern Mediterranean and the Greater Maghreb (18 million holiday-makers respectively). The number of jobs in tourism grows only from 8 % to 11 % in total, although wages increase. The share of tourism in the Mediterranean GDP is 5.2 %.

Along the coast, tourist flows rise from 95 million to nearly 140 million domestic and international tourists (average increase of 2.2 % per year). The relaxation group is the largest in this scenario, with 40 % of holiday-makers. They seek, first and foremost, sun, sea and sand and are not always fully aware of the quality of the natural and cultural environment. Continuation of this trend also implies that the seasonal nature of tourism becomes more pronounced, i.e. that pressure at peak periods increases considerably. All this combined indicates that this scenario leads to a considerable deterioration of the environment : spread

Scenarios	International tourism		National tourism		International & National		Tourisme share in the GDP	Increase of tourism employment
	Number tourists million	Geographical share million %	Number tourists million	Geographical share millions %	Number tourists millions	Gegraphical share millions %		
T1	181	a= 136.4 75.4 b= 29.7 16.4 c= 7.1 3.9 d= 7.8 4.3	127	a= 86.0 67.7 b= 13 10.2 c= 18 14.2 d= 10 7.9	308	a= 222.4 72.2 b= 42.7 13.8 c= 25.1 8.1 d= 17.8 5.7	5.2 %	8 à 11 %
T2	162	a= 123.5 76.2 b= 24.9 15.3 c= 6.5 4 d= 7.1 4.5	106	a= 80.5 75.9 b= 10.8 10.2 c= 9 8.5 d= 5.7 5.4	268	a= 204 76.1 b= 35.7 13.3 c= 15.5 5.7 d= 12.8 4.7	5.6 %	11 à 14 %
T3	199	a= 148.3 74.5 b= 34.9 17.6 c= 8 4.0 d= 7.8 3.9	151	a= 100.2 66.4 b= 15.3 10.2 c= 22 14.5 d= 13.5 8.9	350	a= 248.5 71 b= 50.2 14.3 c= 30 8.5 d= 21.3 6	6.1 %	14 à 17 %
A1	207	a= 147.7 71.6 b= 37.1 18 c= 9.3 4.5 d= 12.2 5.9	168	a= 111.1 66.1 b= 17.3 10.3 c= 25 14.9 d= 14.6 8.7	375	a= 258.8 69 b= 54.4 14.5 c= 34.3 9.1 d= 26.8 7.1	5.7 %	17 à 20 %
A2	227	a= 158.8 70.0 b= 43.1 19 c= 11.5 5 d= 13.6 6	182	a= 115.8 63.6 b= 19.4 10.6 c= 27.5 15.2 d= 19.3 10.6	409	a= 274.6 67.1 b= 62.5 15.2 c= 39 9.5 d= 32.9 8	5.7 %	20 à 23 %

Definition of the four regional groups :
a : France, Italy, Spain.
b : Yugoslavia, Greece, Malta, Cyprus, Israel.
c : Turkey, Syria, Lebanon, Egypt
d . Libya, Tunisia, Algeria, Morocco.

Table III-21 TOURISM IN THE MEDITERRANEAN SCENARIOS - HORIZON 2000
(number, share, economical impacts)

Scenarios	National tourism			International tourism			Total mediterranean tourism		
Scenarios 2000	million	Growth 2000/1984 %	Average annual rate growth 1984 to 2000 %	million	Growth 2000/1984 %	Average annual rate growth 1984/2000 %	million	Growth 2000/1984 %	Average annual rate growth 1984/2000 %
T1	127	20.4	1.1	181	67.7	3.28	308	44.6	2.3
T2	106	0.5	0.04	162	50.1	2.57	268	25.8	1.45
T3	151	43.3	2.2	199	84.4	3.9	350	64.3	3.1
A1	168	59.4	2.96	207	91.8	4.1	375	76	3.6
A2	182	72.6	3.47	227	110	4.76	409	92	4.1
Scenarios 2025		Growth 2025/2000 %	Average annual rate growth 2000 to 2025 %		Growth 2025/2000 %	Average annual rate growth 2000 to 2025 %		Growth 2025/2000 %	Average annual rate growth 2000 to 2025 %
T1	169	33	1.1	312	72.3	2.2	481	56.2	1.8
T2	114	7.5	0.3	265	63.5	1.98	379	41.5	1.4
T3	230	52.3	1.69	344	72.8	2.2	574	64	2
A1	305	81.5	2.4	357	72.5	2.2	662	76.5	2.3
A2	349	91.7	2.63	409	80	2.38	758	85.3	2.5

Table III-22 TOURISM IN THE MEDITERRANEAN SCENARIOS - HORIZON 2000 AND 2025
(number, growth)

of unaesthetic, shoddy accommodation, encroachment on natural areas, congested ways of access routes, more and more parking lots, etc.

Worse trend scenario T-2 unfolds in a context of harsh economic competition, which tends to handicap the weak and serve the strong. Domestic tourism, remaining virtually at its 1985 level, is the first victim, as the stagnation, even regression in living standards, will not allow Mediterranean populations to take longer holidays or more leisure time. International tourism continues to grow, but only slightly (2.5 % per year), accounting for 162 million tourists in 2000 for the countries as a whole.

The outcome of this scenario, with heightened international competition to win or retain comparatively flagging market shares, is the setting-up of very well "targeted" tourist products designed for a wealthy elite, and to a less extent for prosperous executives seeking appropriate forms of recreation. The adventure and health groups may therefore increase considerably in this scenario.

In line with the spirit of competition, the improvement of tourist products causes a growth in employment of between 11 % and 14 % (with, however, low salaries to remain competitive), and the impact on the GDP is proportionately weaker than at present : roughly 5.6 %.

This comparatively pessimistic scenario, quite the contrary of a scenario of tourism for all, implies great disparity in the quality of accommodation : on the one hand luxury complexes for up-market international tourism, and on the other, lodgings for domestic toursim and down-market international tourism.

Striking contrasts can be observed in the impact of tourism on the natural environment. Luxury elitist tourism is not necessarily destructive in actual fact and, in some cases, paradoxically, can contribute to safeguarding unspoilt sites for the pleasure of a few people. Conversely, in the zones reserved for mass tourism, the results can be disastrous : overcrowding, ugliness, destruction of the landscape, cheap facilities hence increased pollution, etc.

It must however be stressed that the total number of tourists is the lowest in this scenario and the Mediterranean area is therefore less affected in any event. This is particularly true of the coast, where tourist pressure is scarcely higher than at present (20 million more).

Moderate trend scenario T-3 is based on the hypothesis of economic recovery, with the beginning of a long-term view. Economic growth means higher income, hence more holidays. Domestic tourism consequently shows good results.

In this scenario overall, Mediterranean tourism in 2000 reaches 350 million visitors, i.e. an average annual growth rate of 3.1 %. The market share of the three north-western countries falls slightly (71 % of the whole area) while the shares of the other three regions increase : southern Europe 14.3 %, eastern Mediterranean : 8.5 %, Greater Maghreb : 6 %. Domestic tourism, with 2.2 % per year, grows less quickly than international tourism (3.9 %). As commercial competition is less keen, holiday styles evolve and the accent is laid on culture and the historical and cultural heritage. The cultural group (26 %) increases more than the others, but the relaxation group is still the largest (38 %).

This scenario is doubtless the one most conducive to innovation in the field of information and communication, in response to growing demand. Imagination is likewise discernible in the creation of new

	Tourists (in million)			Nights (in million)		
	T.I.	T.N.	TI + TN	T.I.	T.N.	TI + TN
1984	51	44.7	95.7	418.2	983.4	1,401,6
T1	85.4	53.9	139.3	743	1,256	1,999
T2	76.4	45	121.4	664	1,048	1,712
T3	94	64.1	158.1	817	1,493	2,310
A1	97.7	71.4	169.1	850	1,663	2,513
A2	107	77.3	184.3	930	1,801	2,731
T1	147	72	219	1,205	1,584	2,789
T2	125	48	173	1,025	1,056	2,081
T3	162	98	260	1,328	2,156	3,484
A1	168	130	298	1,377	2,860	4,237
A2	193	148	341	1,582	3,256	4,838

I.T. : International Tourism
N.T. : National Tourism

I.T. : 47.2 % of the Mediterranean international tourism
N.T. : 42.5 % of the Mediterranean national tourism

average duration 1984 : I.T. : 8.2 days ; N.T. : 22 days
average duration 2000 : I.T. : 8.7 days ; N.T. : 23.3 days (+6 % globaly)
average duration 2025 : I.T. : 8.2 days ; N.T. : 22 days.

Table III-23 COASTAL TOURISM IN 1984 AND ON HORIZON 2000 AND 2025
Number of tourists and nights

tourist products ("aqualands", pleasure grounds, theme parks, etc.) which serve as substitutes for beaches and other sites that have become saturated and/or have lost some of their appeal. In economic terms, the share of tourism in GDP is high, 6.1 %, and the increase in employment ranges from 14-17 %.

On the other hand, the environment is not taken sufficiently into account, nor is intra-Mediterranean co-operation. The sector is dynamic, but there is no overall view or real safeguards : no real co-ordination, no proper long-term reflection, a "sprinkling" of bilateral aid, duplication of facilities, unrestricted exploitation of natural resources without appropriate regulations, etc. This scenario, finally, is the least favourable for the Mediterranean environment, especially the coast, with 158 million tourists flocking to the seaside. This saturation, even excess, may induce tourists spontaneously to change their kind of leisure demand, making this scenario just as unstable, though for other reasons, as the worse trend scenario T-2.

B. ALTERNATIVE SCENARIOS

It should be borne in mind that these scenarios imagine situations which break with past trends, especially regarding international and intraregional solidarity, and the search for the optimum exploitation of natural resources, while avoiding degradation and destruction.

From the economic viewpoint, the multipolar world structure makes some degree of Mediterranean autonomy possible.

Reference alternative scenario A-1 assumes a reorientation of north-south trade in the Mediterranean, with the European Community acting as a driving force and better development conditions in the countries south and east of the Mediterranean basin. Under these circumstances Mediterranean tourism reaches 375 million visitors, i.e. an annual average growth rate of 3.6 %. Although declining in comparison with the trend scenarios, the share of the three countries in the north-west remains considerable (69 %). The position of southern Europe remains unchanged compared with the T-3 scenario, whereas the eastern Mediterranean and the Greater Maghreb show signs of improvement (9.1 and 7.1 % of Mediterranean tourism respectively.

The A-1 scenario fosters domestic tourism, because of a better rate of economic growth, which rises on average by 2.9 % a year to reach 168 million holiday-makers. International tourism, however, is still more dynamic, with 207 million arrivals, (growth rate of 4.1 % per year). Employment increases from 17 % to 20 % by 2000, and the share of tourism in GDP is in the region of 5.7 %.

In this scenario, the "relaxation" group is again the largest (30 %), but the "cultural" group (28 %) is close behind and the "recreation" group grows considerably (22 %). Half the holiday-makers are therefore people who are sensitive to their own culture and that of others, to the quality of their leisure and to that of their environment. Governments are fully aware of the importance of tourism in the context of balanced economic growth because of its impact on employment and the creation of wealth and on the organization of leisure time. Accordingly, staggered holidays become a reality, which makes the growing number of tourists perfectly bearable, particularly the 169 million tourists on the coast and in coastal regions.

Very strict standards are applied in respect of the environment, so that all these tourists can be accommodated, fed and entertained. However, constant vigilance must be the keynote, with the most imaginative management techniques brought in to help, particularly as regards accommodation (whose capacity is currently under-utilized, as plainly shown by the correlation index in Table III-24). It is a matter

COUNTRY	Annual correlation index (1)	Correlation index in peak months (2)
SPAIN	26	40
FRANCE	36.5	54
ITALY	30	45
MALTA	36	54
YUGOSLAVIA	30	46
GREECE	30	45
TURKEY	104	156
CYPRUS	10	15
SYRIA	42	64
ISRAEL	42	63
EGYPT	42	64
LIBYA	60	90
TUNISIA	42	63
ALGERIA	26	39
MOROCCO	42	63

Mothode of calculation :

$(1) = \dfrac{\text{total beds x 300}}{\text{total guest nights}}$ $(2) = \dfrac{\text{total beds x 30}}{\text{15 \% total guest nights}}$

Table III-24 SUPPLY/DEMAND CORRELATION INDEX IN THE MEDITERRANEAN of finding ways in which existing resources can be better employed, and building only where resources are inadequate.

In the integration alternative scenario A-2, domestic tourism expands vigorously as departure rates in the southern and eastern countries catch up on their lag, in response to these countries' sound economic situation. International tourism is composed mostly of visitors from the Mediterranean region itself. The total number of tourists reaches 409 million, i.e. an average annual growth rate of 4.1 %. With 44.5 % of the total, the gap between domestic and international tourism closes considerably. In fact domestic tourism experiences its strongest average annual growth rate (3.47 %), although international tourism remains dynamic : 227 million foreigners (average annual growth rate of 4.76 %). Regional distribution evolves towards a better balance among the four groups of countries ("north-west" , 67 %; "southern Europe", over 15 %; "eastern Mediterranean", 9.5 % and "Greater Maghreb", 8 % of the Mediterranean market).

This scenario gives a certain priority to the enhancement of the natural, cultural and historical heritage, with a consequent expansion of the cultural group (30 %). It is also the one with the strongest development of social tourism, and that of clubs and associations, for the purpose of study and social advancement, which contributes to the education of the "relaxation" group (36 %) and its trend towards a less passive and "predatory" style of holiday. The impact of tourism on GDP is roughly the same as in the A-1 scenario, and the growth of employment ranges between 20 % and 23 %.

This high number of tourists encourages the authorities and tourists themselves to take measures to avoid potential saturation. Along the coast, for instance, there are more than 180 million tourists. It is virtually compulsory to stagger holidays and also probably to split them : going away more often but for shorter periods. The most modern techniques are used for accommodation and facilities. Lastly, in this scenario of change, not only economic but also of attitudes, the tourists themselves become more aware of the value of goods and people which should facilitate the reception of large numbers of tourists without too much harm to the natural and human environment.

III. TOURISM AT HORIZON 2025

The overall approach for the period 2000 -2025 is the same as for the previous period, with a few differences :

- the sound economic growth in the alternative scenarios brings about a rise in living standards, especially in the countries south and east of the Mediterranean basin and, in turn the growth of domestic tourism;
- similarly, the countries in southern Europe attain high levels of GDP per capita, comparable to those of France and Italy at present, which stimulates the growth of intra-regional international tourism.
- in the worse trend scenario T-2, growth recovers somewhat in the southern and eastern countries, restoring some degree of dynamism to domestic tourism, which nevertheless remains at a comparatively low level.
- international tourism continues to grow faster than domestic tourism in the trend scenarios, but tends to settle down. Indeed it seems difficult to go beyond a certain level of departure ra9tes (roughly 70 %).

For horizon 2025, only overall results are available, not for the four regions (Table III-23 above). Compared with the situation in 1984, the multiplier of tourist numbers varies from 1.7 % in the T-2 scenario to 3.5 in the A-2 scenario. The corresponding number of tourists, 379 million and 758 million respectively, must be

EGYPT : QUALITATIVE ASPECTS OF THE CONSEQUENCES OF TOURISM DEVELOPMENT IN THE FIVE SCENARIOS OF THE BLUE PLAN

T-1 Reference trend scenario involves two major changes :
- the opening of new destinations in the country to receive more than double the present number of visitors ;
- the completion of projects to improve infrastructure networks and tourist (amenities).

The new destinations will follow three directions :
- Along the Nile valley towards the newly exploited archaeological sites, wich is expected to lessen the pressure on Luxor and Aswan and attract newcomers from the "cultural" group.
- Along the Mediterranean coast and along the Red Sea to answer the needs of the "relaxation" and "health" groups
- Round the oases in the western desert which combining desert and greenery, particulary attract the "adventure" and "recreation" group.

The improvement of infrastrūctures and tourists equipment create certain problems :
- In the new tourists centers along the Nile valley, the needs of tourists are added to the needs not only mean consumer goods but also networks, building sites, services, etc..
- The coastal zones receive national and international tourists at the same time and in the same place, more and more at the expense of space and with negative effects on the environment.
- In the oases, influences tend to be felt in the socioeconomic area. In order to respond to tourist needs, goods have to be imported from other governorates because of the limited production in the zone. As a result, the local population develops new mode of consumption and, moreover, traditions and customs are in danger of commercialization.

In this scenario, the littoral will not be faced with serious problems of saturation before horizon 2000 and probably not before horizon 2025. But costly investment is needed for infrastructure and equipment.

T-2 worse trend scenario has diquieting consequences for the less developed countries, which include Egypt, because it assumes the development of international tourism with high standards. To answer the needs of these tourists, the country will have to import consumer goods and equipment which local production cannot supply.

The economic benefits of tourism are doubted by the local population which also finds the disproportion between the development of international tourism and the stagnation of national tourism hard to accept. Public opinion has the feeling of being deprived of the right to enjoy the tourist amenities of its country and to pay a very high price in term of damage to the environment and risk of pollution

T-3 moderate trend scenario brings a new flow of tourists, but from the "cultural" group, which crucially poses the problem of the very dense frequentation of archaeological monuments and sites, fragile tourist products *par excellence* because the least damage is irreversible.

A-1 alternative reference scenario allows the less developed countries to apply strict measures for the protection of the environment.

A-2 alternative agregation scenario which assumes considerable national tourist demand, is purely hypothetical in the case of a developing country, at least until 2000

Source : Blue Plan, Mr Sayed Moussa

taken with caution, as in the other scenarios for the 2025 horizon. The same applies to the number of guest nights in Table III-25, which varies from 4,700 million for T-2 scenario to a little over 11,000 million for the A-2 scenario.

Scenarios	2000 Nights (in million)			2025 Nights (in million)		
	T.I.	T.N.	TI + TN	T.I.	T.N.	TI + TN
T1	1,574	2,959	4,533	2,558	3,718	6,276
T2	1,409	2,469	3,878	2,173	2,508	4,681
T3	1,731	3,518	5,249	2,820	5,060	7,880
A1	1,800	3,914	5,714	2,927	6,710	9,637
A2	1,974	4,240	6,214	3,353	7,678	11,031

average stay in 2000 : I.T. 8.7 days
N.T. 23.3 days
average stay in 2025 : I.T. 8.2 days
T.N. 22 days

Table III-25 NUMBER OF GUEST NIGHTS HORIZONS 2000 AND 2025

With these reservations, the following comments may be made :

- tourist numbers in the reference trend scenario T-1 and the moderate trend scenario T-3 are very high : 481 million and 574 million. In view of non-restrictive government policies where environment and planning are concerned, the impacts on the environment are naturally considerable : haphazard land-use, destruction of rare and fragile coastal ecosystems by the building of infrastructure and tourist amenities, breaking up of landscapes by second residences, etc. The spread of planning errors committed in recent years can be witnessed throughout the Mediterranean coast.
- the worse trend scenario T-2, with only 379 million tourists, 114 million of whom are domestic; paradoxically remains the most "favourable" for safeguarding landscapes and natural and historic sites. Its most worrying impacts are at the social and cultural levels, owing to the dualism in the two ways of life : on the one hand the idle rich spending their holiday in "dream spots" reserved for their sole use and, on the other, the disadvantaged groups, unable to pay for a family holiday or obliged to take one under poor conditions. The sight of wealthy tourists has very negative effects on the values of the host society, with a consequent rise in para-tourist delinquency (theft, prostitution, etc.) This situation is naturally unstable and may lead to revolts and the reappropriation of reserved areas;

COUNTRY	Number of hotel beds (x1000)	Appropriation of soil (x1000 m)	Number of other beds (x1000)	Appropriation of soil (x1000 m)
SPAIN	840	33,600	8,923	624,610
FRANCE	1,590	63,600	10,894	762,580
ITALY	1,598	63,920	5,854	409,780
MALTA	14	560	41	2,870
YUGOSLAVIA	319	12,760	1,127	78,890
GREECE	323	12,920	324	22,680
TURKEY	68	2,720	182	12,740
CYPRUS	27	1,080	137	9,590
SYRIA	23	920	71	4,970
ISRAEL	65	2,600	162	11,340
EGYPT	48	1,920	218	15,260
LYBIA	9	360	24	1,680
TUNISIA	72	2,880	77	5,390
ALGERIA	27	1,080	37	2,590
MOROCCO	59	2,360	152	10,640
TOTAL	5.082	203,280	28,223	1,975,610

The different types of tourist lodging (hotel and other, including related areas) occupy an average surface of between 25 and 100 m2 per bed :

- rented rooms, boarding houses : 50 m2 per bed
- hotels : 30 m2 per bed
- youth hostels : 30 m2 per bed
- holiday villages : 100 m2 per bed
- camping - caravan sites : 50 m2 per bed
- car parks : 25 m2 per bed

The average reached is 40 m2 per bed for hotel accommodation and 70 m2 per bed for other accommodation

Table III-26 CAPACITY AND APPROPRIATION OF SOIL OF HOTEL AND OTHER LODGINGS (1984, in thousand beds and m2)

- the number of tourists is the highest of all in the alternative scenarios. But goal-oriented government policies for planning (leisure time as well as space) and balanced economic development allow for these flows of tourists to be absorbed without undue conflict;

Moreover, the harmonious organization of leisure for such huge numbers of tourists can scarcely be contemplated otherwise without causing serious damage : over-saturation, uncontrolled building, etc. Governments have virtually no choice but to implement planning policies of this kind.

One last remark on the alternative scenarios : the highest number of guest nights, namely a little over 11,000 million in the integration alternative scenario A-2, could already today be absorbed by the total lodging capacity of the Mediterranean countries, i.e. 33 million beds, if it were occupied 365 days a year (which would provide 12,000 million·guest nights). This is naturally an unrealistic assumption, but it provides an idea of the importance of staggering holidays.

IV RELATIONSHIPS BETWEEN TOURISM AND THE ENVIRONMENT

The study of the relationships between tourism and the environment in the Mediterranean focuses chiefly on three aspects :

. withdrawals on resources (waste and land);
. pollution and waste;
. physical and socio-cultural pressures;

While recalling that, due to lack of data (statistical in particular), some analyses had to be limited to the national level, without being able to grasp specific trends at the level of the coastal regions themselves.

Lastly, an attempt has been made to analyse the "tourist potential" of each country in relation to the physical and human environment, although the lack of data is even more pronounced than for the socio-economic study. Consequently, only a few simple indicators have been used to illustrate the importance of tourist activities on the Mediterranean environment and to explore the coastal countries' tourist potential.

A. SITE COVERAGE AND USE OF COASTAL LAND

The impact of tourism on land resources can be studied on the basis of prospects for accommodation capacity and the number of guest nights identified by scenario, bearing in mind that tourism uses both accommodation facilities and amenities for sport, cultural or recreational activities.

It is estimated that the different kinds of tourist lodgings cover an average surface area of 40m2 per bed for hotel accommodation; 70m2 per bed for additional lodging, including gardens and parking lots in both cases.

Table III-26 provides an estimate of tourist accommodation capacity and corresponding site coverage for all the Mediterranean countries in 1984. This shows that 90 % of hotel and additional lodging capacity is in the north-west region of the basin.

Altogether, about 2,200 km^2 were used by specifically tourist accommodation in the countries of the Mediterranean basin. If this surface area is doubled to take account of urbanization regulations and necessary infrastructure (such as service roads, etc.), total site coverage amounts to about 4,400 km^2.

It is estimated that about 50 % of hotel and other types of accommodation are situated in the Mediterranean coastal regions, i.e. 2,200 km^2 of urban development for tourist uses. This consumption of surface area, although not too significant compared to the size of the national territory, is considerable compared to coastal regions. It is equivalent to 2,200 km^2 of densely urbanized coast 1 km deep or 4,400 km^2 of densely urbanized coast 500 m deep.

For horizon 2000, and despite the considerable rise in the number of international and domestic tourists, about 40 million tourist beds should be available in the Mediterranean countries, which assumes an average growth rate (20 %) compared with the current situation. The supply/demand correlation index (Table III-24) reveals the under-utilization of hotel and para-hotel facilities. The most likely trend will be towards better management, with few new installations (or rather little difference between new installations and the abandoning of obsolescent ones) except in the south and east, inter alia in the alternative scenarios. In the weak economic growth scenarios, the over-occupation of some accommodation will continue to co-exist with the under-utilization of others. Site coverage, however, will be greater, especially on the assumption that quality will improve, as notably in the alternative scenarios. Total coverage could reach 8,000 km^2 for the countries as a whole. This might also be the case of moderate trend scenario T-3, which implies very dynamic tourist development. In the coastal regions, 4,400 km^2 would consequently be used specifically to accommodate tourists.

B. WATER CONSUMPTION

Here too, accommodation capacity and the number of guest nights have been chosen as indicators. Water consumption is not strictly equivalent to withdrawals, as it depends on the efficiency of the network, nor to the volume of waste water discharged, which depends on the rate of connection to sewage systems.

The hypotheses chosen for the scenarios are as follows, (assimilating tourists to the urban population) :

Domestic water consumption
(litres per person per day)

	1984	2000	2025
International tourism	250	300	300
Domestic tourism	150	175	200

These hypotheses are based on weightings. In fact, a luxury hotel can consume over 600 litres of water per tourist guest night, whereas a camper will use very little. It has also been assumed that water consumption by international tourism will increase no further after 2000, whereas that of domestic tourism will continue to grow until 2025. Estimated annual consumption is given in Table III-27, on the assumption that these hypotheses are valid for all the scenarios.

The results show that worse trend scenario T-2 is the most sparing of water, with consumption increasing by 50 % in 2000 and doubling in 2025 compared to the situation in 1984. Integration alternative scenario A-2 entails a strong increase in consumption, 340 % in 2025 compared with 1984. In this scenario, however, co-operation among states and the long-term view has a favourable effect and the re-use and recycling of water become a reality. This is not the case with moderate trend scenario T-3, where the risk of wastage is real in view of increased consumption, multiplied by 2 in 2000 and by 3.2 in 2025 compared with 1984, in a very dynamic economic context, but still little concerned by optimal use of resources.

		International Tourism	National Tourism	Total	Multiplier coefficient 2000/1984 and 2025/1984
1984		222.5	346.5	569	
2000	T-1	472.2	517.8	990	1.7
	T-2	422.7	42.8	854.7	1.5
	T-3	513.3	615.6	1,129	2
	A-1	540	684.9	1,225	2.1
	A-2	592.2	742	1,334.2	2.3
2025	T-1	767.4	743.6	1,511	2.6
	T-2	651.9	501.6	1,153.5	2
	T-3	846	1,012	1,858	3.2
	A-1	878	1,342	2,220	3.9
	A-2	1,006	1,535	2,541	4.4

Table III-27 ESTIMATE OF TOURISTS ANNUAL WATER CONSUMPTION (in million of m3)

One of the effects of water consumption by tourists is a lowering of the groundwater level through over-pumping (the case in the Hammamet region in Tunisia, for instance), leading to a "social wasteland" or the abandoning of cultivated land. In coastal regions, this phenomenon could be aggravated by the infiltration of seawater, making the aquifer salty (in the Balearic islands, for instance, in some resorts on the Spanish coast, etc.).

C. WASTE AND POLLUTION

Waste has been studied on the basis of tourist guest nights for solid waste and water consumption for liquid waste.

1. Solid and liquid waste

The initial hypothesis for solid waste was an average production of household refuse of 0.9 kg per day per tourist. In the medium term, because of the spread of packaging, this figure was brought up to 1.1 kg in 2000 for all the scenarios. In 2025, there would be a further increase to 1.4 kg per day per tourist in the trend scenarios, whereas a stabilization at the 2000 level would occur in the alternative scenarios. In the latter case, most waste would be biodegradable or recyclable. The findings are given in Table III-28.

		Solide waste	Waste water
1984		2,880	341,4
2000	T-1	4,986	594
	T-2	4,265	512.8
	T-3	5,774	677.4
	A-1	6,285	735
	A-2	6,835	800.5
2025	T-1	8,786	906.6
	T-2	6,553	692
	T-3	11,032	1,115
	A-1	10,600	1,332
	A-2	12,134	1,525

Table III-28 SOLID WASTE AND WASTE WATER
(per year and in thousand tons and million m3)

For liquid waste, it was estimated that waste water represents 60 % of domestic water consumption. This percentage remains constant for all the scenarios.

The consumption of waste is also important : solid packaging (related to consumption patterns), nature of wastewater flow (type of detergent, for instance).

2. Pollution

The effects of tourism on noise, atmospheric pollution from exhaust fumes, or pollution of coastal waters could not be quantified for lack of homogeneous statistical series for all Mediterranean basin countries, especially as these effects combine with those from other sectors of activity.

Noise. Air and road transport increase "sound pollution". The tourist trends examined above show that this kind of nuisance will increase at least until 2000, partly because of the number of tourists using air transport. Over the period 2000 to 2025, the level of sound pollution should stabilize if technical innovations lead to the construction of quieter aircraft, which has in fact been the trend for the past 10 years. Noise from urban sources is also becoming increasingly difficult to tolerate. Public authorities can do a great deal to reduce sound nuisances: regulations at source (for light vehicles, among other things), siting of roads and aerodromes, soundproof screening; maintenance of silent zones, instruction and incentives of all sorts.

Atmospheric pollution from exhaust fumes (see chapter on transport) is considerable in the countries with very high tourist inflows and where arrivals are usually by road. This type of pollution is concentrated along the major motorway access routes, as well as in the receiving areas. Spain, France and Italy are especially affected by this problem, as is Yugoslavia where the percentage of international arrivals by road (86 %) is the highest in the Mediterranean basin and concentration on the coast is very heavy in the summer. In these countries the situation may well deteriorate in the long run owing to the number of tourists, even when the new compulsory depollution systems are taken into account. The countries in the south and east, where international arrivals by road are significant (Syria, Turkey, Morocco) will also be affected by this problem. The construction of transit roads far from inhabited areas could help to remove nuisances.

Pollution of coastal waters due to the discharge of waste water from tourism adds to that due to the discharge of the resident population. Effective depollution rates for each country would have to be available in order to discern trends, which is not the case. In France, the current real rate of depollution for total discharge is 27 % in Provence-Côte-d'Azur and 42 % in Languedoc-Roussillon. In 1990, these rates will attain 47 % and 49 % respectively.

The arrival of increasingly larger tourist populations in some areas could lead to pollution with noticeable effects on health, justifying epidemiological surveys and the publication of the levels of water quality. In areas with high tourist inflows (beaches near urban areas, among others) special attention should be given to the cleanliness of sand and to the disposal systems of pleasure boats (ports, inlets and bays that receive many visitors during the summer period).

D. THE PHYSICAL AND SOCIAL PRESSURE OF TOURISM

Tourist pressure on the area was measured according to two industries :
- tourist density or number of tourists per km^2,
- tourist pressure along the coastline, or number of tourists per kilometre of coast.

Although very imperfect, the second indicator has been used in the absence of data on the surface areas of beaches, which would have provided more specific information on "bathing density". Both indicators concern Mediterranean coastal regions during the peak month (20 % of the total numbers of national and international tourists visiting the Mediterranean).

M E D Regions	1984			2000 - T-1		
	Tourist density (1) tourists / km2	Density on coast (2) tourists / m of coast	Social pressure (3) tourists / inhabitants	Tourist density (1) tourists / km2	Density on coast (2) tourists / m of coast	Social pressure (3) tourists / inhabitants
SPAIN	62	2.3	0.41	84	3.1	0.47
FRANCE	56	1.5	0.46	76	2	0.52
ITALY	20	0.6	0.10	25	0.7	0.13
YUGOSLAVIA	52	0.4	0.89	69	0.5	0.94
GREECE	13	0.1	0.14	31	0.2	0.32
TURKEY	5	0.1	0.05	9	0.2	0.07
MALTA	316	0.7	0.26	696	1.6	0.52
CYPRUS	17	0.2	0.23	32	0.4	0.39
SYRIA	51	1.2	0.18	101	2.3	0.18
LEBANON	-	-	-	-	-	-
ISRAEL	51	1.2	0.07	79	1.8	0.09
EGYPT	1	0.4	0.02	1.6	0.7	0.02
LIBYA	-	-	-	-	-	-
TUNISIA	10	0.3	0.08	19	0.7	0.12
ALGERIA	4	0.2	0.02	8	0.4	0.02
MOROCCO	6	0.6	0.08	13	1.3	0.1
All Med. coastal regions	15.6	0.41	0.14	23	0.61	0,17

(1) $\frac{\text{number of tourists x 0.20}}{\text{surface area of coastal regions km2}}$

(2) $\frac{\text{number of tourists x 0.20}}{\text{coastline m}}$

(3) $\frac{\text{number of tourists x 0.20}}{\text{resident population}}$

Note : 0.20 equals the percentage of tourists staying in coastal regions during the peak month, estimated at 20 % of the total number of tourists.

Table III-29 INDICATORS OF TOURIST PRESSURE IN COASTAL REGIONS

Finally, to gauge the "social pressure" of tourism on the local population, the ratio chosen was that of the number of tourists during the peak month compared to the resident population.

The findings in Table III-29 for reference year 1984 and for 2000 in the case of reference trend scenario T-1, show that overall tourist pressure was weak, and that it rises only very slightly in 2000. Contrasts are sharper when each country is taken separately, as illustrated by a few examples :

- the heaviest tourist density is in Malta, five times higher than in Spain, (in second position) and this ratio will have risen further by 2000;
- on the other hand, use of the coastline is heaviest in Spain, both in 1984 and in 2000;
- Yugoslavia is experiencing the strongest social pressure, twice as high as in Spain (in 1984 and 2000). This perhaps explains the low increase observed and forecast for the number of tourists in this country;
- Spain combines the heaviest use of the coastline with considerable tourist density and social pressure;
- Syria is experiencing heavy tourist pressure on its land and coastline, but not on its population;
- Turkey and Egypt seem to experience low tourist pressure.

This kind of indicator of tourist pressure does not help to tackle the excessive numbers of visitors at archaeological and historical sites, especially acute in places like Luxor or Venice (where municipal authorities are considering setting up a system to restrict the number of visitors). This problem also concerns natural sites, for instance some particularly attractive islands in the summer (nature reserves like Port-Cros, Greek islands, etc.).

Over-frequentation implies very negative and even destructive impacts, notably through trampling, visitors' breath or artificial lighting in confined or underground areas. Once begun, the degradation of this wealth is irreversible. Those responsible are well aware of the dangers of excess tourist inflows and are seeking norms and solutions, which are still far from clear-cut.

E. POTENTIAL FOR TOURISM

On the basis of the criteria described above and other wide-ranging ones, such as the climate (annual hours of sunshine), air transport infrastructure (passenger unloading capacity), a country's cultural and natural riches, tourist accommodation supply (hotel and para-hotel capacity), the level of additional activities (restaurants, bars, sports facilities, casinos, etc.), an effort was made to define "tourism potential", representing either assets or possibilities for tourist development in each Mediterranean country in the light of various scenarios. For this purpose, a "potentiality index" was tried out, based on a weighted average of the indicators listed below. This approach, which needs to be carried further, made it possible to undertake an initial evaluation of tourist development potential at horizon 2000 for the four regions defined earlier.

The interest of this approach lies in making a dynamic connection between these indicators, which all have an influence on one another. To take the example of Spain, the following features can be noted :

- a climate more attractive in summer than in winter,
- already high tourist density,
- an extensive coastline, but already very full in summer,

- very high accommodation capacity,
- a very high level of additional facilities,
- good air transport infrastructure,
- well-exploited cultural wealth,
- already heavy social pressure.

These observations show that Spain can take steps to improve the quality of the services offered and to diversify them as there are no problems of quantity, and that to preserve its attraction for tourists the authorities should in any case be careful about the risk of seasonal saturation.

The reverse of the Spanish example could be valid for Egypt and Turkey, which have :

. a dense population able to receive very large numbers of tourists,
. in the case of Egypt, an attractive climate assets for two departure zones (northern Europe and North America in winter and spring, Arab countries in summer),
. an extensive and under-utilized coastline,
. archaeological and historical treasures,
. very low accommodation capacity,
. transport infrastructures needing improvement.

Both these countries consequently have a very high tourist development potential, which could materialize in the T-3 scenario, and become even more of a reality in the alternative scenarios.

The trends envisaged in the T-1 and T-2 scenarios imply a lowering of potential in the three north-western countries because seasonal saturation is not relieved in these scenarios; according to the criteria selected, this area can barely advance any more. Its potential remains stable in the other scenarios.

Southern Europe increases its potential in all the scenarios except the worse trend scenario T-2, where it stagnates.

At any rate, this study of tourist potential is a good illustration of the difficult balance required in order to ensure economically profitable, socially harmonious and ecologically acceptable tourism. However, since tourism needs a good-quality environment, it can contribute to some extent to improving and conserving it, to the spread of criteria as regards living standards, to the enhancement of natural and cultural sites, and can become a real driving force for environmental protection.

V. CONCLUSIONS AND ISSUES FOR APPRAISAL

All the scenarios indicated a considerable development of tourism in all the Mediterranean countries. One of the most important issues for the future is that of better geographical distribution among the host countries, which could lead to an improved balance among the four regions studied. The necessary facilities will have to be constructed so that the three regions currently receiving less tourists may increase their share of the market (while preserving as far as possible their natural wealth). The moderate trend scenario T-3 illustrated the risk of this kind of increase in the absence of co-ordination and planning. Moreover, will the most frequently visited countries in the leading region accept this diversion, or would they try to keep their share of the market? And, in the same vein, how will the Mediterranean countries of the European

Community react when the Single European Act comes into force in 1992, leading to a huge redistribution of goods and persons, which could pave the way to the expansion of installations (with north European capital) in areas like Sardinia, the Greek islands, etc.?

One aspect of this international competition is the search for the new kinds of amenities or leisure styles to attract a different class of tourist. There is the example, shifting from conventional amenities, of the encouragement given to lightweight yatching facilities, such as dry ports (in France, marinas are too often "parking lots" where, according to statistics, boats only go out seventeen days a year), or to camping or hiking. In a completely different style, there are the pleasure grounds which, perhaps poorly designed or targeted, have not been as successful as their promoters expected.

Another query is related to the emergence of domestic tourism in a number of countries south and east of the Mediterranean basin, inter alia those with a high population growth rate and with good or strong economic growth. Will this kind of tourism, which usually starts with holidays at home (particularly difficult to account for in statistics) develop according to the European model, based on new accommodation capacity whose rapid growth could conflict with the quality of and respect for the environment and landscapes?

The problem can also be mentioned of social segregation, which runs counter to the spirit of intermixing of populations through tourism. The worse trend scenario T-2 depicted it in the form of luxury tourism "islands". But it could also take other shapes, between domestic and international tourism.

Along with "geographical" distribution, there is also "temporal" distribution or "time planning". The scenarios clearly indicated the importance of the problem, without really suggesting any solution since the difficulties to overcome are so vast. Will national development policies, by taking into account the economic, social and cultural issues of tourism, manage to avoid the concentration of holidays in the peak period? This problem is perhaps one of the most important and most urgent : congestion on roads, in air corridors and airports, which recently reached the highest levels ever, and the ensuing risk to life, provide an initial idea of the scope of the problem and the decisions to be taken.

Finally, from the environmental viewpoint, one of the most worrying aspects is the excessive number of visitors to historical and some natural sites.

On the other hand, it seems that most of the other impacts of tourism could be brought to an acceptable level by thorough study and above all planning of development goals, by realistically taking stock of the advantages and disadvantages involved, and by using integrated planning methods.

CHAPTER III.5

TRANSPORT IN THE MEDITERRANEAN

The prospects for transport are closely linked for those for intra-Mediterranean trade, for trade between the region and the rest of the world, and for the traffic (mostly oil tankers) which passes through the Mediterranean. The volume of merchandise and passenger flows and the dynamics of the infrastructure work required vary considerably with the hypotheses of the different Blue Plan scenarios. But prospects are still dependent on the physical and historical features of the Mediterranean regions. The first section identifies some trends in the light of the various scenarios.

The review of relationships between transport and the environment can be tackled by grouping transport activities into four categories (Section II), each representing different types of impact, if only in terms of the host environment or the kind of pollutants emitted or nuisances provoked :

- land transport,
  . road (Section II-A) ;
  . rail (Section II-B) ;
- maritime transport (Section II-C) ;
- air transport (Section II-D).

Special attention has been given to maritime transport because of its importance for the Mediterranean Sea itself and for all the coastal activities related to it.

In addition, telecommunications and information transmittal should be considered which are briefly described in Section III.

Some issues for appraisal conclude this chapter.

I. GENERAL PROSPECTS BY SCENARIO

A. SOME TRENDS AND FACTORS OF CHANGE

Maritime transport, strongly established in the region from time immemorial will change radically during the next forty years. How will port facilities integrate with road and river infrastructure in the hinterlands ?

There is a considerable difference between maritime transport infrastructure in the countries north of the basin (from Spain to Greece and, partly, to Turkey) and that in the southern and eastern countries.

Development during the first industrial age led to drawing a distinction between :
- peninsular ports, some of which may play a strategic role or a role in redeployment, either at the national level (like the Piraeus) or, more often, at the regional level (like Naples or Barcelona). Some have already launched into a process of reconversion together with industrialization (like August or Taranto) ;
- the more important deep-sea ports (like Marseilles, Genoa, Venice, Salonika), which benefited from the political and economic situation and from a significant transport infrastructure and which, in particular, have a much more extended hinterland than the peninsular ports. The Suez Canal, opened in 1869, contributed to their development.

The prominent role played by Spain, France and Italy in traffic, was heightened with the integration of these countries into the European Community.

The spillover effect, and also a certain degree of monopolization on the part of the major deep-sea port complexes, were strengthened by the appearance of new efficient technologies related to combined carriage*, itself increasingly linked to the multinational organization of the economy (role of the predominant urban metropolises, interconnected through high-level service operations. Tied to the intercontinental traffic system, the Mediterranean has become increasingly dependent on external momentum and strategies. A major Mediterranean port like Fos-sur-Mer for example, faces very strong competition from Rotterdam (numerous lines and services offered) and other North Sea ports, despite its special facilities for handling containers.

This keen competition is likely to grow. The Channel tunnel may provide a fresh impetus to the efficient road-rail combinations serving Europe, and encourage the Mediterranean part to fuse increasingly with the future structure of northern transport.

Another example of external influence is that of the link up between the Mediterranean and the outlet of the Danube, through the straits. The north-south eastern road route is slowly materializing: "the 10,000 kilometre road" which should connect the Polish port complex lying on the Baltic Sea -Gdansk

*"Combined carriage" : a legal term referring to the global contract covering all the transport components intervening between the starting point and the destination, before breaking of bulk. Maritime transport, one of the links of this multiform chain, has, to some extent, become commonplace.

Gdynia- to the Persian Gulf through the Bosphorus and Anatolian plateau, with its Iraki and Iranian branchings, is being undertaken by sections in the various European states concerned*.

The southern and eastern coast too will develop on the basis of a few break-bulk points, mostly connected with the north-west coast. Bulk goods transport will continue to progress, and the growth of combined carriage will, no doubt, be the main innovation in the next two decades.

The proportion of food and agricultural products (grains, meat, etc.), coal and manufactured goods in Mediterranean transport should rise and, as a result, all the leading port complexes are likely to be enlarged. Whereas medium-sized ports may decline, the major ports will be extended with satellite or off-loading facilities (like Fos with respect to Marseilles) and some new ports may be constructed for very specific products.

As regards tonnage, ports on the southern and eastern shores are likely to expand the most in the coming decades (related to the development of industry and energy). A very large increase in the range of products and services offered is expected and many processing activities will be established.

Pressures exerted will be even heavier because they will be both stronger and faster ; this will certainly be the case in southern and eastern countries. Impact will depend on economic, technological, political and financial measures taken at the national and international level as well as at the regional or local level. The Blue Plan scenarios are therefore differentiated by the evolution of transport itself (starting with means of transport), and by measures taken to cut down pollutant emissions or discharges into atmosphere, water or soil, to reduce noise and other nuisances, and to protect sites and social and cultural patterns.

B. TRENDS ACCORDING TO THE SCENARIOS.

1. Reference trend scenario T-1

While traditional trade flows develop, profound changes take place in terms of logistics. The two north-west Mediterranean countries -France and Italy- which to some extent are in a dominant position as regards Mediterranean trade, both within the basin and with the rest of the world, are mainly oriented towards northern Europe; 40 % to 50 % of their trade is with the countries of the European Community.

Trade favours the north-south orientation of transport routes. The more coherent infrastructure networks in the northern regions, both in France and in Italy, tend to be mutually strengthening and international land transport (road and rail) remains important. The North Sea-Mediterranean link is basically ensured by road (except for bulk). In the countries south and east of the basin, the polarization brought about by Europe (more than 50 % of trade) produces a more coherent infrastructure network on the coast and the development of ports, furthered by economic relations that encourage maritime transport. In this context, the ports of Tarragona, Barcelona, Marseilles, Genoa, Trieste, Venice, Rijeka, Piraeus, Salonika, and Volos ensure the link with the East and Africa, where Morocco's Atlantic seaboard is even more closely linked to the Mediterranean through works like Jof Lasfer. Interest is renewed in the western and northern-eastern

*Four Mediterranean countries are involved : Italy, 98 km, Yugoslavia, 1,700 km, Greece, 960 km, and Turkey, nearly 3,000 km. Launched in 1977, this project (TEM - Trans-European Motorway) should be finished at the beginning of the 1990s.

tips, somewhat neglected up to now, because of the deployment of road traffic on either side of the straits (Gibraltar, Tangiers, Bosphorus).

In both the northern and the southern and eastern countries, attempts made, here and there, at physical planning and the balanced development of transport infrastructure only produce results when economic parameters prevail, regardless of opportunities arising from circumstances. In this respect, the development of automobile transport leads to the expansion of networks that more or less incorporate basic economic and social needs.

This scenario does not pay any special attention to the environment. This means that the negative impacts of transport on the environment will grow (increased pollutant emissions, formation and dispersion of photo-oxidants, noise, air and water pollution from hydrocarbons, increasing risks of accidents, etc.), nevertheless leading to the necessary action for the reduction of emissions and nuisances, with a lag on the part of other countries compared to the European Community.

2. Worst trend scenario T-2

Because of keen international competition among the major industrialized countries, the idea of a Mediterranean area tends virtually to disappear. Trade flows are characterized by the concept of transport chains and routes, information technology, and new organizational techniques which give priority to shippers rather that to transport operators and locate decision-making centres on the outskirts of the Mediterranean basin.

. <u>on the northern shore of the basin</u>

The role of France and Italy, which continues to influence Mediterranean trade and transport, is less strong than in reference trend scenario T-1, mainly as a result of very lively competition between the various countries of western Europe. The interest of some European countries in the East European and Middle-Eastern markets furthers the development of the Danube route. The Black Sea-North Sea link then facilitates a greater internationalization of the capital already committed along the corridor, which diverts part of the traffic hitherto going through the Mediterranean. The "10,000 km" road gradually materializes, increasing the volume of north-south traffic coming from (and going to) western and eastern Europe.

At the same time, the search for transport security prompts the development of other routes and the strengthening of the traditional Rhone-Rhine-North Sea, Rhone-Channel and Italy-North Sea routes. Competition is fairly keen between different means of transport.

Transport infrastructure develops within the context of short-term plans, more operational and flexible enough to cope with unpredictable but frequent policy changes. The concepts of economies of scale and flow management tends to reduce the number of ports. Transport techniques also develop in accordance with the same concern for adaptabililty and safety. Thus containerization continues to expand, but not as much as to the use of ro-ros (roll-on/roll-off vessels), a special handling process. At the same time, true "dry ports" compete with sea ports under the impetus of new techniques. Thus for example, river-maritime transport facilitates the development of traffic to Lyons and in the Rhone valley, with its effects on the physical, economic and social environment. Another example is the Peripignan automobile port, impelled by the vitality of Catalonia and the growing importance of Barcelona.

. <u>on the southern shore of the basin</u>

The economy is even more outward oriented, reflected by the development of major ports and large coastal industrial zones. The development of land infrastructure involves the major routes, commercially justified in an international outlook and oriented in the direction hinterland-Mediterranean coast, but does not prevent the parallel development of coastal navigation.

The concept of physical planning tends to fade in the face of plans for siting the most productive and profitable short-term investments. In the south and east polarized development favours the coast, with main infrastructure facilities scaled down to minimum.

Worst trend scenario T-2 thus envisages a considerable strengthening of road traffic, along with its nuisances and pollution, to the detriment of rail and sea transport. In both the north and south the increase in the vehicle stock, especially commercial vehicles, the development of infrastructure and the rise in the volume of trade is accompanied by even more damaging effects on the environment because decisions and investments prefer the short-term above all, and the search for quick profitability tends to sacrifice both the heritage (landscape, natural areas) and the quality of the environment (particulate and gaseous pollutants, noise, congestion etc).

3. Moderate trend scenario T-3

Compared to the reference trend scenario T-1, awareness of the Mediterranean's potential -with the need to protect this market- leads to the organization of better balanced relations, with an incipient long-term view. A major infrastructure mesh -national network routes- supplemented by secondary infrastructure linking the countries as a whole, seeks a more effective use of human resources (through better spatial distribution), and of land and subsoil resources.

The fabric of land infrastructure (mainly road) is strengthened in all countries as a result of increased economic activity. In the north, the existing network is filled out on account of regionalization and decentralization. In the south and east of the basin, the economic development of the hinterland requires the expansion of roads, motorways and, in some cases, railways to feed the area. While traditional, but reorganized, exchange routes still predominate, new structurizing routes are developed. National and international air transport expands vigorously and requires the construction or enlargement of airports in the southern and eastern countries.

In the countries south of Mediterranean basin, the development of the hinterland begins to take priority over that of the coastal regions, with infrastructure linking the two areas within the context of an economic and social development plan furthering economic, social and cultural decentralization. Ports develop, often through the extension of existing infrastructure. The creation of new ports helps to bolster the major existing industry-port complexes. In addition, the number and capacity of airports, which have become essential to keep pace with (or promote) hinterland development, is rising (which implies an expansion of national fleets).

Still in the south and east of the basin, the major imbalance between road and rail is gradually attenuated by the development of rail traffic and, therefore, of the necessary infrastructure whenever it is economically and socially justified. Since rail is suited to the long-distance transport of weight cargo -important for a number of developing countries- this encourages a certain degree of rail standardization in some southern and eastern countries. Navigation has the opportunity to develop on the coast.

The development of infrastructure in the southern and eastern countries, is nevertheless curbed by the coast, while international loans do not encourage the long-term view and tend to prefer road transport.

Significant efforts have been made in countries north of the basin (partly under pressure from European Community directives), then by the southern and eastern countries, to reduce atmospheric pollutant emissions related to transport (NOx, CO, particulate matter, lead, etc.). However the structure and age of the vehicle stock (tourist and commercial vehicles) and the time required to renew it cause a considerable delay, even as the volume of traffic continues to increase.

4. Reference alternative scenario A-1

In this scenario, Europe is stronger and as such acts as the commercial negotiator for the other individual Mediterranean countries. Trade develops between north and nouth, with possibly a certain degree of competition among some of the southern countries.

The countries of southern Europe, in particular France, Italy and Spain, are the special partners of North Africa (mainly the Maghreb). The spatial development of ports is better balanced, both at the national and international level, since the creation of an economically integrated Europe becomes a reality.

The Mediterranean Sea, recognized as the heritage of the Mediterranean countries and protected as such, becomes to some extent a transit zone in an economic and transport area covering the whole of Europe and Africa. More or less well-knit transport networks would provide the structure for this area (especially in the A-1 alternative scenario, in which a permanent link with Gibraltar would be established, the Sicily-Italy links would be enlarged, etc.). This kind of structure, in addition to the stimulus of economic and social development, would help minimize spatial and environmental impact.

In this kind of scenario, necessary measures are taken and actively applied to reduce emissions and nuisances through the use of less polluting technologies, less polluting and low consumption vehicles, and better traffic management (speed limits, for instance), ultimately improving the quality of urban and rural air. Europe imposes its standards for environmental protection, to some extent, and contributes to absorbing the extra cost.

In this scenario, the imbalance in the network configuration remains considerable between the countries north of the basin and those south and east : a better integrated meshing in the north in the context of a European physical planning policy (major international north-south and east-west turntable in Sicily, for instance, involving Europe, Africa and the Middle East). On the other hand, countries assume a role as intermediaries and transit areas towards the Sahelian and west African countries. Outside financing and loans favour the north-south routes. Logistic support can nevertheless be undertaken to make the role of middleman more active and productive.

5. Integration alternative scenario A-2

Countries groups are formed in the south and east of the Mediterranean basin on the basis of economic complementarity (human and natural potential, agriculture, industry, etc.). These include partners from Europe, in the context of better balanced commercial relations. Horizontal relations are furthered between economically viable regional bodies.

Relationships favouring South-South links are gradually set up. As a result, land-based infrastructure develops, such as, for instance, the by-pass across the high plateaux in Algeria linking Morocco to Tunisia and then further on to Libya, Egypt and the Middle East.

Major investments, set within a long-term and large-scale perspective, thus with no immediate result, may cause a drop in the commercial GDP in the initial stage.

Coastal navigation expands rapidly, and existing air links are strengthened (business travel, tourists, freight and workers).

Within the European Community, the south European countries do not always benefit from the partnership, which curbs infrastructure development compared to reference alternative scenario A-1.

In a subsequent period, intra-Mediterranean trade recovers within better negotiated frameworks in which the notion of complementarity and the need for co-operation prevail. The role of southern country groups as intermediaries between Europe and Africa is maintained, to the benefit of the partners as a whole. South European regions regain an important role deriving from their geographical position with respect to the southern and eastern Mediterranean, in view of their potential and large-scale economic function.

Infrastructure develops more consistently in vertical directions, linking the hinterland to the coast, and the countries among themselves. Some major hubs are formed at interconnections between different transportation means and at the terminals of international, national, regional or local spokes. These nodal points are determined within the context of a physical planning policy that exceeds national boundaries.

This kind of situation could encourage, in an ultimate stage, the economically viable grouping of countries to the north, south and east of the Mediterranean basin, regardless of the groups to which countries individually already belong.

II. PROSPECTS BY MEANS OF TRANSPORT

After an overall analysis of possible transport trends according to the different kinds of scenarios, it is worth reviewing the major forms of transport which all have a rather special kind of relationship with the environment.

A. ROAD TRANSPORT AND THE AUTOMOBILE STOCK

The Mediterranean basin is one of the world regions which was a relative latecomer to road mobility: the relief and inclination towards the sea acted as a curb.

	1970	1980	2000	2025
Spain, France Italy et Greece	29,360	51,402	73,966	83,077
Yugoslavia Turkey, Cyprus, Malta et Israël	1,527	4,478	19,992	35,801
Syria, Lebanon Egypt	366	945	11,580	25,355
Libya, Tunisia, Algéria and Morocco	783	2,250	14,945	30,430
	32,036	59,075	120,483	174,663

The table shows future trends of the automobile stock in the Mediterranean countries (tourist and commercial) vehicles for an average scenario, type T-1 reference trend or T-3 moderate trend) for 2000 and 2025, together with 1970 and 1980 figures for comparison purposes.

In 1970, Spain, France and Italy represented a little more than 90 % of the total. In 2000, Spain, France, Italy and Greece (i.e. the four Mediterranean countries belonging to the EEC) will represent no more than 61 % of the total, and in 2025 less than 50 % ; at this time the levels of vehicle ownership will exceed 200 per 1000 habitants in most countries.

Source : Blue Plan.

Table III-30 TREND OF THE MEDITERRANEAN COUNTRIES' AUTOMOBILE STOCK (in thousands of vehicles)

The growing importance of road transport for the movement of both goods and passengers, has nevertheless led to a policy for the development of new land routes for trucks and automobiles. Many road and motorway "terminals" were established on the northern shore, as well as a motorway network started in Italy in the 1930s and now developed mainly in Spain and France, but gradually reaching the other countries. The relationship between the growing density of networks and the growing intensity of flows, of commercial vehicles in particular, is at the origin of this process.

Trends in the vehicle stock reflect as much population growth as the expansion of overland exchanges and rising incomes. Table III-30 illustrates inter alia the recent vigorous growth of the automobile stock in the southern and eastern countries, nevertheless still far from reaching the "saturation" point observed in the northern countries. Unlike the latter, where rail had won the bulk of major flows during the first industrial era, the impact in the southern and eastern regions may come mostly from roads.

The extremely rapid progress of road traffic inevitably means thinking in terms of the planning of combined transport systems, from the sea to land (road and rail) and air with one underlying concern : taking into account all communication technologies which, in turn, provide a decisive impetus for the development of transport networks.

1. Site coverage and impact of road networks

Outstandingly flexible, road transports ensures door to door-service dand usually requires less investment than other kinds of transport.

There is a major north-south imbalance in the Mediterranean road network : in the north, networks are comparatively dense and interconnecting, and include a growing motorway network (of the 13,958 km of motorways existing at the beginning of the 1980s, 13,176 were in the three north-western countries, Spain, France and Italy) ; in the south and east networks are less developed, serving the major cities in particular, and road connections with neighbouring countries remain inadequate. Road infrastructure requirements in these countries are therefore considerable*.

At the beginning of the 1980s, according to the International Road Federation (Table III-37), the total length of the road network in the Mediterranean basin countries was a little over 2 million km (all roads included), of which nearly three quarters in the three countries north-west of the basin. Among the countries in the south and east, Turkey was in the lead, followed rather far by Algeria and Morocco. The Egyptian network seems rather small, but this is partly due to the very characteristic geography of the country.

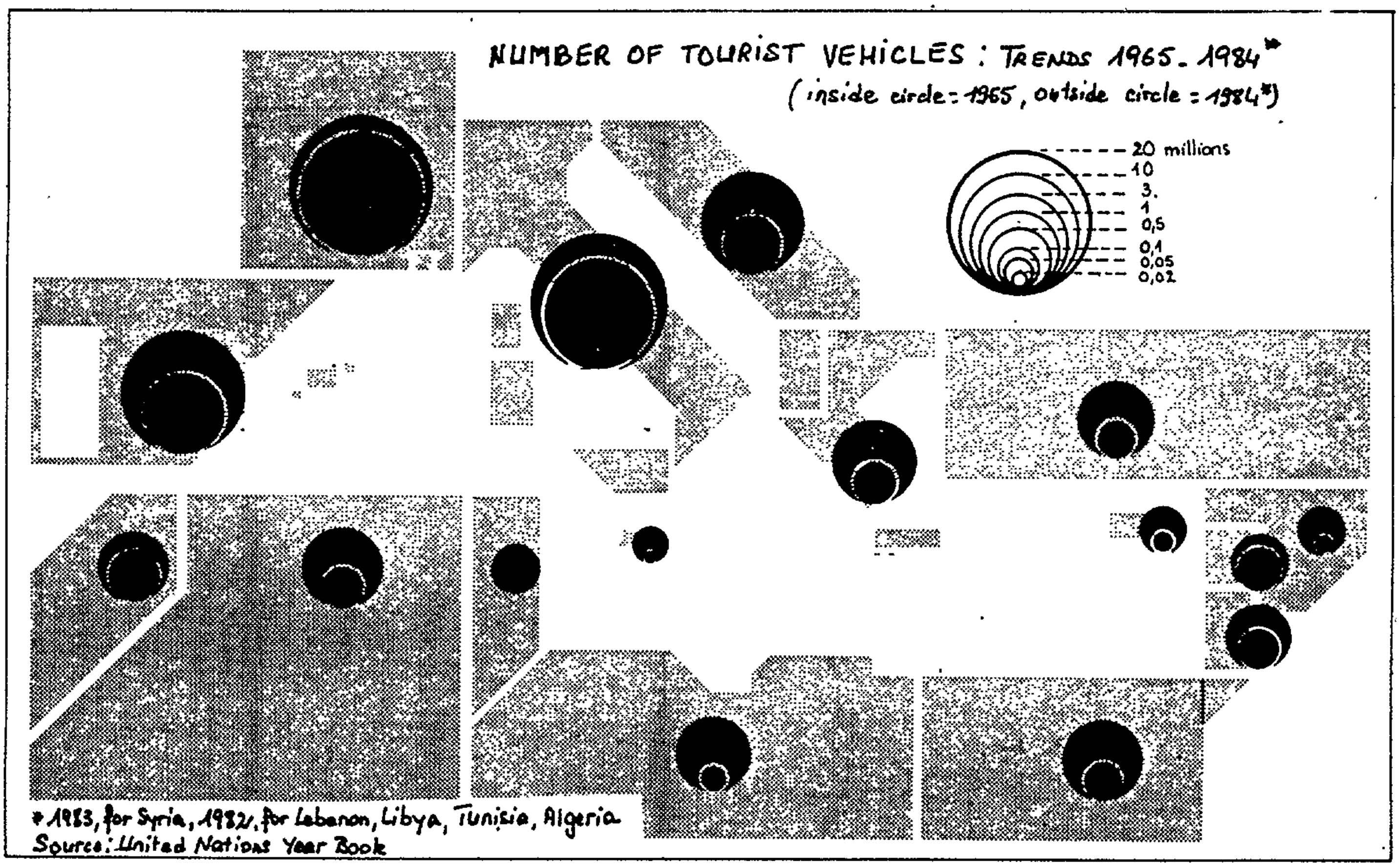
The scenarios have adopted the growth of the Mediterranean road network in the light of the economic development hypotheses and assumed physical planning. policies. Growth in the coutries north of the basin, and especially in the three north-western countries, would be comparatively weak, rising from 1.6 million km at the beginning of the 80s to 1.7 million or a maximum of 1.9 million km in 2025. The latter figure in fact corresponds to the integration alternative scenario A-2 in which the hypothesis of a population increase in the countries to the north of the basin was explored.

*It is possible to go round the Mediterranean by road, i.e. to go from Tangiers to Algeciras, a distance of 30 km, by a huge detout of 25 000 km. In Europe the itinerary covers part of the "E network" of the major European routes, and in Africa, sections of other major projects such as the Trans North-African (Nouakchott, Cairo).

SPAIN	317814
FRANCE	803415
ITALY	293799
MALTA	33
MONACO	46
YUGOSLAVIA	113383
ALBANIA	?
GREECE	37445
TURKEY	232867
CYPRUS	10270
SYRIA	18844
LEBANON	7070
ISRAEL	4631
EGYPT	28190
LIBYA	?
TUNISIA	23695
ALGERIA	72091
MOROCCO	57634
TOTAL MEDITERRANEAN	2021967

Source : International Road Federation

Table III-31 TOTAL ROAD LENGTH 1981



The growth in road networks in the countries south and east of the basin is comparatively much higher, since the total length could be multiplied by a factor of 3.2 and even a maximum of 4.3 in 2025 compared to the beginning of the 80s. The maximum for the countries south and east of the basin would be close to 2 million km in the T-1 reference trend and T-3 moderate trend scenarios, about 11 % longer than the road network in the northern countries (although the per capita kilometre density would still remain lower). The alternative scenarios attribute slightly lower figures to the countries south and east of the basin in 2025, partly because of the better spatial organization assumed in these scenarios.

These increase may seem very large, but it should be stressed that road transport is likely to be the main beneficiary of economic and social development, as rail network development depends on the growth of weight cargo and the choice of strategies as regards means of transport.

Since these estimates include all roads (secondary, national, main, motoways), it is more difficult to calculate site coverage. Experts have suggested using an average width of 20 m (including verges and considering, for example, that a six-lane motorway is 100 m wide).

Table III-32 summarizes the results of the scenarios for the length of networks and their site coverage. According to the scenarios, these will amount to between 63 000 and 75 000 km^2 in 2025 for the Mediterranean basin countries as a whole (i.e. the equivalent of the combined surface area of virtually all the large Mediterranean islands). Between 10 000 and 20 OOO km^2 could be located in the Mediterranean regions as such.

Among the major impacts of this kind of road network on the environment (usually difficult to quantify), are :
- pollution of surface water and groundwater from runoff (hydrocarbons, used oil, etc.);
- the alteration of water systems during road construction ;
- competitive use of land, especially in densely populated areas (motoway layout sometimes expropriate the best agricultural lands in the region ; this is the case for instance of the A8 motorway in the Var, France) ;
- the extraction of road-building material ;
- abandoned dumps, demolition materials, and road work waste (especially from motorways) ;
- the risk of structural defects appearing in old or worn road infrastructure ;
- effects of degradation and of dividing up districts, agricultural land and wild life and plant life habitats ;
- noise, even more of a problem when roads run through urban areas.

Generally speaking, the layout of new land routes should be studied more carefully. Agricultural land is limited in the Mediterranean basin and should, along with the coastal area, be treated carefully.

Some traffic could be channelled into the hinterland, and motorways laid at some distance from the coast.

2. Road transport pollutant emissions

The nature and scope of environmental impact produced by road transport depends on trends in :
- the stock of vehicles in circulation (tourist and commercial vehicles) ;
- the volume of traffic (assessed in number of kilometres covered per vehicle per year) ;
- the road network (estimated in length of roads).

		Length (x 1000 km)		Land impacts (km2)	
		2000	2025	2000	2025
T-1	N	1668	1703	33.360	34.060
	S	902	1974	18.040	39.480
	T	2570	3677	51.400	73.540
T-2	N	1668	1703	33.360	34.060
	S	939	1457	18.780	29.140
	T	2607	3160	52.140	63.200
T-3	N	1708	1768	34.160	35.360
	S	1352	1974	27.040	39.480
	T	3060	3742	62.500	74.840
A-1	N	1708	1768	34.160	35.360
	S	1305	1812	26.100	36.240
	T	3013	3580	60.260	71.600
A-2	N	1754	1929	35.080	38.580
	S	1305	1812	26.100	36.240
	T	3059	3741	61.180	74.820

Source : Blue Plan

Table III-32 TOTAL LENGTH AND LAND IMPACTS OF MEDITERRANEAN ROADS ACCORDING TO THE SCENARIOS

Road transport pollutant emissions comprise mainly nitrogen oxides, carbon monoxide, poorly burnt hydrocarbons and particulate matter, all of which involve considerable risks for health and ecological balance (including that of forest and crops).

Atmospheric polluant emissions, particularly nitrogen oxide (NOx) and sulphur dioxide (SO2) from road traffic depend on a large number of factors which can be grouped into three categories :
- the characteristics of the vehicle : type (private vahicle, commercial vehicle), engine capacity, fuel used (gasoline, diesel), age, etc. ;
- use of vehicle, in particular mileage on different stretches (built-up areas, roads and motorways in open country, traffic speed) ;
- the typical emissions of each vehicle expressed in g/km, which depend on the vehicle's characteristics and conditions of use (to simplify, average speed over distance covered can be used as an indicator).

Total pollutant emissions have tended to rise because of the increasing size of the vehicle stock. The only effective way to combat the formation and hence the dispersion and accumulation of photo-chemical oxidants in urban and rural areas is currently to reduce the combined emissions of hydrocarbons and nitrogen oxides.

As regards NOx, accurate information is not available everywhere. In France, where total NOx emissions have been stable for 15 years, the proportion contributed by road transport has nevertheless risen from 49 % in 1973 to 70 % in 1986 ; i.e. from 8.6 million tonnes NOx per year to 11 million tonnes of NOx per year. About half these emissions come from private gasoline vehicles ; one third is produced by commercial diesel vehicles.

The share of transport is very low (7.2 %), in SO2 emissions compared to industrial or electronic boilers, but is growing in comparative terms. Traffic in France emitted 114,000 tonnes of SO2 in 1986 (compared to 128,000 tonnes in 1980) ; 90 % of these emissions come from diesel vehicles, particularly commercial vehicles, mainly over intercity stretches.

In Italy as in France, transport has become the biggest emitter of particulate matter (43 % in France ; 56 % in Italy, i.e. 69 million tonnes in France in 1986 and 229 million tonnes in Italy in 1984), for an automobile stock of about 20.5 million vehicles in both countries.

It is estimated that 90 % of carbon monoxide in the air deriving from human activities comes from the transport sector, automobiles in particular.

The technological trends of motor vehicles, stemming in particular from the concern to save fuel, have tended recently to favour the direct-injection diesel engine ; unfortunately it is considerably more polluting than the gasoline engine. Conversely, gas (LPG) propulsion is an interesting innovation.

Chain reactions, in the presence of sunlight, between the nitrogen oxides, hydrocarbons and oxygen, produce photochemical oxidants (or photo-oxidants), defined as compounds with a high oxidizing capacity, amoung which ozone (03) is the most widespread (others are : hydrogen peroxide, peroxyacetylnitrate - PAN, peroxybenzoylnitrate - PBzN, etc.).

Photochemical polllution of the atmosphere causes eye irritations (as well as increased vulnerability to infection), the deterioration of plants and materials, and visibility-reducing smog. Data show that in many cities, like Athens, where traffic has to be regulated (the stones of the Parthenon are already seriously affected), Cairo, Algiers, Rome, wher traffic has been forbidden in the town centre, etc., the hourly levels of 100-200 g/m^3 recommended by WHO are regularly exceeded, and can reach 300-400 g/m^3 or even 700 g/m^3.

These photochemical oxidants, about half of which are formed by road traffic in cities or heavily populated industrial zones (high pressure furthers the process) are likely to be transported by the wind over very long distances and accumulate in less populated areas where they are a threat to the environment plant life and crops, the forest, etc.

The smog prevailing in some cities and the effects of photo-oxidants (in the Mediterranean these pollutants seem more serious than acid rain) are relatively recent phenomena and it is difficult to assess all their consequences. In addition there is the nuisance of congestion and the stress caused by traffic, heading towards saturation point, not to mention the price to be paid in terms of automobile accidents (if traffic conditions and vehicles in 2025 resemble those today, there will be some 180 000 deaths a year in the Mediterranean coastal countries as a whole).

The work of the Blue Plan indicates that the automobile stock (all vehicles) of Mediterranean countries almost doubled between 1970 to 1980 (from 32 million to 59 million vehicles), and would no doubt double again between 1980 and 2000 (120 million vehicles), to exceed 170 million vehicles in 2025. The biggest increase will occur in the countries south and east of the basin, where the automobile stock could rise from 8.5 % of the total in 1980 to more than 47 % in 2025.

These figures vary little from one scenario to another, because the rate of motorization depends on the level of economic development : lower development levels correspond to slightly larger populations.

If private vehicles alone are considered (83 % of the total in 2025), fuel consumption would peak around 2000 then fall (by about 5 %) until 2025 because of the slow down in the growth of the automobile stock and the reduction in specific consumptions (estimates were made with averages of 8.5 l/100 km in 1980, 6 l/100 km in 2000, and 4 l/100 km in 2025).

Trends in pollutant discharges, and also nuisances such as noise, loss of time and risk of road accidents depend on the trends in standards set for automobile emissions in the coming decade (probably becoming stricter) and efforts to manage road traffic.

In 2000, road transport activities in the Mediterranean basin could release about 3.6 million tonnes of NOx and 8 million tonnes of hydrocarbons, excluding particulate matter (whose composition is often toxic), carbon monoxide and toxic organic components (mutagens, teratogens, carcinogens) present especially in the urban environment.

Emissions could decrease after 2000 either because of technological progress and reduced fuel consumption alone, or because of regulations. In fact, the impact of nitrogen oxides on the quality of air in urban and rural environments was recently proven to be stronger than expected (particularly because of their role in the formation of photo-oxidants).

Expected results from technical advances to improve the energy output of vehicles and from the introduction of unleaded gasoline will nevertheless be delayed by :
- lengthening of the useful life of vehicles ;
- the time span (10-12 years) for renewing the vehicle stock.

The later decisions are taken on this matter the later their effects will be felt.

At the same time, the introduction road management energy policies (speed limits, anti-noise barriers, controls, etc.) would have a more immediate impact on safety and the quality of transport.

B. RAIL

Considering the historical importance of the sea itself and the uneven relief, as well as numerous conflicts (and therefore disruptions) between countries during the past century and a half, rail has not played an important role in the Mediterranean region. Road transport by truck is a decisive competitor over short, medium and even long distances. Air transport, expanding vigorously over the past twenty years, also affects prospects for rail, although new technologies (high speed trains) could create the conditions of a new future for the railway.

The rail network varies from one country to another, denser in the north than in the south (60 km of rail per square kilometre in France and Italy ; about 10 km per square kilometre in the south and east), generally in decline ; small unprofitable lines are being closed down in several places. The state of the network and rolling stock is also very different depending on the country, as is the level of electrification (in the region of 10 % in Algeria, 30 % in Yugoslavia, 40 % in Morocco, and 50 % in France and Italy for example).

Passenger traffic has nevertheless increased between 1970 and 1980 ; it rose from 112,000 million passengers per kilometre to 138,000 million. It grew by 22% in the northern countries (where at the same time the population increased by 6.5 %) and by 26 % in the southern and eastern countries (a figure virtually identical to that of population growth).

As regards merchandise, the tonnage transported (about 135,000 million tonnes per kilometre) has fallen for the past 15 years ; already in 1975 merchandise traffic accounted for no more than 12 % of traffic transported in Spain, 17.7 % in France (compared to 40 % ten years earlier) and 35 % in Yugoslavia.

It seems that no significant quantitative changes can be expected in the future. Nevertheless, some new factors may intervene :
- the development of a European high speed network, probably towards Spain and northern Italy ;
- use of the train for some intercity stretches where the road network is congested, even saturated ;
- the connection with Sicily ;
- the possible integration of the Maghreb network, resulting from co-operation between the three North African countries (inter alia in the integration alternative scenario A-2) with a possible extension to Libya (a possible Tunis-Tripoli link has been studied). This linkage, extended as far as Egypt has, moreover, already been advocated by the Union of African Rainways, established in 1972 ;
- possibility of rail links towards Morocco and Algeria if the Gibraltar tunnel materializes.

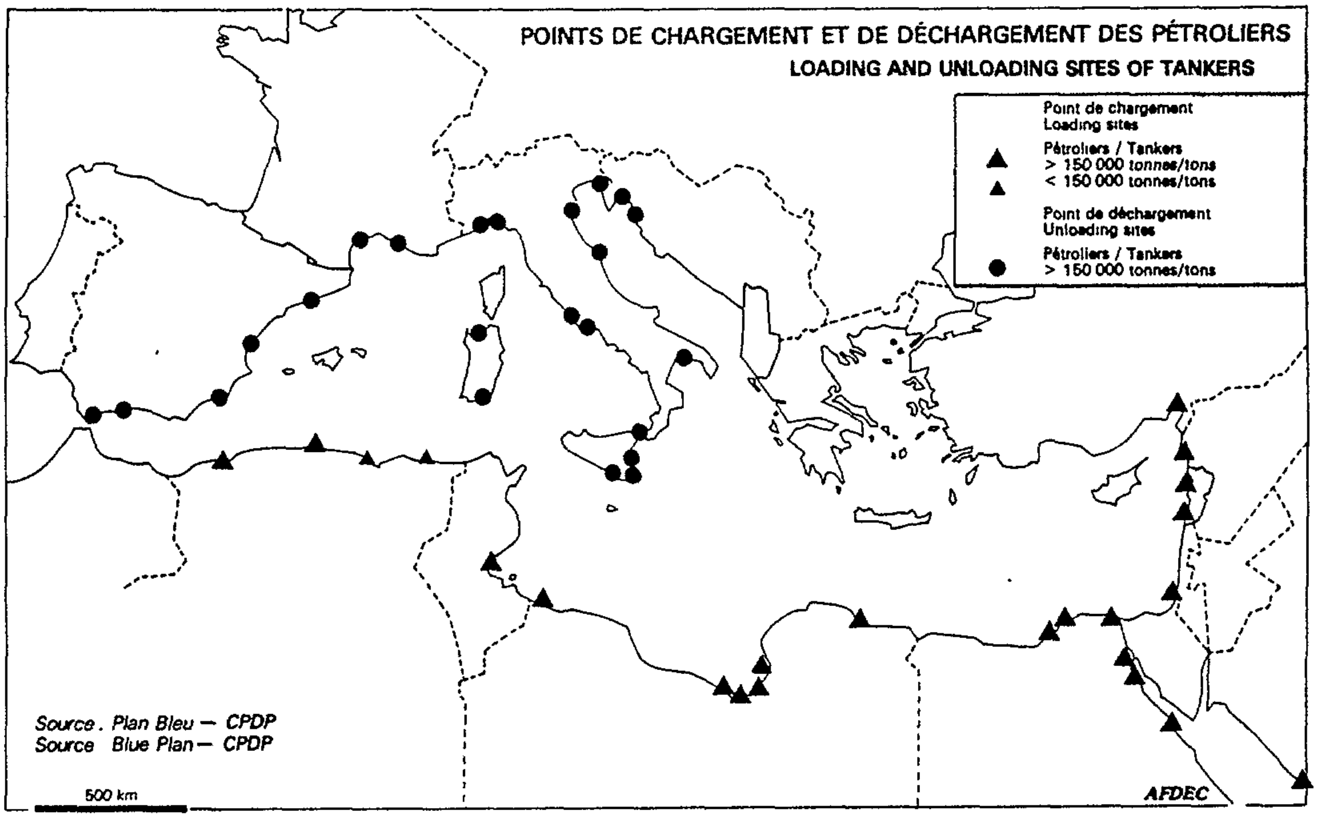
THE SUEZ CANAL : SOME FIGURES

The Suez Canal was opened in 1869.

Total lenght (Port Said to Port Tawfiq) : 162.5 km
Depth : 9,5 m (future : 23,5m)
Capacity of fully loaded ships : 150,000 tdw (planned 250,000 tdw)

<u>1985 traffic</u>

	North-South	South-North	Total
Number of ships	10,235	9,556	19,791
including tankers	1,758	1,616	3,374
Goods traffic (10^3 t)	105,695	151,901	257,596
including oil and oil products	12,262	81,792	94,054



As regards relationships with the environment, the railway system, in tonnage transported or in passengers per kilometre, is by far the most economical in energy use and least polluting.

It should be observed, however, that infrastructure development (very inflexible), formerly linking mainly the hinterland and the sea (use of hinterland resources during the colonial period), usually involves coastal plains, already under heavy pressure (intensive agriculture, urbanization, industry, tourism), but where nevertheless rail would contribute to relieving the volume of road traffic and avoiding an increase in saturation points.

C. MARITIME TRANSPORT

Sea transport has played a vital role in trade among Mediterranean countries and between them and the rest of the world from time immemorial. In fact, air transport has wrested a growing share of trans-Mediterranean passenger traffic from sea routes only over the past thirty years. Moreover, this traffic has grown to such an extent that the routing of passengers by ship -now mostly car ferries- is still an indispensable supplement to the aeroplane during the summer holiday period.

Overland pipelines, whether those of the Middle-East or south-west Europe, also compete with maritime transport by shortening the distances between loading and unloading ports. As regards Mediterranean traffic, however, they have so far tended rather to promote growth, since these ports are located on the Mediterranean Sea.

Up to the horizons selected for the Blue Plan, therefore, maritime transport will continue to play an irreplaceable role in Mediterranean countries trade, particularly if it involves the routing of weight cargo, large volumes of liquid and dry merchandise, or even massive passenger traffic during seasonal migrations.

1. General features of maritime transport in the Mediterranean

Ships passing through the Mediterranean Sea are involved in many kinds of traffic which fall into three main geographical groups : traffic between coastal states, traffic with its departure or arrival point in a coastal country port, and traffic crossing the sea to form a link between the Atlantic, the Black Sea and the Red Sea -through Gibraltar, the Bosphorus and the Suez Canal- with no commercial port of call.

From the economic viewpoint, only the first two categories can be considered as Mediterranean traffic as such because they are directly related to the economic activity of the coastal states. The third is group, however, cannot be ignored, considering its overall volume and the large proportion of hydrocarbons in its cargo, with its potential pollution hazards.

Mediterranean maritime traffic as such, by category of merchandise, comprises a very large hydrocarbon tonnage : crude oil, refined products (including liquified petroleum gas) and liquified natural gas (recently experiencing competition from the trans-Mediterranean gas pipeline through the strait of Sicily), equal to about half of the 600 million tonnes unloaded in Mediterranean ports.

This figure should be compared with that of the volume of world maritime transport, 3.3 million tonnes in 1985, of which 1,200 million tonnes of oil and derivatives, i.e. 36 % of the total. The share of hydrocarbons in Mediterranean traffic as such is therefore higher than the world level, especially considering transit traffic.

Another feature of maritime transport in the Mediterranean Sea is the imbalance between the western and eastern parts of the basin. The activity of the north-western countries (Spain, France and Italy) produces the largest share of traffic in the region as regards tonnages of merchandise loaded and unloaded. In contrast, the economic activity of the southern and eastern countries is more modest and maritime traffic in the eastern Mediterranean is more a matter of necessary routing, including to the ports on the western shores, than of the requirements and resources of the coastal countries, since the oil loaded on their shores comes mostly through pipeline from non-Mediterranean countries.

Despite the importance of national coastal navigation for countries like Italy, Greece, Yugoslavia, Turkey and even Tunisia, which accounts for about 20 % of port traffic for the region as a whole, the active fleet in the Mediterranean is used above all for international links. Nevertheless, it very difficult to define a "Mediterranean fleet" because the concept of a flag, of financial and technical supervision, and of commercial operations do not coincide.

At any time there are in the Mediterranean freighters or passenger ships employed in national coastal navigation, usually under the flag of the country concerned ; freighters and ferries maintaining regular lines between Mediterranean countries, usually under the flag of one of them ; ships on these lines also serving third countries, some of them under the flag of these countries ; tankers, bulk carriers and tramp freighters, effecting transport to order and coming from or going to one of the coastal countries, which may be under any flag, particularly flags of convenience ; finally, vessels of all kinds and nationalities in transit, which do not stop at ports in the region except possibly to pick up or put down a pilot. The problem is even more complicated because some countries, like France and Spain, Morocco, Egypt, Israel and Turkey, have several seaboards but their ships do not necessarily operate out of their port of registry. It should also be considered that the Greek fleet, flying the Greek flag, has worldwide activities which are far from being concentrated in the Mediterranean. This is even more true of ships placed under flags of convenience - Panama and Liberia in particular- by Greek ship owners, the most important of whom are moreover based in London or in New York, while maintaining links with their home country. It should also be noted that some small states in the Mediterranean region have "opened" their flag to ship owners who do not have their business headquarters in the country, thus enabling their fleet to reach a tonnage out of proportion with their share of Mediterranean maritime transport.

As at 1 July 1987, according to Lloyd's Register of Shipping, all the 10,369 ships navigating under flags of Mediterranean coastal states were equivalent to a fleet drawing 58.3 million gross registered tonnes (GRT), with a lading capacity of a little over 98 million tonnes, i.e. 14 % of the world total in terms of GRT and number of units, and 15 % in terms of lading capacity.

The distribution of this capacity by country economic category was as follows :
- 30 % for the countries north-west of the basin : Spain, France and Italy ;
- 55 % for Yugoslavia, Greece (representing alone 44 % of the total Mediterranean flags), Turkey and Israel ;
- 10 % for countries whose flags are very largely "open" : Gibraltar, Malta, Cyprus and Lebanon ;
- 5 % for the industrializing countries south and east of the basin : Morocco, Algeria, Tunisia, Libya, Egypt and Syria.

It can thus be observed that the distribution of transport capacity among Mediterranean flags scarcely corresponds to the different countries' share in the region's maritime trade, a trend which is on the rise (difficulties for the more developed countries to continue operating ships under their own flags, and interest of the less developed countries in financing the expansion of their merchant fleets). This situation has nevertheless disadvantages as regards combating Mediterranean pollution, for the coastal states are in a better position to ensure compliance with regulations when their ports are visited by their own ships.

2. Hydrocarbon transport in the Mediterranean

2.1. Oil and refined products

Geographically, the Mediterranean is located between the world's largest oil producing area, the Middle East, and two of the main consuming regions, western Europe and North America. The main flow of loaded tankers crosses it from east to west starting from the Suez Canal or from Middle-Eastern pipeline terminals, and heads either towards the Atlantic through the strait of Gibraltar, or towards the north-west ports of the basin where the large refineries and the pipeline heads feeding central European refineries are located.

Another form of east-west traffic, although much smaller, runs from the Soviet Black Sea ports ; this usually involves refined products heading for southern Europe but also, beyond Gibraltar, to Cuba.

In addition, there is transversal traffic ; from North Africa, near consumption centres, towards southern Europe and, via Gibraltar, western Europe ; and from the Suez Canal and the east Mediterranean pipeline terminals towards Balkan Europe or the Danube regions, passing through the Bosphorus.

Crude oil traffic is declining considerably compared to the situation at the end of the last decade, before the second "oil shock". Globally, nearly 1,500 million tonnes were transported in 1979 ; in 1985 this figure had decreased to 870 million, i.e. a drop of 42 %. Since then falling oil prices have caused a considerable recovery, and it is estimated that over 960 million tonnes of oil were transported by sea in 1987, still 36 % less than in 1979. On the other hand, transport of oil products is much more stable, and rising slightly : nearly 218 million tonnes in 1979, over 300 million in 1987.

The tonnage of oil cargo travelling through the Mediterranean is estimated at about 20 % of the world total, whether it is loaded or unloaded there or only in transit. Considering that the surface area of the Mediterranean Sea is only 0.7 % of the world's total maritime surface area, this tonnage illustrates the exceptional density of oil traffic in this virtually closed sea, and at the same the vulnerability of the sea to the pollution that oil transport cannot fail to cause.

It is generally recognized that most of the pollution ascribable to ships is caused by ballasting in the high seas, and to a much lesser extent to accidents. The Marpol Convention, which came into force in 1983, has nevertheless had a positive effect on the behaviour of tanker captains in this respect.

It is clear that, as regards ships loading or unloading in Mediterranean ports, compliance with the Convention will improve as reception facilities for hydrocarbon-laden ballast and tank-flushing water are installed. Nevertheless, 36 out of 52 ports located in 11 Mediterranean countries, reviewed in the SNAM-Progetti report dated February 1983, did not have the kind of facility required to meet the Convention's stipulations.

As regards oil spills at sea, caused by accidents, there were 120 incidents in ten years from 1977 to 1986, i.e. between 12 and 13 per year, according to the Regional Oil Combating Centre (ROCC) in Malta.

The tanker fleet under flags of Mediterranean states comprised, as at 1 July 1987, 946 units, corresponding to 25.5 million GRT. The disproportion between the distribution of tanker tonnage by Mediterranean flag and the relative importance of each country involved in oil import or export in the region is even greater than that for the total fleet :
- the three north-western countries, the main importers, have only 27.8 % of the total, virtually equivalent to the small countries with "open" flags which have 27.5 % ;
- Yugoslavia, Greece, Turkey and Israel amount to 40.2 % of the total. Greece alone accounts for 35.7 %, whereas the southern and eastern countries, although mostly exporters, only have 0.5 % of the "Mediterranean" oil fleet, whose fields of action are clearly more global than regional.

Trends in the maritime transport of oil and oil products in the Mediterranean up to the Blue Plan horizons will depend on two factors. One is changes in energy consumption and in the role played by oil in meeting these requirements in importing regions located around the Mediterranean or served by maritime routes using it. The other is changes which may occur in oil resources in regions neighbouring the Mediterranean or in major producing zones. These modifications will naturally be affected by oil price fluctuations.

The scenarios formulated by the Blue Plan do not imply a significant increase in overall oil requirements in the Mediterranean basin coastal countries. Nevertheless, comparative stability stems from the contrasting trends envisaged for consumption in the most developed northern countries, which would continue to decline, although more slowly than in recent years, and in the southern and eastern countries, which should rise fairly fast. Since the latter are themselves either producers or have Middle-Eastern pipeline outlets nearby, this growth in their oil demand should not imply imports by sea, but could gradually reduce their exports towards the northern countries, which would tend to reduce intra-Mediterranean traffic.

On the other hand, transit traffic through the Mediterranean, from the Middle-East via the Suez Canal and pipelines towards north-west Europe and North America, could increase as North Sea and United States deposits become depleted.

The trend already noted in recent years towards a rise in the proportion of refined products in oil traffic flows should continue, even extend. In fact, a geographical redistribution of refining activities is taking place. After having been concentrated in the high consumption areas, refining is now developing close to producing regions, thus resuming initial practices to some extent.

In the future therefore a decline is likely in the average tonnage of tankers operating in the Mediterranean, since the optimal size for the transport of refined products is under 100,000 tonnes lading capacity, whereas for crude it is close to or may exceed 200,000 tonnes. This will result in an increase in the number of units using the Mediterranean for the same tonnage transported. Impact on the environment is difficult to assess because the risk of accidents of sea should increase in proportion, but spillages will involve lower tonnages. In addition, refined products have a different impact on the environment when spilled as compared to crude oil : they are generally more volatile and more soluble, but also possibly more explosive and/or toxic.

Finally, the increase in the transport of refined products implies the construction of new ships which would have to meet the stipulations of international conventions. Hopefully they will also be more reliable as regards propulsion, manoeuvrability and navigation due to progress in automation and information technology leading to the development of "intelligent ships" which could avoid human errors.

2.2. Natural gas

Algeria is one of the world's leading exporters of natural gas and Libya also has large reserves of this non-polluting energy source. In order to be transported by sea, gas must first be liquified at the loading port, an expensive operation (including in energy), and ultra-sophisticated ships with very high construction costs have to be used. Over distances not exceeding 3,000 km, underwater gas pipelines that convey methane in its gaseous state are a new and more economical means of transport, successfully introduced by the trans-Mediterranean gas pipeline between Algeria and Italy via Tunisia, the strait of Sicily and the strait of Messina. Pipeline capacity is 12 Gm^3 per year, as compared to Algerian LNG exports by sea, currently approaching 20 Gm^3 per year. The gas pipeline project linking Algeria to Spain and the rest of western Europe, with an underwater section whose length varies according to the path chosen, is again being reviewed and there is a good chance of it materializing before the end of the century.

The scenarios formulated by the Blue Plan as regards energy envisage a growing role for natural gas at the world level and that of the Mediterranean basin in particular. The T-3 trend scenario and the alternative scenarios assume that the transport of gas between producers in the south and possibly the east of the basin and consumers in the north-west will reach such volumes that the construction of new trans-Mediterranean gas pipelines will be inevitable. At the same time, LNG exports should expand towards the United States and perhaps Greece and Turkey.

Aside from the risk of explosion at liquefaction and regasification terminals, LNG transport by sea has few disadvantages for the environment, and the only serious accident recorded so far for a methane tanker - grounding on a rock in the strait of Gibraltar- has demonstrated the solidity of these ships. This is an important development for the expansion of LNG maritime transport. In contrast, the alternative often suggested, transforming gas into methanol and loading on ordinary tankers, would be more hazardous for the environment as this product is highly toxic.

3. Maritime transport of other merchandise

3.1. Transport of bulk goods

After oil and refined products, the main goods transported by sea in volume, if not value, are iron ore, coal and grain : in 1987 world traffic was estimated at 309 million tonnes, 272 million and 182 million tonnes respectively.

Among the "major bulk" goods, iron ore and metallurgical coke (included with coals) are unloaded in large quantities in the countries northwest of the Mediterranean basin which have installed huge waterside steel complexes, such as those at Fos or Taranto. The drop in European Community steel consumption and competition from producers outside Europe has caused a drop in the unloading of ore and coke European ports compared to registered tonnages a decade ago, despite the fact that coastal steel works have suffered less from the crisis than those -often older- established inland.

For the period considered by the Blue Plan, a substantial recovery of steel production in the European Community is unlikely (as seen in Chapter III-2) ; in contrast some currently industrializing countries south and east of the Mediterranean basin should develop their production considerably, probably by using the direct reduction technique based on natural gas. On this assumption, coke transport towards these countries would not expand ; on the other hand, they should start importing iron ore as their domestic resources are insufficient in either quantity or quality.

Rather than metallurgical coke, the bulk of maritime transport in this weight cargo category is composed of "steam coal", used mainly for electricity generation. The Blue Plan scenarios imply the vigorous growth of electricity consumption in the countries south and east of the basin, where the production capacities to be created will be mainly thermal. Along with heavy gasoil and natural gas, coal will certainly play an important role, especially in countries with insufficient hydrocarbon resources, a fortiori on the assumption of a considerable rise in oil prices. Coal transport is therefore likely to increase in the Mediterranean.

Since the region has comparatively little coal or high-grade iron ore, weight cargo traffic heading for Mediterranean ports comes from outside the basin : USSR, United States, South Africa and Australia for coal ; west coast of Africa, India, Brazil and Canada for iron ore. These imports from distant sources are the subject of contracts for high tonnages, which furthers the use of ore carriers or high tonnage freighters, most of them in the "Panamax" category (70,000 tonne capacity), but some of them exceeding 100,000 tonnes, even 150,000 tonnes capacity, insofar as reception ports have the necessary draught, storage space and facilities for these large ships and the handling of their cargoes.

As regards grain, the countries on the south and eastern shores of the basin are already major importers, especially Algeria and Egypt. Anticipated population growth in these countries and their limited agricultural resources implies strong growth of these imports up to horizons 2000/2025, which will come chiefly from distant sources such as Argentina, the United States and Canada.

Considering the large number of grain loading points, often located in ports with shallow draughts, grain traffic is broken down into smaller quantities and usually transported by low tonnage freighters ranging from 20,000 tonne capacity to 30,000 tonne, rarely exceeding 50,000 tonnes on average. Small tramp cargo boats are also used. In future, average tonnage should rise moderately.

Many other "dry" goods are transported by sea in bulk : various ores, among which phosphates, bauxite and manganese are the most important in terms of volume ; natural or agricultural products such as wood, soya and various oilseeds ; and finally finished and semi-finished industrial products, such as cement and clinker, crushed or powdered chemicals, fertilizers, oilcake and other animal feeds.

"Liquid bulk goods", aside from hydrocarbons, are also transported : chemicals, vegetable oils, molasses and even fresh water. Aside from the latter, exceptionally exported from Provence to southern Spain during recent periods of drought and which can be transported in ordinary tankers (well cleaned), these products, because of their physical or chemical characteristics or because they are foodstuffs, must be loaded onto small or medium-sized tankers, barely exceeding 20,000 tonne capacity, but divided into sections and installed with special equipment for the handling and storage of the liquids transported, either alternatively or simultaneously.

All these kinds of transport exist in the Mediterranean, and although many come from outside it some originate there, such as phosphates and phosphoric acid exported by Tunisia (those coming from Morocco are loaded at its Atlantic ports), cement manufactured in Greece and Spain, or wines loaded in wine storage ships leaving from Spanish, French, Italian and Algerian ports. On the whole, however, the region is more an importer than an exporter of both "lesser bulk goods" and "major bulk goods", in order to meet the requirements of the processing industries located mainly north-west of the basin, and the food and animal feed requirements in the south-eastern countries.

The scenarios formulated by the Blue Plan all envisage the more or less rapid industrialization of these southern and eastern countries. This will result in the growth of their bulk imports of raw materials and semi-finished goods, which will become increasingly varied as their industrial fabric diversifies. A similar phenomenon will occur in the case of the bulk transport of foodstuffs under the growing pressure of these countries requirements, which will expand not only globally as a result of population increase, but will also diversify, due to rising standards of living.

Thus the maritime transport of lesser bulk goods should, like that of major bulk, experience rather strong growth in the Mediterranean up to the Blue Plan horizons, since the stagnation, even declined in tonnage unloaded in the north-western ports would be amply offset by the increase in that handled by other ports. This will imply the rethinking of port installations in most of the southern and eastern countries, in order to receive and handle a much larger number of bulk carriers, whose size will tend to expand with the increase in traffic.

3.2. Perishable foodstuffs

Citrus fruits and other fruit and vegetables exported by the countries south and east of the Mediterranean to western Europe are generally transported by sea ("fruit" cargo ships installed with ventilated, refrigerated holds), as routing by air is only justified for a few fragile fruit during periods when their value is very high. Because of the bulk break points and temperature changes between the departure port and the arrival port, a quickly growing portion of perishable foodstuffs is loaded at the production site onto trucks, semi-trailers or isothermal containers which, after crossing the sea in a ro-ro cargo ship or container carrier, arrive at the major consumption centres by road. By using these "load units" in this way, goods do not need to travel by special ship and can fit into the flow of "general goods" transported mainly by regular cargo lines.

Fruit and vegetables are currently very important exports in terms of value for some countries like Morocco and Israel, but as illustrated by the example of Algeria, they may stagnate or decline in the future due to increasing domestic consumption and the limitations that scarce water and arable land resources impose on production increases.

Few deep-frozen products are currently transported in the Mediterranean, aside from fish caught off the west coast of Africa by Greek and Egyptian deep-sea trawlers. Meat imports by countries south and east of the basin are rather low, but should expand vigorously during the period covered by Blue Plan scenarios, as in the case for other foodstuffs. For ritual reasons, however, cattle is imported on the hoof rather than as refrigerated carcasses, and unless special abattoir chains under the supervision of Muslim and Jewish religious authorities are organized in the exporting countries, it seems likely that this kind of transport will continue and that the large "floating sheep-folds" that currently transport Australian and New Zealand sheep to the Middle-East will also ply the Mediterranean.

3.3 General merchandise

Transport in the Mediterranean has, from time immemorial, been characterized by the very broad variety of the goods transported, as proven by the inventories of cargo on recovered wrecks. The very broad category "general merchandise" or "miscellaneous" still accounts for the majority of port operations, considering how often cargo-boats, usually from regular lines, call into port.

This merchandise is handled in either traditional packaging : bags, bales, drums and boxes, increasingly placed on pallets, or closed "load units", twenty- and forty-foot containers, semi-trailers and trucks. Three basic kinds of ship correspond to these packaging categories : the traditional shipping line cargo-boat with several bridges, equipped with its own lifting mechanism, the compartmentalized container carrier, usually using port gantries, and the ro-ro cargo vessel with horizontal boarding for vehicles or semi-trailers (which also takes containers). There are also combined ships : polyvalant cargo boats and ro-ro container carriers.

Although one of the world's main container carrier routes, the one linking north-west Europe to Asia and Oceania crosses the Mediterranean over its broadest width, between the strait of Gibraltar and the Suez Canal, the penetration of containers in Mediterranean traffic as such has been comparatively slow; of the 56 million "twenty-foot equivalent" units transported by sea throughout the world in 1985, only 8% were loaded or unloaded in Mediterranean ports.

In contrast, ro-ro cargo-boats have gained ground over the past twenty years for intra-Mediterranean links, first of all for north-south connections and more recently for the routes crossing the basin lengthways. In 1987, more than 100 regular lines offering ro-ro services crossed the Mediterranean and the Adriatic in every direction.

Prospects for general merchandise traffic vary greatly depending on the different scenarios formulated by the Blue Plan. A very global approach (which would have to be confirmed by detailed sectoral analyses), indicate however, that in an initial stage the southern and eastern countries will greatly increase their imports of capital goods and transport equipment, while nevertheless increasing their domestic value added. In a second stage, the increase will involve consumer goods and household equipment. In contrast, general merchandise traffic in the ports north-west of the basin is already very high and its growth prospects are more limited.

The growth of general merchandise traffic between coastal countries and with the rest of the world will be accompanied by a growing concern for the productivity of maritime transport, which implies the increasing use of faster handling techniques such as containerization and ro-ro services. In the first case, introduction in ports south and east of the Mediterranean has been slow, sometimes for lack of equipment but especially of the organization needed for the rapid flow of these load units in the port hinterland. These shortcomings may be remedied under the pressure of demand for the transport of goods that can be containerized on arrival, or coming from industrialized countries outside the basin.

In fact, ro-ro traffic will predominate on intra-Mediterranean links, and although the use of containers will also develop, these units will mainly be loaded, like trucks and semi-trailers, on to ro-ro cargo vessels and, outside the tourist season, on passenger ro-ros. As regards the latter, the rise in living standards expected in the countries south and east of the basin will tend to balance the north-south tourist flows, and the use of maritime transport could rise because of the growing difficulty of air transport to meet the high season peaks.

The expected increase in the number of cargo and passenger drive on-drive off vessels operating in the Mediterranean presents a special problem as regards hazards for the marine environment. In fact, the expected growth in the transport of chemicals will be accompanied by a diversification in uses and destinations which will inevitably increase the load of these ships of drums and road tanks whose contents are often highly toxic and sometimes poorly identified. And yet, because of their structure with little transversal compartmentalization, ro-ro vessels are particularly prone to capsizing and sinking after a collision, grounding, or even the shifting of poorly stowed cargo in a very high sea.

Care should therefore be taken to ensure that these loads, hazardous for the marine environment are, as far as possible, transported on other kinds of ship that are less unstable after a mishap. Nevertheless, it is unthinkable to exclude all these goods from ro-ro freight flows, but it should be rigorously ensured that in future these good are loaded only on ships yet to be constructed which will meet the new international safety regulations currently in preparation, much stricter as regards the stability and floatability of drive-on drive-off vessels than those either to applied.

4. Hazards for the marine environment

The expected development of maritime traffic in the Mediterranean implies, as has just been mentioned for ro-ro freighters, the tightening up of regulations on ship safety and pollution control, and also closer supervision of international regulations by port authorities and national navies, which are generally competent to organize monitoring in the high seas. Those responsible for maritime traffic, ship owners and ship captains should observe an increasingly strict discipline, especially those operating under flags of convenience from small countries which hardly have the means to supervise the application of international conventions.

It is currently estimated that more than 200,000 commercial vessels over 100 GRT cross the Mediterranean each year. At any moment, there are about 2,000 of these ships at sea, of which 250 to 300 are oil tankers. This figure should grow considerably in the future, despite the trend towards increasing vessels tonnage which accompanies the rising volume of traffic.

Traffic is already very heavy in some areas near major ports or near some obligatory crossing points such as straits or the Suez Canal. Fortunately, navigating conditions are usually easier than in other parts of the world because of the reliability of maps and marine signalling, weak tides and currents, and finally good visibility most of the time. Nevertheless, modern monitoring and assistance systems should be improved and the concerted efforts of coastal countries in this respect is increasingly essential, especially since the transport of hazardous materials and of passengers is expected to increase during the period covered by the Blue Plan.

The current frequency of "events at sea" is about sixty a year and they are most frequent near the Straits of Gibraltar and the Dardanelles, as well as in the waters east and south of Greece.

Aside from hydrocarbons, the most dangerous substances for the marine environment are some chemicals which, if accidentally spilt either sink or, depending of the case, form sheets or clouds of gas or vapour, part of which is dissolved or dispersed in water. The products that are transported in bulk, such as phosphoric acid, nitric acid, benzene, methanol, phenol, trichlorethane are carried in special takers, suitably equipped with closed compartments and a double hull to reduce spills in case of accident.

Products transported either packed or in drums, loaded like general goods on cargo boats, particularly ro-ros, are not the least harmful because they include hydrazine, sodium hydrosulphite and arsenic anhydride. Some industrial or nuclear waste also travels in drums or armoured casks, but their loading on non-specialized vessels should be totally prohibited.

Clearly any prospective study on the subject brings into play assessments of the hazards involved in the combination of ship, load and navigating conditions, along with the formulation of appropriate precautionary or emergency measures. The increased risk stemming from expected growth in the traffic of hazardous materials should be partially offset by technological progress in maritime safety and increasing automation on ships. Annex II of the MARPOL 73/78 Convention should also have a positive effect when it comes into force.

Concerted effort among coastal states on maritime hazards, which falls within the scope of the work programme adopted in Genoa in 1986, must advance rapidly in order to tackle this growing problem. It is worth noting in this respect the decision taken in 1988 by these states to enlarge existing co-operation as regards hydrocarbon transport carried out in the Malta Centre to include the prevention of accidents at sea involving the transport of chemicals. Nevertheless, it is clear that in this new area, much more difficult to delimit than that of oil, increased co-operation among maritime and port authorities will be needed in order to improve identification of loads and their destinations.

D. AIR TRANSPORT

For the past twenty years, air transport has considerably changed the geography of the Mediterranean basin. Distances have been shortened to the extreme ; it used to take about three months to sail across the Mediterranean from east to west, nine days in a steam ship a century ago ; four hours today over the longest distance.

The existing rigidities of the air network, which still oblige passengers to transit through off-centre gateways such as Madrid, Paris, Belgrade or Frankfurt, Geneva or Zurich will gradually disappear and an intra-Mediterranean mesh will be formed, with many more direct links.

Currently transport through the large airports is a reflection of the major agglomerations. In the coastal regions, Barcelona, Marseilles, Nice, Rome, Athens, Istanbul, Tel Aviv, Cairo, Algiers are all operational. And already the geography of airports is revealing other hubs : Malaga, Alicante, Palma and Ibiza, Corfu, Monastir etc., whose future is linked to tourism. Recreational aerodromes are opening up some regions. On the whole, accessibility is good, which explains for example why the hydroplane could not find its niche in the Mediterranean, even for low capacity transport.

Freight, which still represents only one tenth of the tonnage transport, is growing and is a considerable resource for airports. It is linked only partly to tourism, and in one direction it involves the transport of high value manufactured goods (electronic materials, etc.) and, in the other, the transport of agricultural produce able to bear the cost of transport (early fruit and vegetables).

Air transport in the Mediterranean, however, at present involves essentially passengers - professional people, migrants but above all tourists : the aeroplane is the way in for about 25 % of tourists. Naturally, this figure varies from one country to another, as seen in Chapter III-4, but on the whole it is likely that the level will rise considerably during the next decade.

In addition to technological changes which will not fail to effect aviation (speed, safety, consumption etc.), prospects for intra-Mediterranean air transport will no doubt be closely linked to relations among coastal countries. The growth of tourism will play a major role among them : according to the Blue Plan scenarios, tourist flows could increase by a factor of two to three in the low growth hypotheses, and by seven in the strong growth hypotheses. There will probably be a rise in the proportion of tourists from distant origins (the United States, Japan or the Middle East) which currently account for about one fifth of international tourists.

The annual average growth of air traffic flows for the period 1985 to 2000 in an average scenario (T-1) would be 4 % for the countries on the northern shore and 6 % for those on the southern and eastern shores.

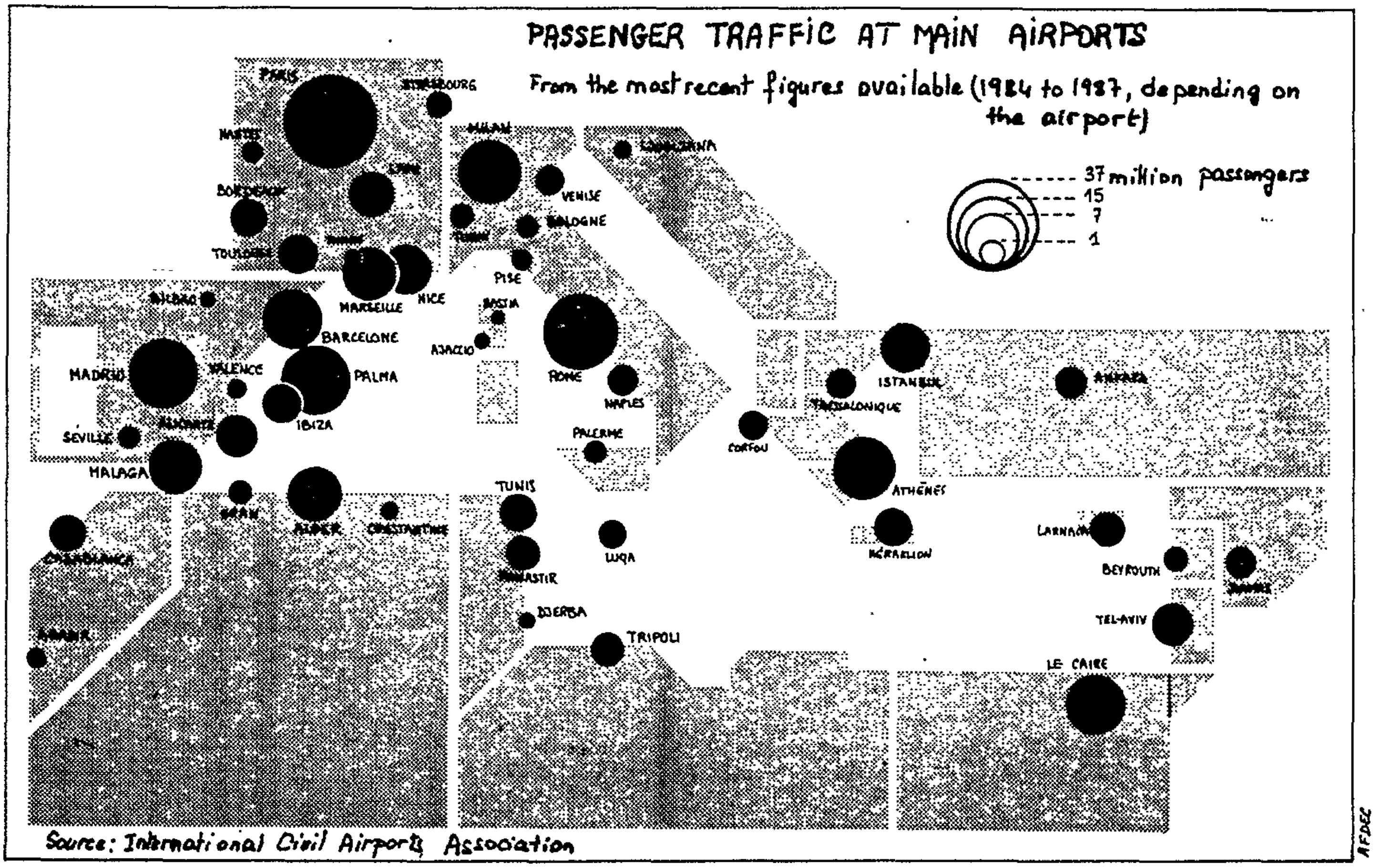
The frequence of flights and the expansion of networks will lead to a growth in the size of fleets and the enlargement of many airports on the southern and eastern shores, as well as the creation of new airports, mainly at the regional level. The development of "third level networks" will become necessary as a result of the strengthening of regionalization policies and interregional relations, considerable in the countries north of the basin in all the scenarios - except for perhaps worst trend scenario T-2 - and in the southern countries in moderate trend scenario T-3 and the alternative scenarios. But small airports will necessarily have to be profitable, since their activities rely moreover on the economic dynamism of the region they serve.

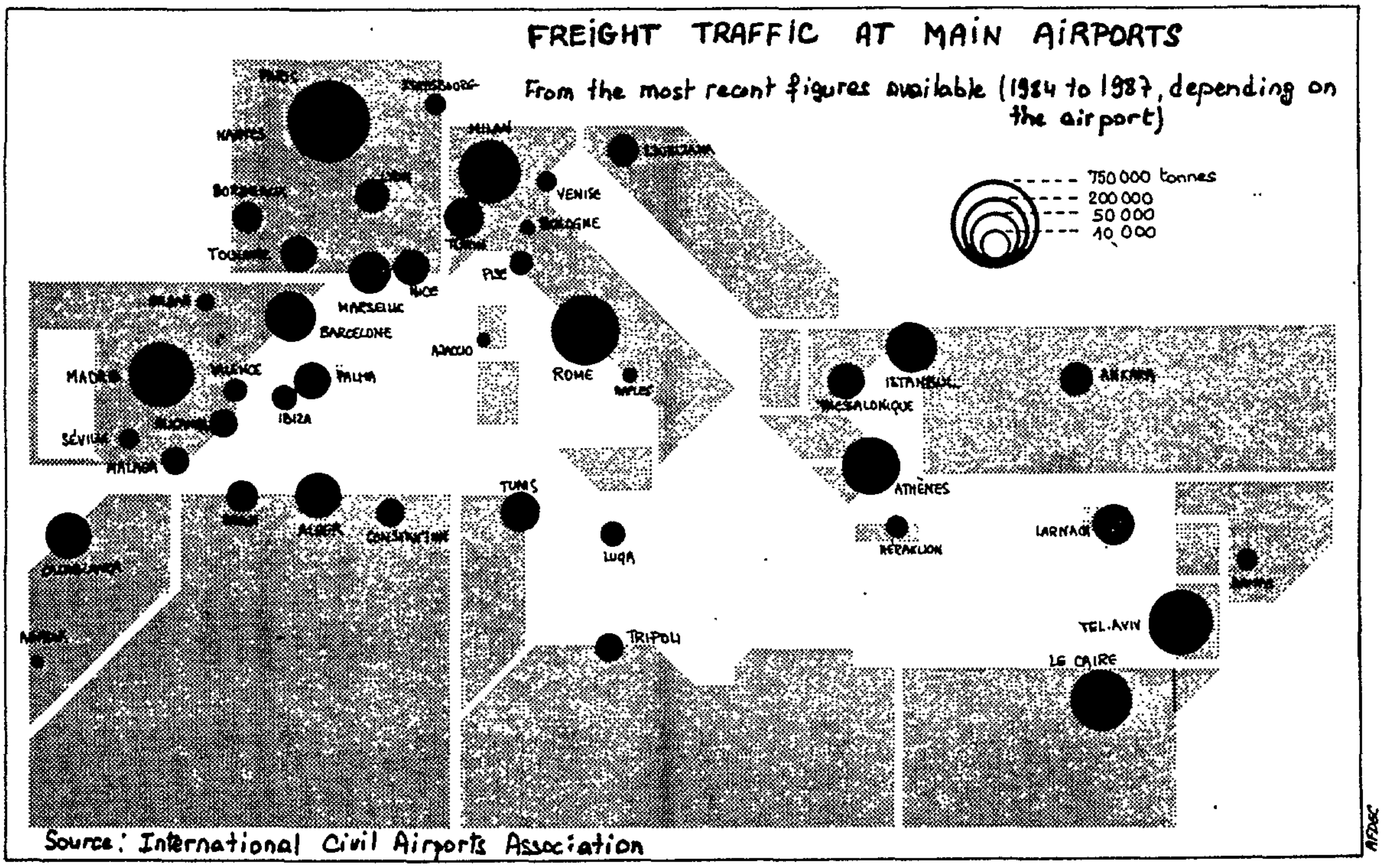
The expansion of international tourism will require the development of gateways for long-range carriers. But as regards the growth of intra-European and intra-Mediterranean traffic (mid-range carriers) :
- either traffic flows are or will be sufficiently large to justify the use of mid-range carriers, with direct flights ; this will be the case of the main departure or arrival points for international tourism in the region. The growth of flows could be stabilized in the high season (staggering of holidays over several months is foreseen in the A scenarios, which will help to decongest airports and air corridors while ensuring increased cost-effectiveness of equipment) ;

- or traffic flows are lower ; their services will operate via connection turntables and/or direct links, but in this case lines using smaller airplanes could not offer very attractive services (rather high cost per seat, despite expected improvement). This situation corresponds more to the "business" links which would develop with interregional relations.

Relationships between air transport and the environment concern both airports and aeroplanes.

As regards airports, the problem of site coverage should be noted : the extension of existing congested airports (already started in Cairo), but also the establishment of new local or regional airports are to be expected (perspective studies will no doubt involve some major tourist sites, but new airports will be limited).


PASSENGER TRAFFIC AT MAIN AIRPORTS
From the most recent figures available (1984 to 1987, depending on the airport)
37 million passengers
15
7
1
PARIS
STRASBOURG
NANTES
LYON
BORDEAUX
TOULOUSE
MARSEILLE
NICE
MILAN
VENISE
TURIN
BOLOGNE
PISE
BASTIA
AJACCIO
ROME
NAPLES
PALERME
BILBAO
BARCELONE
MADRID
VALENCE
PALMA
IBIZA
SEVILLE
MALAGA
ORAN
ALGER
CONSTANTINE
CASABLANCA
TUNIS
MONASTIR
DJERBA
LUQA
TRIPOLI
CORFOU
THESSALONIQUE
ISTANBUL
ANKARA
ATHÈNES
HERAKLION
LARNACA
BEYROUTH
TEL-AVIV
LE CAIRE
Source: International Civil Airports Association
AFDEC


FREIGHT TRAFFIC AT MAIN AIRPORTS
From the most recent figures available (1984 to 1987, depending on the airport)
750 000 tonnes
200 000
50 000
10 000
PARIS
STRASBOURG
NANTES
LYON
BORDEAUX
TOULOUSE
MARSEILLE
NICE
MILAN
VENISE
TURIN
BOLOGNE
PISE
AJACCIO
ROME
NAPLES
BARCELONE
MADRID
VALENCE
PALMA
IBIZA
SEVILLE
MALAGA
ALGER
CONSTANTINE
CASABLANCA
TUNIS
LUQA
TRIPOLI
THESSALONIQUE
ISTANBUL
ANKARA
ATHÈNES
HERAKLION
LARNACA
TEL-AVIV
LE CAIRE
Source: International Civil Airports Association
AFDEC

Many airports have been built on the edge of the sea because of land use in coastal areas and efforts to avoid low-altitude flights over urban areas. Hopefully precautions will be taken in the future to avoid some kinds of land-fill which destroy shallow waters.

Noise is inevitable around airports : but the outlook for this nuisance will largely depend on the substantial progress already achieved for new aeroplanes (over the last fifteen years in particular). It will also and above all depend on the strategies and application of measures enacted by the land authorities ; in order to counteract the speculative growth of housing, these authorities could envisage the development of economic zones linked to air transport and its activities.

As regards aeroplanes, consideration must be given to air traffic, the current limits of civil air corridors, and observance of corridors. The likelyhood of congestion must also be tackled. This is already occurring (with unexpected severity in 1988) and is likely to grow at least up to 1992, even 1995 (time needed to bring corrective measures into operation, or possible slow-down in the growth of international and/or domestic traffic).

In the next ten years, a generation of much larger capacity aeroplanes may be developed (over 400 passengers), involving the heavily used major airports or furthering high density tourist routes. The trend will be towards reduced fuel consumption. For a more distant future, there is also, even now, the question of alternatives, such as motors running on liquid hydrogen. But in the medium term, one of the major "wastage" problems to be solved (waste of time, resources and the quality of life) will be that of air congestion around certain airports.

III. TELECOMMUNICATIONS IN MEDITERRANEAN BASIN

Telecommunications are an important means of "transport" for the future of commercial relations among Mediterranean countries ; their development supports and accompanies that of national and regional economies while reflecting relations (special or too weak, depending on the case) between neighbouring or distant countries.

The blue plan undertook a perspective study of telephone traffic among Mediterranean countries. The study and the following findings (obtained with the systems of France Câbles) are based on documents published regularly for Europe and the Mediterranean basin by the international advisory commission for telephones and telegraph specialized body of the I.T.U. (International Telecommunications Union).

To extend the I.T.U. estimates beyond 1990, the following annual growth rate of traffic were chosen for telephone ; plus five percent from 1990 to 2000, plus three percent from 2000 to 2025. As regards requirements other than the telephone, these represent a variable portion of telephone traffic, increasing with time, taking into account the emergence of new services, made possible by the numerization of a network : five percent in 1990, ten percent in 2000 and twenty percent in 2025.

Before 1990, the telephone circuits used as the medium for the telegraph and telex are estimated at three percent of the number of telephone circuits used for local telephone communications. Even if this percentage remains low, it should be noted that the corresponding operating revenue are not and could be equivalent to ten and twenty percent of purely telephone revenue.

Overall, the findings of the studies showed that for the countries in the Mediterranean region, paying telephone minutes will be increased by a factor of 5.5 between 1985 and 2025 (from less than 1,000 million to more than 5,000 million) and that the number of circuits (telephone, telex, telegraph and new services) will increase by a factor of 4.5 (from 12,600 to over 57,000) (see figures).

It should be noted that in the introduction of digitalized transmission techniques will be widespread in the 1990-2000 period, gradually replacing the former analogue techniques and reflected by greater efficiency of the network as a whole.

Underwater cables are one of the basic components for routing intra-Mediterranean telecommunications. An initial network of underwater optic-fiber cables is being set up and will link Israel, Turkey, Greece, Italy, France and Spain in 1991. It can be expected that all the current networks will have been replaced by an optical-fiber cable network by 2000.

The attached figures clearly show that the predominant telephone links in the Mediterranean basin, are north-south and north- north. Aside from a Libya and an Egypt-Lebanon cable, there are in fact no direct underwater links among North African countries themselves or with the Middle Eastern countries. This can be considered as an additional indication of the flimsiness of the real economic ties between countries in these ares, whose enlargement was examined in the A scenarios.

IV. ISSUES FOR APPRAISAL

One of the first issues concerns trends in the distribution of various means of transport during the next fifteen and forty years, the horizons of the Blue Plan scenarios. Although the future of maritime transport seems to be fairly well delimited, it is much more open-ended for road and air transport and "unexpected eventualities" cannot be excluded for rail (high speed trains, even ultra high speed trains). The "energy consumption" aspect no longer seems to take priority as it did in the past decade, but what will be the case in ten or twenty years time when global energy consumption will have grown, transport will have increased everywhere and some energy sources will start to become scarce ? Consumption efficiency certainly rising along with technological advance, but increased speed always has to be paid for in energy. And the "fuels of the future" which are sometimes mentioned -methanol, hydrogen, even electricity- are only derived energies which have to be produced, often with fairly low overall output, from available primary energies.

Will road transport in fact continue to grow, whether for door-to-door goods, over distances exceeding thousands of kilometres, or for private transport, swollen by growth of leisure time, the breaking up of holidays, the dispersion of housing, etc. The countries of southern Europe despite the congestion and pollution of cities (described for example in Athens as a major ecological disaster), and the heavy and constant cost in human lives, continue to encourage their automobile industry, gradually followed by all the countries. And despite of often considerable financial efforts, infrastructure (including parking possibilities in cities) cannot keep space with traffic growth, a fortiori in the Mediterranean region with its compartmentalization, growing scarcity of space in coastal regions, etc. Will this lead to a segregation of traffic in time and/or in space between trucks and private vehicles ?

How will air transport face up to the growth in traffic observed over the last few years and more specifically the charter traffic partly responsible for the congestion experience in 1988 ? Will it be through an increase in aircraft capacity, equivalent to promoting certain already overburdened routes to the detriment of a regionalization of traffic ?

It is clear that the relationships between transport and the environment are complex. The problems of pollution (chemical and noise) are sometimes tackled through technological progress but also through the application (sometimes difficult or poorly accepted) of a now well known technical solutions or by regulations which are only worth as much as the awareness of their target population or the supervisory capacity of their authors. Perhaps less attention has been devoted to the problems of site coverage and the location of infrastructure, an issue which would have to be tackled in the general context of national physical planning, especially for countries in which this kind of infrastructure will develop most vigorously.

These questions highlight the growing need for national and international co-operation on means of transport, which incidently raises the question -mentioned in the first section- of the location of decision-making centers in the ever-growing field of travel.

CHAPTER III.6

URBANIZATION AND "LITTORALIZATION"

Cities have played a fundamental role in the history of the Mediterranean region. With their different functions they have, for more than two thousand years, foreshadowed an early form of "urban network" which is today an increasingly pronounced geographical characteristic of world urbanization.

Places for exchanges, "communication centres", sources of cultural identity and shaping forces in the development of civilizations, the Mediterranean cities were formerly built on a scale commensurate with direct community life. Building materials and techniques determined the configuration of the buildings within the limits of a setting itself determined by the relief. Social and economic bonds were firmly established over long periods of time.

Although their societal and economic role is just as great today - and some 80 % of Mediterraneans will live in them in one generation, as against only 40 % half a century ago - their size and configuration have turned them into conurbations, regulated in varying degrees. More than 200 million Mediterraneans are now concerned by the management of urban sprawl and the balance of urban life. Environmental problems, inevitable with the increasingly artificial nature of the urban framework, are more marked at the city gates in areas affected by "suburbanization", but also in the very centre of cities where congestion is frequent. Many Mediterranean cities are sick on account of problems arising from their size or their growth.

Without going into all the issues bound up with urbanization, the work done under the Blue Plan has been concerned with identifying some of the trends relating to the relations between growth and environment. They will be outlined here taking into account the fact that the future will, it is true, depend on changes in size and scale or systems of growth, but just as much on the way in which city authorities will ensure that urbanization is kept under control and on the extent to which they will succeed. The stakes will be particularly high as regards the environment and the quality of life in coastal regions which, moreover, are increasingly becoming focal points of accelerated urbanization.

I. A LOOK AT THE RECENT PAST : 1950-1988

The countries south and east of the Mediterranean basin have since the mid-20th century been characterized not so much by an evolution as by a real "urban explosion" : not only by the number of city-dwellers, but also by the greater density of urban housing, peri-urban sprawl, the transformation of ways of life and consumer patterns, the daily scale of the commuting made necessary between the home and the place of work, and the nuisances of traffic jams and pollution. These developments have already generated numerous imbalances in respect of water consumption, the wasting of agricultural land, congestion, the confusion of buildings, the ugliness of suburbs, etc.

A. URBAN DYNAMICS

Between 1950 and 1985 the number of people in the world living in cities increased by 2.7 times and it is reckoned that by the end of the century half the world's population will be concentrated in a proportion of 78 % in the most developed countries and 40 % in the least developed countries.

In all the countries of the Mediterranean basin, out of a total population of 335 million in 1985, the urban population represented about 207 million, i.e. 58 % of the population living in an urban district, as against 43 % in 1950.

In 1950, Spain, France and Italy together accounted for 70 % of the 91 million city-dwellers, and in 1985, still 52 %. While the total population of the Mediterranean area increased by 168 % between 1950 and 1985, the urban population for its part rose by 227 %. In the east and south, the rates of urban growth and population growth are interconnected.

Spain, France and Italy differ from the other countries in the Mediterranean area in regard to both the level of urbanization attained and present rates of urban growth (Greece and Yugoslavia occupy a specific, intermediate position). In order to bring out the contrasts more clearly, the Mediterranean countries have been placed in three groups : the north-western countries, the sourthern and eastern countries and a few "intermediate" countries (Table III-33).

During the period 1950-1970 group A (Spain, France, Italy, Yugoslavia and Greece) underwent very marked urbanization, starting just after the last war, with a maximum being reached in the 1960s ; this was due, firstly to the rural exodus and the promotion of certain former rural districts, and secondly, from the natural growth of the population. During the period 1970-1985, this trend continued in Spain, Greece and Yugoslavia but slowed down in France and Italy.

Region	% share of the urban population			Number (in millions)			Multiplier in relation to 1950		
	1950	1965	1980	1950	1965	1980	1950	1965	1980
Total Med. countries	42.9	50.9	56.8	91	135	189	1	1.48	2.08
Region A	49.8	58.9	66.1	70	95	119	1	1.36	1.7
Region B	29.6	37.4	44.4	19	36	63	1	1.89	3.32
Region C	35.0	56.1	67.8	2	4	7	1	2	3.5

Source : United Nations and Blue Plan

Table III-33 EVOLUTION OF URBAN POPULATION IN THE MEDITERRANEAN BASIN

The southern and eastern countries (placed in group B) comprised a total urban population of 20 million in 1950, representing some 50 % of the urban population of the Mediterranean area. In 1985 this population rose to 75 million (an increase of 275 %) and the rate of urbanization attained 47 %

This marked expansion of the urban population in the sourthern and eastern countries was due to total population growth (multiplied by 2.4 during the period 1950-1985) and to the increase in the rural exodus whose contribution sometimes increased in certain cities to an annual rate of more that 3 % (Algiers, Cairo). The number of urban settlements and towns has sharply risen there since the 1960s as a result of the creation of new urban districts and the extension of urban boundaries. But the rate of this growth of the urban population in the southern and eastern countries has not been matched by urban development (development schemes and services) which should have accompanied it, nor by the creation of jobs, in other words, urbanization has preceded industrialization.

Intensive growth has on the whole occurred on existing sites. There have been very few "new towns" and these have taken the form of deliberate exstensions (Fos near Marseilles or development units in Israel) or of tourist developments (Costa Brava in Spain, Dalmation Coast in Yugoslavia, Languedoc-Roussillon in France). The essential part of the growth has been concentrated on existing cities, born of a combination of historical and geographical factors. Large-scale work has been carried out to allow for the growth of existing cities and to overcome handicaps (in respect of water resources for instance), but even in cases of earthquakes, cities have been rebuilt on former sites.

The unequal evolution of the countries of the north and those of the south and east has been compounded by difference in economic (and urban) development between the various regions in each country, highlighting a certain type of special extension of urbanization around a particularly favoured urban axis (Istanbul-Izmir), often following a coastline (Casablanca-Rabat, the Tunisian Sahel, the region of Alexandria), or around a capital (Athens, Cairo, Algiers, Tunis). There is an increasing concentration of towns along the Mediterranean coast, with many conurbations in the north-west, from Barcelone to Genoa.

Définitions of Urban Population

COUNTRY	Définitions supplied by National Statistics offices
Région A	
Spain	Localities of 10 000 inhabitants or more. Municipios of 2 000 inhabitants or more.
FRANCE	Communes with a centre of more than 200 inhabitants living in adjacent dwellings or not more than 200 metres distant from one another and communes where the majority of the population lives in a multi-communal centre of this type.
ITALY	Communes of 10 000 inhabitants or more.
GREECE	Population living in municipalities and communes of over 100 000 inhabitants including the 12 urban centres : Greater Athens, Greater Salonica...
YUGOSLAVIA.	Localities of 15 000 ihnabitants or more ; localities of 5 000 to 14 999 inhabitants with less than 30 % active in agriculture ; localities of 3 000 to 4 999 inhabitants with less than 70 % active in agriculture ; localities of 2 000 to 2 999 inhabitants with less than 80 % active in agriculture.
Region C	
MONACO	Total population of the commune of Monaco.
MALTA	Urban centre of Valetta
ALBANIA	Towns and other industrial centres of over 400 inhabitants.
CYPRUS	Six district towns and suburbs of Nicosia
LEBANON	Localities of 5 000 inhabitants or more.
ISRAEL	All settlements of over 2 000 inhabitants excepting those where at least a third of the heads of household belong to the active civil population living on agriculture.
Région B	
TURKEY	Population of localities situated within the municipal boundaries of the chief towns of the provinces and districts including the centre of Istanbul.
SYRIA	Towns, district centres (Mohafaza) and sub-district centres (Mantika).
EGYPT	Chief towns of the Governorates of Greater Cairo, Alexandria, Port Saïd, Ismaïlia, Suez ; chief towns of frontier Governorates ; other chief towns of Governorates and chief towns of districts (Markaz).
LIBYA	Total population of Tripoli and Benghazi and urban sections of Beida and Dema
TUNISIA	Population living in the communes including the district of Tunis.
ALGERIA	All communes with a town, a rural town or an urban centre as chief town, including Greater Algiers..
MOROCCO	Population living in municipalities, autonomous centres and other centres including Greater Casablanca.

Although no attempt has been made here to undertake a systematic retrospective study of the coastal regions and the littoral proper, it may be noted for instance that the urban population of those regions rose between 1962 and 1968 from 2,745,000 to 3,329,000 for France, from 824,000 to 1,357,000 for Morocco, and from 2,532,000 to 4,262,000 for Algeria. The attraction of the coast, which has also been a factor in tourist development, is thus clearly seen.

B. THE SIZE OF CITIES

Where size and urban functions are concerned, the situation in the countries of the north-west (Spain, Italy, France) contrasts, by the organization, scale and diversity of the functions of the cities (industrial cities, ports, tourist centres, university towns, etc.) with the rest of the Mediterranean area. In those countries there is a relatively large number of regional capitals and small and medium-sized towns ; there are about 130 cities with a population higher than 50,000 in Spain, and 100 in France, i.e. a density of two to four cities per 10,000 km^2.

In the south and the east, settlement pattern reveals a relatively marked imbalance under the combined effect of the lesser relative importance of the big cities and the presence of a capital, clearly separated from the other conurbations. Often between 30 % and 60 % of urban employment is concentrated in the capital, and the sphere of its economic influence extends over practically the whole of the territory. The other cities have a very limited area of influence.

It may usefully be recalled that an unbalanced settlement pattern cannot but reflect very deep-seated structural imbalances. A strong movement in the direction of concentration aggravates the problems of urban development and weakens locomotive effect on productive economic activities ; it accentuates the disparity in the distribution of populations both between rural and urban regions and between different districts in the same city.

As for small and medium-sized towns, their number has greatly increased under the effect of administrative decentralization which has been in progress since the 1960s in the inland regions and new communication facilities. The distribution by size of those towns, according to their relative importance, confirms this situation.

A comparative analysis of the rate at which cities grow according to their size, at the national level, reveals that in a fair number of countries in the past few years it has been the medium-sized cities that have expanded most rapidly ; in regions where population growth is slowing down, the population of certain big cities has decreased in size. If population movements are observed at district level, it is seen that the centres of the biggest cities tend to remain stable (Istanbul, Cairo, Tunis) or to suffer demographic decline (Rome, Marseilles) on account of a movement towards outlying residential areas and suburbs and peri-urban areas.

The development of increasingly rapid means of transport and of telecommunication media has largely contributed to the mobility of firms and industries that were formerly centralized in a small number of capitals or big cities.

Higher standards of living and the demand for individual housing, the attraction of more wide-open spaces and leisure facilities, and the recent decentralization of distribution services (supermarkets) have accelerated the movement away from towns and towards suburbs, particularly in the north-west.

Over the past decade, France and Italy have been affected by a new form of spatial distribution of the population, namely urbanization or the "rurbanization" of the countryside. Thus in France during the period 1975-1985, there were relatively high rates of growth in districts previously considered to be "rural", a phenomenon facilitated by the spread of individual means of transport and telecommunications.

The past decade has thus witnessed the development of a new type of urbanization, resulting in different, more sprawling, more scattered and more widespread forms of spatial organization, often extending to rural localities that may lie 20-30 or more kilometres away from the urban centres.

In the countries of the north, the mainly residential peri-urban belts have sometimes become favoured spots for small, dynamic enterprises. In the countries south and east of the basin this trend simply takes the form of a number of isolated operatiuons, confined hitherto to conurbations that have effectively benefited from the progress of transport facilities and telecommunications.

C. RELATIONS BETWEEN URBANIZATION AND THE ECONOMY

The complexity of the relations between urbanization and economic and social life cannot be analysed in detail, but by looking at some of their essential features we may better understand ongoing trends, take stock of points of difference and lay the foundations for a prospective study. We shall therefore be considering migrations, technological development and land-use planning policies.

1. The role of migrations

Large-scale migratory movements have occurred within the Mediterranean countries, reflected generally in urbanization, accompanied by a switch on the part of those actively involved in the agricultural sector to industry and to certain tertiary activities. These large-scale population movements, which started in the northern countries in the 19th century, gradually spread to the countries south and east of the Mediterranean, especially after the Second World War.

Population trends in Marseilles and Istanbul for instance, clearly illustrate the dynamics of the major phases of these migrations. The population of Marseilles has increased sixfold in 150 years (from 111,000 inhabitants in 1801 to 640,000 in 1946). Likewise, Istanbul, starting with a population of 860,000 in 1945, attained 5,500,000 in 1985, which is more than six times as high.

The nature and scale of migratory movements have an obvious bearing on the spatial distribution of human beings and activities throughout the Mediterranean countries.

The most spectacular population movements, by virtue both of their magnitude and of the economic and social problems generated by the urban growth to which they give rise, are those that start in rural areas and go towards urban areas. These movements seem to result at present more from the unequal development of different regions, changes in agriculture and the inadequacy or indeed the absence of a non-agricultural rural economy than from the job opportunities effectively offered by the urban labour market.

As for migratory movements towards foreign countries, apart from their effects on population levels and structures, the substantial income (deriving from the sending of money by emigrant workers) received by a number of labour-exporting Mediterranean countries, mainly south and east of the basin, contribute not only to overall economic results but also to the profound implications these have for the rapid development of urbanization.

In the north, the increase in indicators of urbanization is due mainly to the migration balance, while in the south and in the east, the absolute increase in the urban population is also largely due to the population explosion, which is not confirmed to rural areas alone.

2. Technological development

Economic transformations, and especially economies of scale due to the concentration of production units and populations, largely explain the changes that have occurred in the Mediterranean cities within the space of a generation. However, technological changes play a central role in these developments. Some changes concern the economic function itself, others, urban forms of the context of the city.

The former include the new distribution and communication technologies. The first of these, connected with the rise of the automobile, lead to changes in trade (supermarkets in the suburbs), especially in the north-west ; and the second, which announce a "communication society", lead through computer technology and its offshoots to the emergence of a sector where, in some countries, the creation of jobs already exceeds industrial creations. Distribution and communication are the two growth vectors of the "tertiary" or "quarternary" sector whose development - even in countries where it is modest - is leaving the industrial sector far behind.

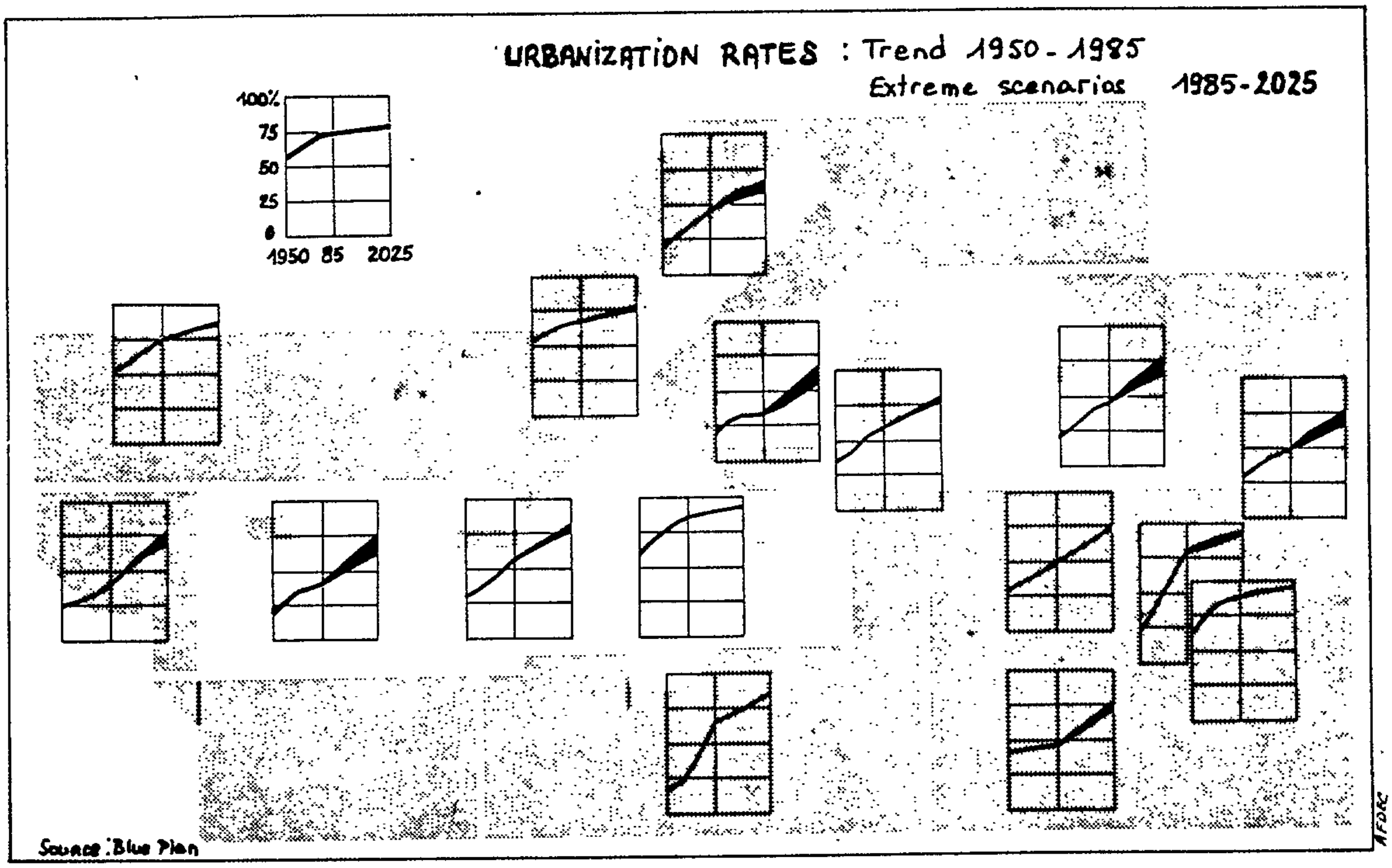
The new technologies do not merely have relations with urban functions : they transform cities in a variety of ways. Automobiles completely transform streets which are so important in ancient Mediterranean cities, and the change is not for the better. Although the introduction of pedestrian precincts provides a means of to some extent withstanding the invasion of automobiles in the centre of towns and medinas, their impact is considerable in the case of extensions of cities. New public transport technologies have for their part hardly progressed and the experimental forms they might assume have remained at the experimental state for 30 or 40 years.

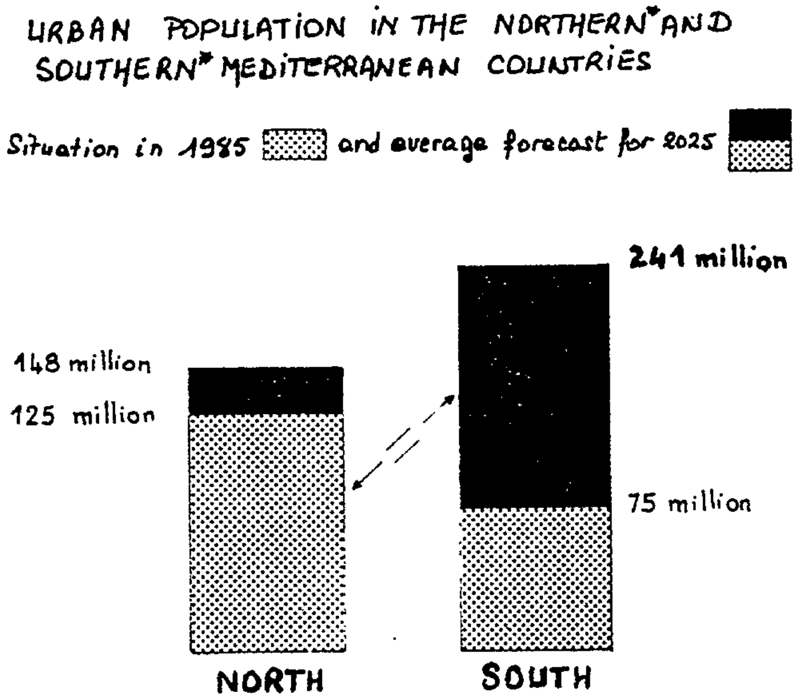
Building techniques and materials have progressed considerably. As a result, construction work is carried out faster, urban centres are able to be renewed (for better and for worse), buildings mount ever higher and areas can now be urbanized which previously could not be owing to the relief. But cities do not change in 20 years! Their physionomy remains marked by their history and by their infrastructures : the water supply and sanitation systems are usually 50 or 100 years old.

3. Land-use planning policies

Two types of policies have affected urban growth and especially the geographical·distribution of cities.

The first concerns the improvement of housing and what are called "urban amenities". Even though the factors contributing to the qualitative attraction of a city are not easily discerned, it has to be noted that some cities attract more than others. Mention may again be made in this connection of the attraction exercised by the cities on the coast ; but the main point to be noted is the supply of accommodation and the





The additional population in the South is equal to the current population of northern cities.

* Northern Countries : Spain to Greece - Southern countries : Morocco to Turkey.
Monaco, Malta, Albania, Cyprus, Lebanon and Israel are not included in this diagram, their total population in 1985, as in 2000 or 2025 is roughly equivalent to only 4% of the Mediterranean total.

quality of the buildings. Obviously no comparison can be made here between the various countries and there is a great gap in this respect between the North and the South.

In the countries north of the basin, at the quantitative level, the efforts made to improve the situation have on the whole been effective and most of the population are provided with decent accommodation and the associated facilities.

On the other hand, the measures taken to limit the growth of cities have seldom been successful, and the creation of new towns as a means of better distributing the population or in order to establish counter-magnets has been only half-successful.

In the countries of the south and east, the population explosion and the rural exodus have led to more and more people being crowded into the capitals and metropolises. Mass migration has overloaded the urban housing market, the labour market and all the public services. This has brought in its wake a segmentation and a sort of loosening of the urban fabric and has militated massively against economic and social development. On the whole, legal measures in the public or private sector have never been sufficient to cope with the demand. In addition, when private enterprise steps in, the inadequacy of the real estate market makes for a situation in which it can benefit from a ground rent which becomes increasingly substantial as urbanization proceeds apace and a well-to-do middle class emerges. The existence of a great variety of institutional means for regulating urban expansion and the efforts to promote subsidized housing have consequently not made it possible to control urban development in the countries of the south and east, as combined needs for such development largely exceed the real financial possibilities of households (housing) and public services (water, roads, sanitation and transport).

While, however, comparisons do not mean much between countries, they do at the national level, at least for those who migrate and are able to choose their residence.

The Mediterranean conurbations and cities are therefore faced with a large number of problems, according to the general situation of each country.

Thus in the past twenty years, the sudden growth of a number of large metropolises, from Istanbul to Casablanca, has generated fresh difficulties in respect of management and planning. The Cairo authorities, for instance, need to solve by the year 2000 the problems involved in providing housing and facilities for close on 1000 additional inhabitants daily.

The inadequacy of the means available to the countries of the south and the east to cope with their problems of housing and facilities, even minimally, has led to a form of urbanization very difficult to control and to the spread of spontaneous, makeshift and illegal housing on the outskirts of cities.

A distinction must however be made between urbanization proper, seen as the increasingly marked concentration of the population in conurbations, and the growth or decline of different centres. Thus, whether urbanization continues apace or, on the contrary, slows down, some cities decline and others expand.

The land-use planning policies decided upon at the national level, even when they are particularly strict (as in the cases of Algeria, France, Italian Mezzigiozno, Yugoslavia, Israel, etc.), have not so far affected

COUNTRIES	Urbanization rate	SCENARIO T1			SCENARIO T2			SCENARIO T3			SCENARIO A1			SCENARIO A2		
	1980	1985	2000	2025	1985	2000	2025	1985	2000	2025	1985	2000	2025	1985	2000	2025
SPAIN	72,79	75,79	79,97	86,94	75,79	80,20	87,56	75,79	79,73	86,31	75,79	79,73	86,31	75,79	79,62	86,01
FRANCE	73,23	73,44	75,21	78,17	73,44	75,55	79,08	73,44	74,87	77,26	73,44	74,87	77,26	73,44	74,07	75,13
ITALY	66,47	67,35	71,06	77,24	67,35	71,61	78,71	67,35	70,50	75,76	67,35	70,50	75,76	67,35	69,84	74,00
GREECE	57,73	60,12	67,54	79,91	60,12	67,84	80,71	60,12	67,24	79,10	60,12	67,24	79,10	60,12	66,66	77,57
YUGOSLAVIA	42,33	46,27	56,74	74,19	46,27	57,46	76,11	46,27	56,02	72,26	46,27	56,02	72,26	46,27	54,89	69,26
WHOLE REGION A	66,11	68,31	72,63	80,65	68,31	72,63	80,65	68,31	71,65	78,39	68,31	71,65	78,39	68,31	71,36	75,91
MONACO	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00
MALTA	83,14	85,30	89,35	92,38	85,30	89,35	92,38	85,30	89,35	92,38	85,30	89,35	92,38	85,30	89,35	92,38
ALBANIA	33,43	34,05	39,94	58,30	34,05	46,50	67,26	34,05	39,94	58,30	34,05	39,94	58,30	34,05	39,94	58,30
CYPRUS	46,31	49,47	59,69	73,73	49,47	59,69	73,73	49,47	59,69	73,73	49,47	59,69	73,73	49,47	59,69	73,73
LEBANON	74,77	80,08	87,99	91,83	80,08	84,56	92,03	80,08	87,99	91,83	80,08	87,99	91,83	80,08	87,99	91,83
ISRAEL	88,58	90,27	93,34	95,58	90,27	92,62	96,54	90,27	93,34	95,58	90,27	93,34	95,58	90,27	93,34	95,58
WHOLE REGION C	67,77	70,09	73,94	81,87	70,09	75,35	84,97	70,09	74,65	81,87	70,09	74,65	81,87	70,09	75,33	82,27
TURKEY	43,78	45,92	55,77	72,19	45,92	56,67	74,60	45,92	54,86	69,77	45,92	53,45	66,00	45,92	53,45	66,00
SYRIA	47,43	49,45	58,56	73,74	49,45	59,22	75,50	49,45	57,89	71,97	49,45	56,59	68,50	49,45	56,59	68,50
EGYPT	44,69	46,37	56,37	73,05	46,37	57,21	75,27	46,37	55,54	70,83	46,37	54,25	67,37	46,37	54,25	67,37
LIBYA	56,62	64,46	72,15	84,96	64,46	72,30	85,37	64,46	71,99	84,55	64,46	71,87	84,22	64,46	71,87	84,22
TUNISIA	52,32	56,76	65,48	80,02	56,76	65,84	80,96	56,76	65,13	79,07	56,76	64,65	77,81	56,76	64,65	77,81
ALGERIA	41,17	42,63	53,06	70,44	42,63	54,22	73,55	42,63	51,89	67,33	42,63	50,26	62,98	42,63	50,26	62,98
MOROCCO	41,28	44,80	55,85	74,26	44,80	57,06	77,50	44,80	54,63	71,01	44,80	54,17	69,78	44,80	54,17	69,78
WHOLE REGION B	44,37	46,58	56,64	73,25	46,54	57,45	75,68	46,58	56,64	73,25	46,69	54,59	67,88	46,69	54,59	67,88
Total Mediterranean countries	56,76	61,61	63,95	75,98	58,43	64,46	77,58	58,15	63,97	75,50	58,31	62,91	72,36	58,31	62,96	71,88

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Table III-34 URBANIZATION RATE OF THE FIVE MEDITERRANEAN SCENARIOS (%)

COUNTRIES	Thousand	SCENARIO T1			SCENARIO T2			SCENARIO T3			SCENARIO A1			SCENARIO A2		
	1980	1985	2000	2025	1985	2000	2025	1985	2000	2025	1985	2000	2025	1985	2000	2025
SPAIN	27,200	29,200	33,500	39,000	29,200	33,600	39,300	29,200	33,700	39,700	29,200	33,700	39,700	29,200	34,900	44,500
FRANCE	39,300	40,100	41,500	41,100	40,100	41,700	41,600	40,100	42,800	45,100	40,100	42,800	45,100	40,100	43,200	47,700
ITALY	37,900	38,600	41,100	41,400	38,600	41,400	42,200	38,600	41,300	43,300	38,600	41,300	43,300	38,600	42,200	46,800
GREECE	5,570	5,940	6,810	7,640	5,940	6,840	7,720	5,940	7,020	8,530	5,940	7,020	8,530	5,940	7,190	9,410
YUGOSLAVIA	9,410	10,700	14,000	18,500	10,700	14,200	19,000	10,700	14,100	19,300	10,700	14,100	19,300	10,700	14,200	20,100
WHOLE REGION A	119 000	125 000	137 000	148 000	125 000	138 000	150 000	125 000	139 000	156 000	125 000	139 000	156 000	125 000	142 000	167 000
MONACO	26	27	30	36	27	30	36	27	30	36	27	30	36	27	30	36
MALTA	306	327	373	424	327	373	424	327	373	424	327	373	424	327	373	424
ALBANIA	913	1,040	1,640	3,370	1,040	1,910	3,880	1,040	1,640	3,370	1,040	1,640	3,370	1,040	1,700	3,790
CYPRUS	291	331	455	665	331	455	665	331	455	665	331	455	665	331	455	665
LEBANON	2,000	2,140	3,180	4,790	2,140	3,060	4,800	2,140	3,180	4,790	2,140	3,180	4,790	2,140	3,370	5,460
ISRAEL	3,440	3,840	4,950	6,560	3,840	4,910	6,630	3,840	4,950	6,560	3,840	4,950	6,650	3,840	5,340	7,760
WHOLE REGION C	6 980	7 710	10 500	15 800	7 710	10 700	16 400	7 710	10 600	15 800	7 710	10 600	15 800	7 710	11 300	18 100
TURKEY	19,500	22,600	36,400	66,400	22,800	38,900	78,400	22,600	35,900	64,100	22,400	33,300	53,900	22,400	33,300	53,900
SYRIA	4,170	5,190	10,400	23,400	5,190	10,800	26,800	5,190	10,300	22,900	5,190	9,630	19,200	5,190	9,630	19,200
EGYPT	18,600	21,800	36,000	66,000	21,800	37,600	73,200	21,800	35,500	64,000	21,700	33,700	57,300	21,700	33,700	57,300
LIBYA	1,680	2,320	4,390	9,420	2,330	4,510	10,700	2,320	4,380	9,380	2,320	4,260	8,350	2,320	4,260	8,350
TUNISIA	3,340	4,020	6,170	10,300	4,050	6,470	11,300	4,020	6,140	10,200	4,000	5,860	9,410	4,000	5,860	9,410
ALGERIA	7,680	9,260	17,700	35,700	9,300	18,800	41,600	9,260	17,400	34,100	9,220	16,200	29,300	9,220	16,200	29,300
MOROCCO	8,000	9,830	16,500	29,800	9,950	17,900	34,900	9,830	16,100	28,400	9,830	15,700	27,300	9,830	15,700	27,300
WHOLE REGION B	63 000	75 000	128 000	241 000	75 400	135 000	277 000	75 000	128 000	241 000	747 000	119 000	205 000	74 700	119 000	205 000
Total Mediterranean countries	189 000	207 000	275 000	405 000	208 000	283 000	443 000	207 000	277 000	413 000	207 000	268 000	377 000	207 000	272 000	391 000

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Table III-35 TOTAL NUMBER OF URBAN POPULATION OF THE MEDITERRANEAN SCENARIOS freedom of individual choice. An urban policy decided upon at the national level may be able to avail itself of decisive incentives (investment assistance, location of activities, etc.). On the whole, however, it cannot be said that the urban strategy adopted for land-use planning has been sufficiently vigorous, and its practical results have been small in relation to the social and environmental issues involved.

II PROSPECTIVE TRENDS IN URBANIZATION

In the light of the general framework of the scenarios, the basic hypotheses for the population scenarios and recent trends in urbanization observed in the different Mediterranean countries, a few broad guidelines for urbanization emerge, starting with the following : the proportion of the urban population will continue to increase in all countries, with a degressive increase until the attainment of a saturation level varying according to the society (in other words, the urban growth-rate will tend to vary in the opposite direction to the level of urbanization).

This exercise in future studies is not easy for many reasons, relating to :
- firstly, the definitions of the urban population which, what with thinning out over a given area, the development of outskirts and networks, "ruranization" and the introduction of the ways of "city life" into small and medium-sized towns less and less tied to agriculture, are increasingly ambiguous ;
- the population hypotheses, the divergence between which has deliberately been left open ;
- international migrations which have not been taken into account very much but which represent increasingly significant movements involving city-dwellers. The magnitude of these movements may attain a balance of 500,000 a year, for the whole of the Mediterranean. These migrations and especially the returns have a direct influence on the building of housing (in terms of both scale and characteristics) ;
- the size of the cities concerned by population movements (here it has been necessary to simplify and to assign the mean growth-rate to average-sized towns). In this connection, the evolution of big cities is to speak the "advance indicator" which corresponds to spontaneous concentration or to decentralized urban growth (balanced urban sprawl, promotion of small and medium-sized towns) ;
- societal trends regarding which many questions exist ;
- the structure of households which will influence the types of housing ;
- attitudes towards work, changes in work rhythms, the evolution of employment where, here too, the boundaries are less clearly marked than formerly (part-time work, dual societies whose importance is far more appreciable in the Mediterranean region than in Northern Europe (for instance, the informal sector may in some towns be more developed than the formal sector) ;
- the standard of living and, in particular, the use of income for forms of residence different from those of today : second homes often located on the coast, homes relating to a future retirement and to retirement itself, etc.)

The results of the combinations of these scenarios are shown by scenario in Tables III-34 and III-35.

It will be seen that overall, at the level of States, the urban population increases from 91 million in 1950 and 207 million in 1985 to 277 million in the year 2000 and 413 million in 2025. Growth will be observed mainly in the southern and eastern regions whose multiplier in relation to 1980 is shown to be 3.82 as against 1.24 in the north-west regions (group A).

To give an idea of the tremendous extent of urban growth in the cities of the southern and eastern countries, it can be said that the additional population of those cities will in 40 years be equal to the present urban population of cities in the northern and eastern countries!

The rate of urban growth would thus in the southern and eastern regions be some five times higher than that of the European cities at the height of their period of growth.

The evolutions considered up to now concern the entire territory of the countries bordering the Mediterranean. As regards the coastal regions of those countries, defined according to the criterion of territorial administrative units touching the littoral, it is seen that the present urban population of those regions is 82 million and that, according to the scenario, it will increase to a minimum of 106 million or a maximum of 113 million (T2) in the year 2000, and 155 or 170 in the year 2025. Here too, of course, most of the growth will be in the southern and eastern regions.

The coastal urban population is shown by country and by scenario in Table III-36.

Nothing allows one to foresee a slowing down of the growth of the coastal regions and of the littoral fringe in particular. To what extent can this evolution be halted? All depends on the goal-oriented policy of States.

The perspectives adopted by the Blue Plan for the coastal population shown in the north and especially in the south and east more rapid growth than that of the total urban population, and in scenario A2 for the northern countries scarcely more rapid than that of the total population (or even slower for the southern countries in scenarios A1 and A2) ; they presuppose a strong and deliberate policy aimed at redressing the balance in favour of the inland regions. Similarly, the fact of foecasting, in the coastal region of the southern countries, in all the scenarios expect one (T2), lower rates of urbanization than inland (while at present they would appear to be identical or slightly higher) reflects the need to take deliberate measures to reduce the problems of space, public facilities and the environmental consequences of urban concentration in the coastal regions. The trebling of the coastal urban population of the southern countries envisaged by the Blue Plan, lower than that of the total urban population, presuppose a slowing down of the growth of the very large conurbations (Cairo, Istanbul, Alexandria, Beirut, Algiers and Tunis) in the regions close to the coast, which would be redirected not to other places on the coast but to the inland towns of those countries.

Taking into account the geography of the littoral and the scattered housing patterns outside cities, this urban growth of the coastal regions is considerable. It will present serious problems in respect of management and the environment.

Growth according to the size of towns

The distribution of the growth of populations among the large metropolises or conurbations and small and medium-sized towns is of decisive importance : on the way in which this growth takes place according to the size of human settlements will largely depend the answers to a number of environmental problems and the way in which a certain form of urban life will develop. At the financial level, it has been noted that in several countries of the world, when the population exceeds 100,000 inhabitants, urban services cost more.

	1985	T1 2000	T1 2025	T2 2000	T2 2025	T3 2000	T3 2025	A1 2000	A1 2025	A2 2000	A2 2025
SPAIN	11177	13899	16770	14230	17685	13684	16277	13684	16277	14023	17800
FRANCE	4810	5416	5606	5216	5468	5564	6314	5564	6314	5773	7033
ITALY	27923	29850	30429	30346	31228	30149	31408	30149	31408	30855	34210
GREECE	5261	6595	7391	6167	7490	6781	8209	6781	8209	6939	9033
YUGOSLAVIA	1404	2069	3049	2464	3560	2257	3693	2257	3693	2272	3743
REGION A	50575	57829	63245	58423	65431	58435	65901	58435	65901	59862	71819
MONACO	27	30	36	30	36	30	36	30	36	30	36
MALTA	327	373	424	373	424	373	424	373	424	373	424
ALBANIA	1040	1640	3370	1910	3880	1640	3370	1640	3370	1700	3790
CYPRUS	331	455	665	455	665	455	665	455	665	455	665
LEBANON	2140	3180	4790	3060	4800	3180	4790	3180	4790	3370	5460
ISRAEL	3840	4950	6560	4910	6630	4950	6560	4950	6560	5340	7760
REGION C	7705	10628	15845	10738	16435	10628	15845	10628	15845	11268	18135
TURKEY	5300	8083	15858	9357	18673	7816	14775	7380	12996	6944	11218
SYRIA	415	832	2340	972	2948	824	2061	773	1890	722	1728
EGYPT	5900	10406	19526	11116	21960	10064	18035	9579	15606	9688	16511
LIBYA	1420	3045	7603	3098	8678	2996	6236	2950	6280	2908	6329
TUNISIA	3350	5021	7870	5519	9016	4752	7472	4575	6920	4399	6387
ALGERIA	5520	10000	17708	11187	22162	9341	16297	8560	14221	7774	12145
MOROCCO	1515	2475	4470	2740	5250	2415	4260	2385	4170	2355	4095
REGION B	23420	39862	75375	43989	88687	38208	69136	36202	62083	34790	58413
MEDITERRANEAN BASIN	81700	108319	154465	113150	170553	107271	150882	105265	143829	105920	148367

Table III-36 URBAN POPULATION IN COASTAL AREA FOR THE FIVE MEDITERRANEAN SCENARIOS

It is not easy to evaluate this distribution as it is due to the continuation of very long-established migration flows, to the importance of "reservoirs of migrants" - the rural regions in particular - and the lure of cities where factors to do with job offers are decisive.

It is also due to efforts that are not always rewarded, to land-use planning policies attempted at the national or regional level in favour of inland cities (the case of Algeria) or middle-sized towns, to avoid congestion in the large metropolises.

Figure III-11 illustrates the extreme evolutions of the scenarios at the 2000 and 2025 horizons, corresponding to the worse trend scenario T-2 and to alternative scenario A-2. These two scenarios express the different redistributions of urban growth :

- the normative nature of alternative scenario A-2 which provides for a balancing of the settlement pattern through :
. a reduction in the population growth of capital cities ;
. a strengthening of the role of regional capitals ; and
. the promotion of small and medium-sized towns ;

- the contrasting 'laisser-faire' character of scenario T-2, contributing to concentration around the major conurbations and to imbalances in the urban network.

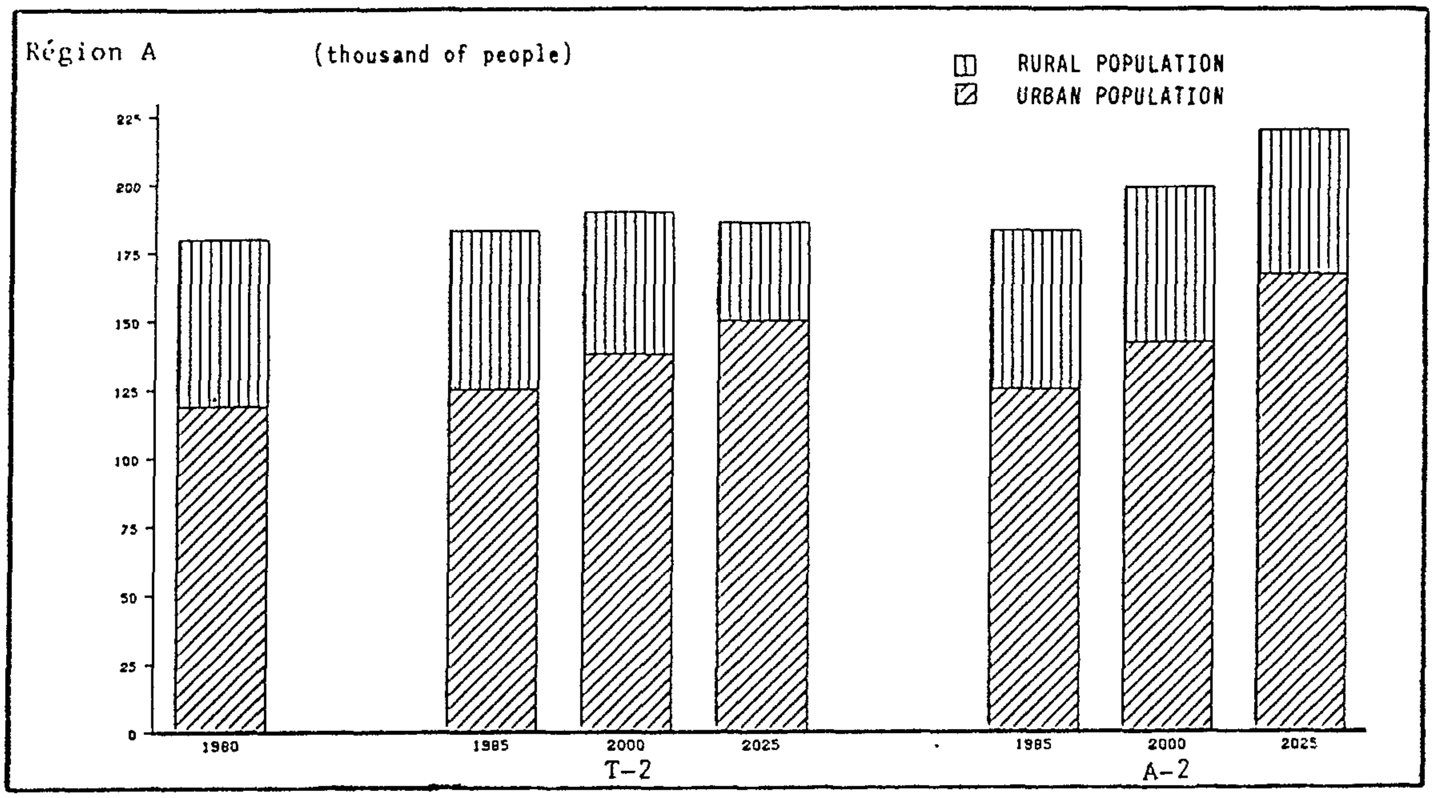
Overall, the divergence between these two extreme scenarios is observed in all countries, although the factors contributing
thereto vary in importance according to the country and major region.

Some modulation is seen according to the type of scenario or development : "megapolises" increasingly difficult to control for the trend scenarios, counter-magnets and promotion of small and medium-sized towns, with improved spatial distribution, for the alternative scenarios.

Figure III12 and Table III-37 show by way of example, trends in the populations and number of cities of mnore than 50,000 inhabitants in regions A and B according to trend scenario T-3.

Between the two extreme scenarios (respectively 337 and 443 million persons living in cities in 2025, as against slightly more than 200 million today), there is a difference of 66 million city-dwellers, or about 6 to 7 cities of the size of present-day Cairo. And naturally, there are also considerable differences according to the scenario in respect of homes provided with drinking water, electricity, infrastructures and services, i.e. in respect of quality of life or on the contrary of pauperization, or indeed of the creation of shantytowns.

The additional studies carried out for the development of the scenarios have shown to what extent the albeit considerable efforts made by most of the States south and east of the basin remain insufficient in view of the scale and urgency of housing needs. Even in the most optimistic scenario, many factors need to be combined to bring about any appreciable improvement in situations in the future.



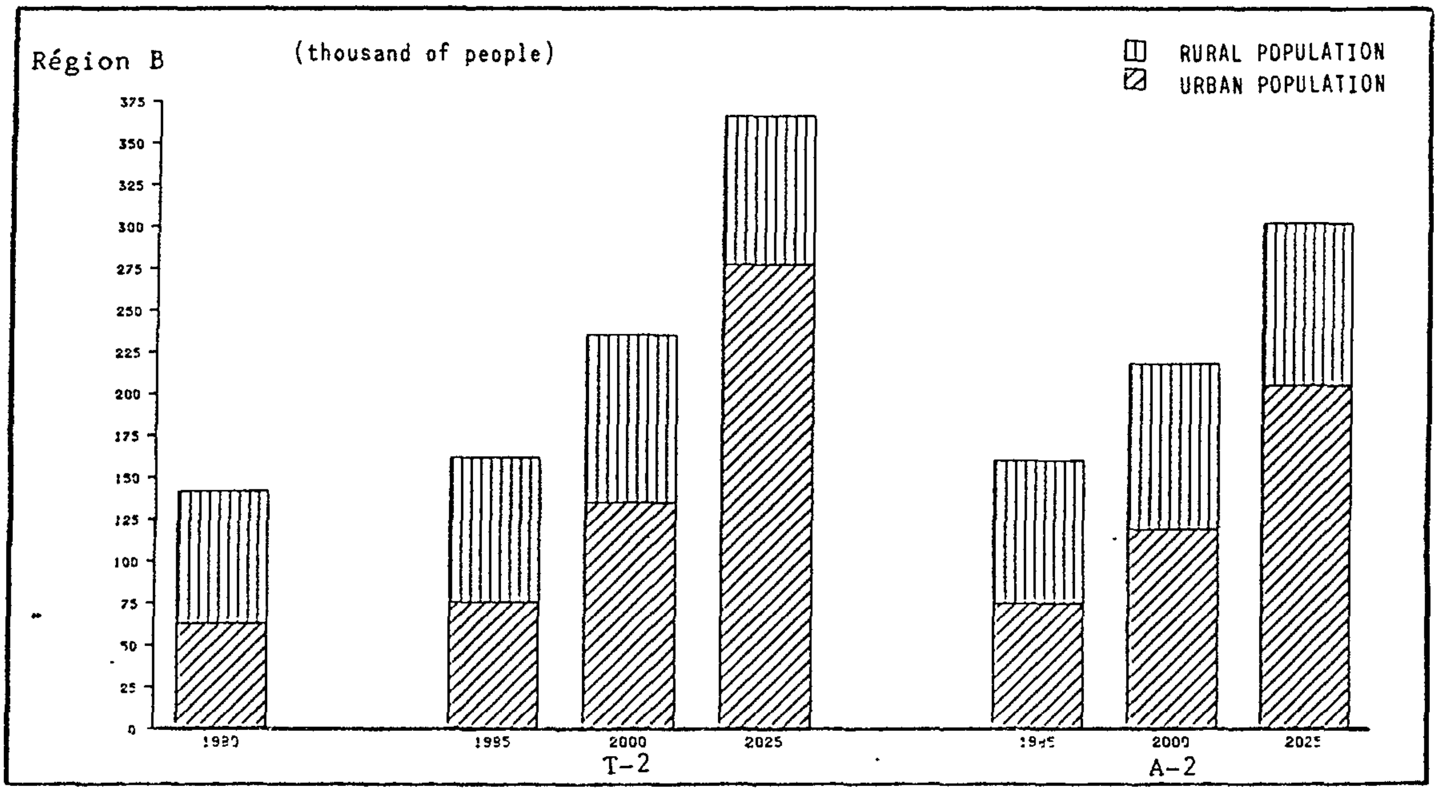
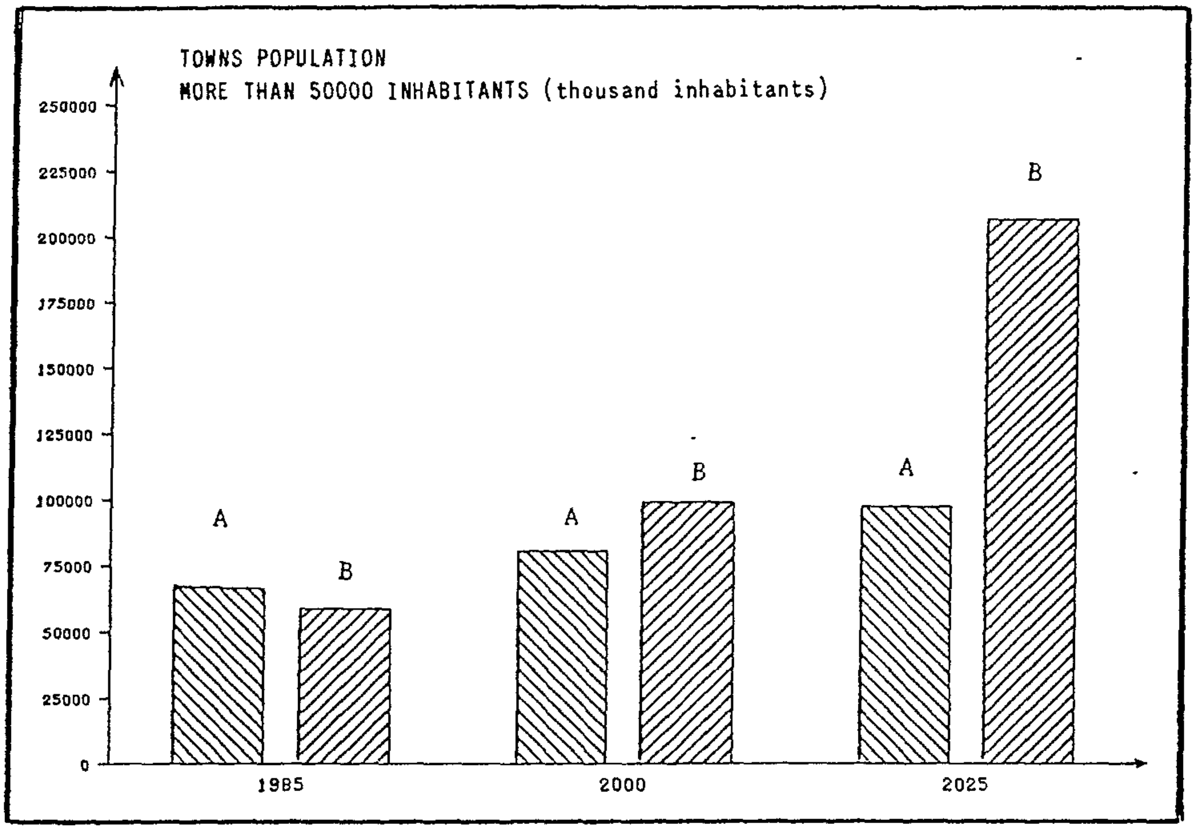


Figure III-11 Evolution of the urban population of the big regions A and B according to the extreme scenarios T-2 and A-2



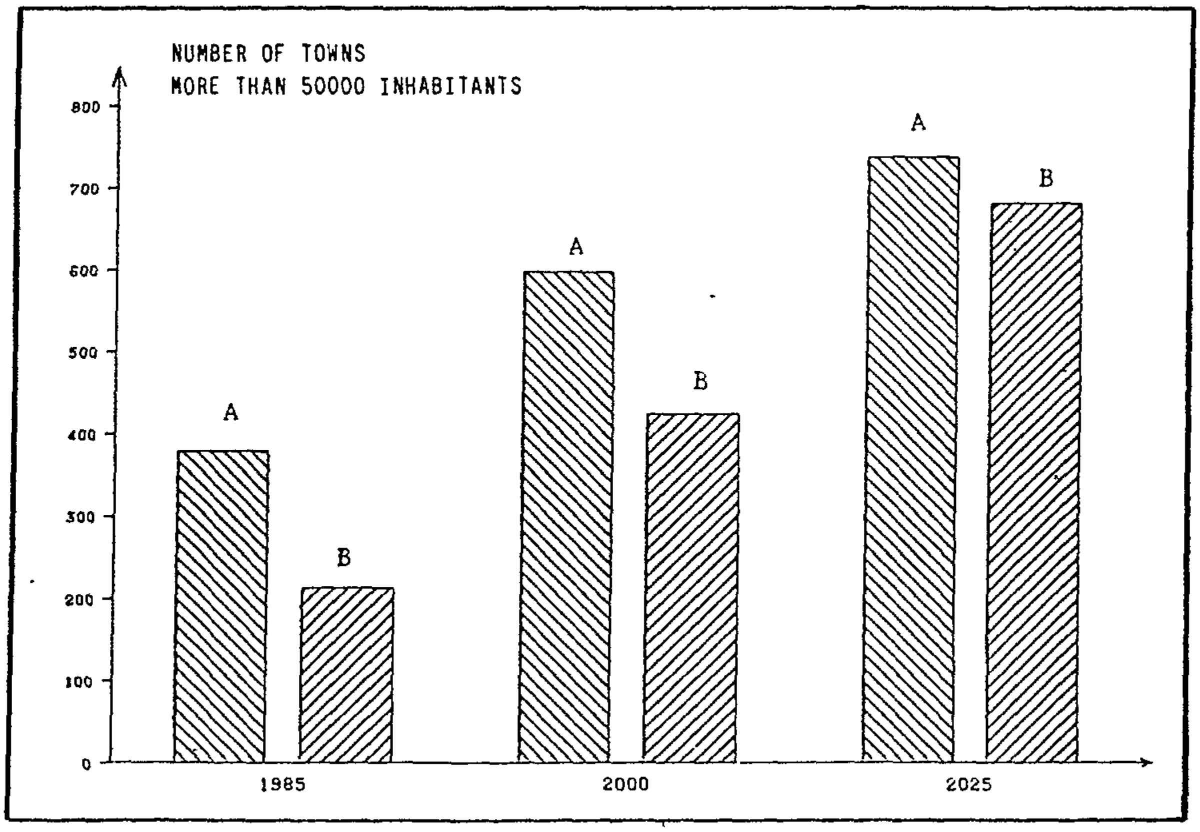


Figure III-12 Trends in the population and number of towns of more than 50 000 inhabitants in regions A and B according to the T-3 scenario

	SCENARIO T1			SCENARIO T2			SCENARIO T3			SCENARIOS A		
	NUMBER TOWNS	POPULATION	% (*)	NUMBER TOWNS	POPULATION	% (*)	NUMBER TOWNS	POPULATION	% (*)	NUMBER TOWNS	POPULATION	% (*)
SPAIN												
1985	103	20 743	70	103	20 743	70	103	20 743	70	103	20 743	70
2000	141	25 352	76	136	25 189	75	151	25 381	75	165	26 681	76
2025	172	31 145	80	164	31 036	79	188	31 460	79	214	36 106	81
FRANCE												
1985	100	12 919	31	100	12 919	31	100	12 919	31	100	12 919	31
2000	175	17 084	42	151	21 827	53	164	16 026	38	169	16 475	39
2025	157	15 966	39	149	21 555	52	203	18 391	41	233	20 174	43
ITALY												
1985	130	21 616	56	130	21 616	56	130	21 616	56	130	21 616	56
2000	172	26 030	63	161	26 990	66	194	24 812	59	206	25 851	61
2025	176	26 402	64	169	28 101	67	229	27 037	63	269	30 469	64
GREECE												
1985	8	4 614	78	8	4 614	78	8	4 614	78	8	4 614	78
2000	21	6 023	89	18	5 620	83	23	6 170	88	25	6 302	87
2025	27	6 949	91	23	6 623	86	32	7 808	92	37	8 567	92
YUGOSLAVIA												
1985	38	5 565	53	38	5 565	53	38	5 565	53	38	5 565	53
2000	61	7 907	56	58	8 279	59	65	7 996	56	67	8 006	56
2025	79	10 737	58	74	11 437	60	86	12 300	64	88	12 454	62
WHOLE												
1985	379	65 457		379	65 457		379	65 457		379	65 457	
2000	570	82 396		524	87 905		597	80 385		632	83 315	
2025	611	91 199		579	98 752		738	96 966		841	108 310	
TURKEY												
1985	99	19 339	72	99	19 339	72	99	19 339	72	99	19 339	72
2000	156	29 482	82	160	31 715	82	156	29 050	81	152	26 723	81
2025	229	56 826	86	266	68 775	88	232	54 983	87	205	45 131	83
SYRIA												
1985	13	4 100	79	13	4 100	79	13	4 100	79	13	4 100	79
2000	25	8 458	81	25	8 808	81	26	8 368	81	26	7 544	78
2025	49	22 274	95	48	25 555	95	51	21 927	95	76	18 375	96
EGYPT												
1985	38	17 658	81	38	17 658	81	38	17 658	81	38	17 658	81
2000	85	28 797	80	81	30 312	81	98	29 580	83	92	27 929	82
2025	112	58 622	88	109	65 750	90	121	57 205	90	116	51 240	90
LIBYA												
1985	3	1 693	73	3	1 693	73	3	1 693	73	3	1 693	73
2000	7	3 091	70	9	3 159	70	9	3 095	71	8	3 313	78
2025	16	9 419	95	16	10 701	95	16	9 380	95	9	6 689	96
TUNISIA												
1985	9	2 131	53	9	2 131	53	9	2 131	53	9	2 131	53
2000	25	3 455	56	29	3 637	56	26	3 452	56	25	3 272	56
2025	42	6 708	65	47	7 548	67	42	6 665	65	40	5 973	64
ALGERIA												
1985	24	5 809	63	24	5 809	63	24	5 809	63	24	5 809	63
2000	55	1 223	68	55	12 818	67	55	12 592	72	54	10 922	67
2025	137	33 565	94	141	39 326	95	136	32 036	94	135	27 387	93
MOROCCO												
1985	27	7 545	76	27	7 545	76	27	7 545	76	27	7 545	76
2000	52	13 132	79	53	14 261	79	54	12 756	80	54	12 732	81
2025	80	25 371	85	83	29 873	86	84	24 116	85	83	23 308	85
WHOLE												
1985	213	58 475		213	58 475		213	58 475		213	58 475	
2000	405	87 638		412	104 710		424	98 893		411	92 435	
2025	665	212 785		710	247 528		682	206 312		664	178 103	

* Share of the urban population in towns of more than 50 000 inhabitants.
Population in thousands inhabitants.

Table III-37 EVOLUTION OF TOWNS POPULATION OF MORE THAN 50 000 INHABITANTS

III. URBANIZATION AND ENVIRONMENT

The continuation of urbanization in the Mediterranean area at a fast rate in all the scenarios suggests a need to be increasingly attentive to the relations between urban development and the environment and to the decisive factors affecting the way people live in urban settings. These relations will be far from identical from one country or situation to another, and the size of urban settlements will affect the "design for living", which is more fragile in very big cities than in small and medium-sized towns.

In an attempt to show more clearly the effects of urban growth on the Mediterranean environment, it has been felt useful to examine a few essential factors in respect of environmental impact, namely :

. space,
. water : supply and evacuation,
. waste,
. air and noise,
. "natural" spaces.

A. THE CONSUMPTION OF SPACE

One of the major effects or urbanization on the environment is the taking over of the rural or natural area previously circling the heart of the city. Urban growth takes place not so much through the densification of existing urban nodes as through the phenomenon of urban sprawl, through spreading in ways that are often uncontrolled, encroaching on agricultural land which is sometimes of vital importance (as in the case of Egypt) or, more frequently, on the littoral itself, already highly coveted for other activities and whose preservation is essential both for the quality of tourism and leisure activities and for ecological reasons.

It is not easy to form a precise idea of the consumption of space by urbanization. It may be defined as resulting from the urbanization ex nihilo of a rural area, from the transformation of an area occupied by rural dwellings, from the extension of the peripheral area of an existing urban settlement, from the filling in of built-up areas within a conurbation, from the utilization of former industrial sites, etc. Urbanized space comprises built-up areas and areas reserved for infrastructures, but also certain non-built-up areas such as cemeteries, sports grounds, parks and green areas and even, in some cities, peri-urban forests. It also comprises in principle peri-urban agricultural land not being worked pending its reassignment, infrastructures outside the city but closely linked to it, such as airfields, refuse dumps, nearby motorways or by-passes, industrial waste land, etc.

Where they exist, statistics concerning the spatial dynamics of cities are often approximate or indeed dubious. For the Mediterranean cities, especially in the southern and eastern countries, data concerning the consumption of space or all collective utilities are few and far between over a long period. Remote sensing will in future make for quite considerable monitoring, but the data will only be fully useable after a period of ten years, even if all the necessary tools are set up as of now.

The growth of space consumption in the future will result from three factors :
1) higher population figures, particularly marked east and south of the basin ;
2) higher standard of living and the use of large unit areas for housing proper and community facilities (transport, leisure, social facilities, green areas, etc.).

Per capita consumption of space increases as the standard of living goes up, and does so particularly in that the marginal propensity to consume space itself increases with income. This marginal propensity, which is high in the Nordic and Anglo-Saxon countries, is comparatively low in the Mediterranean countries, in both the north and the south.

Available data for the unit consumption of space generally correspond to needs observed in the OECD countries and a few developing countries. These data vary considerablly : 40 m^2 per inhabitant for Cairo (other figures being 16.5 m^2 between 1968 and 1977, and 14 m^2 in the 1980s, per additional inhabitant), 190 m^2 per inhabitant for the city of Madrid and 450 m^2 for the area of Madrid (as compared with 750 m^2 per inhabitant for Los Angeles).

For prospective studies in the Mediterranean basin, it is often helpful to start from relatively low levels of unit consumption (which may sometimes appear pessimistic) for the countries of the south and the east in order to determine minimal objectives for improving the standard of living. On the basis of these figures, ratios can then be used to ensure the maintenance of a level of health and well-being corresponding to the general level of development of each Mediterranean country ;
3) the varying degree of control through town-planning of urban growth and the forms it assumes : where a very strict policy is applied, the surface area used can be reduced by about 50 % to 60 %, where there is equal population growth.

A number of estimates have been made for the surface areas occupied by cities (according to the definitions above) at the 2000 and 2025 horizons. Unit surfaces per inhabitant have been kept constant for countries in region A, i.e. in the order to 250 m^2. For region B, the 1985 figures, ranging between 40 m^2 for Egypt and Syria and 70 m^2 for Turkey, have been gradually increased, up to 100-125 m^2 per inhabitant, according to the scenarios, for most of the countries in 2000 (60-80 m^2 for Egypt, on account of its specific constraints) and 125-150 m^2 in 2025 (80-100 m^2 for Egypt). The lowest values correspond to the reference trend scenario T-1 and the worse trend scenario T-2, and the highest values to the moderate trend scenario T-3 and the two alternative scenarios.

The prospects of urbanized surfaces in 2000 and 2025 are consequently fairly stable on average in the countries north of the basin. But in the countries of the south and east, they increase according to the scenario by a multiplier ranging from seven to eight times the present average consumption for region B (with the multiplier being higher than ten in the case of some countries like Algeria where many completely new towns should be created in 'new' regions like the Hauts-Plateaux region).

But despite these figures (28,000 to 32,000 km^2 for all countries in region B in 2025), the space consumed by urbanization is insignificant when compared with the size of national territories, especially if account is taken of the advances in agricultural productivity, with the exception of Egypt. Such is not the case if one considers not the whole of the territories but only the coastal regions (cf. the corresponding chapter).

The most important conclusion connected with the consumption of space by urbanization are :
- that the mode of urban organization adopted should be the least productive of pollution and waste and should facilitate their elimination ;
- that in countries where the useful farming area is very limited (as is the case in Egypt in particular) care should be taken to urbanize non-productive land.

In both cases, problems of town-planning are involved, like the problem of the choice of types of habitat (a major factor in the volume of urbanized space).

Irrespective of surface areas, mention should be made of the topographic aspect of the land urbanized. Many Mediterranean cities have spread to the hills and mountains surrounding their original site, and sloping land presents a number of risks of instability, not to mention the handicaps for modern buildings and the highway infrastructure. In the countries south and east of the Mediterranean basin, and among others in the countries of the Maghreb, the steepest slopes have been urbanized by the most disadvantaged populations, these spontaneous settlements generally being lacking in basic facilities. In 1972, a landslide in a district of Constantine thus made it necessary to evacuate 15,000 people.

B. WATER

Drinking water services are at present unsatisfactory for approximately half of the population of the southern and eastern countries.

The scenarios for the Blue Plan are based on the (optimistic?) hypothesis that per capita water needs will remain constant until 2025, growth factors (domestic water and improved sanitation for the population, losses due to the transport of water over longer distances, consumption by irrigated farming, etc.) being offset by factors making for a decrease (water-saving techniques in the agriculture and energy sectors, recycling of waste water, reduction of leaks, etc.).

The main question is whether urbanization and the development of tourism are significant causes of the foreseeable critical situation in regard to water supplies in certain counties. Drawing again on the quantitative data provided by the sectoral studies for the Blue Plan, it seems possible to reply in the negative where absolute values are concerned. It is believed that urban domestic consumption will rise in 2025, according to the scenarios, to between 6.8 billion cubic metres (worse trend scenario T-2) and 7.8 bllion cubic metres (integration alternative scenario A-2) for countries north of the basin, and to between 3.1 billion cubic metres (integration alternative scenario A-2) and 3.7 billion (moderate trend scenario T-3) for the southern and eastern countries. Even if rural domestic consumption and touristic consumption are added,one arrives at fairly modest percentages of total consumption, of the order of 5 % to 7 %, according to the scenarios. Overall, agricultural needs are by far the most significant and, in certain countries (Syria, Israel, Egypt, Libya, Malta, Tunisia), may constitute a stranglehold for development.

Although this is true in regard to total water resources, the situation is different in reality, taking into account the availability of facilities, and especially the priority assigned, in particular, to drinking water supplies for cities. This is the case for instance in Algeria, and particularly for water supplies for the city of Algiers. In 1967, the Algiers area consumed approximately 80 million cubic metres of water annually (65 million cubic metres of drinking water, 15 million cubic metres of industrial water), brought from wells not very distant from the city. In 1983 urban needs were estimated at 150 million cubic metres a year, and the

ENVIRONMENTAL PROBLEMS IN THE GREATER CAIRO REGION

Greater Cairo is composed of Cairo (East of the Nile), Giza (on the West Bank), and the adjoining areas North in Shubra-el-Kheima, and South up to Hawamdieh. This is a total densely populated area of 400 km^2 and more than 11 million people, with an additional 1 1/2 million coming by day. Population density averages 30,000/km^2, but in certain central districts it reaches 1,000,000/km^2. As regards crowdedness, Cairo is preceded only by Calcutta and Bangkok. There are 250,000 residential houses and 1.5 million family dwellings. The first fresh water distribution station was established in 1865. Now there are 17 major water stations, producing 3 million m^3/day, 75 % of which comes from the Nile and 25 % from deep wells underground. The first sewage was established in 1911, and was handling 48,000 m^3/day.

There are now 7 large sewage treatment stations handling 2 million m^3/day, which is about 90 % only of the total effluent from the city. Thus 200,000 m^3, are absorbed underground, or left unpumped in the streets. 30 % of the city area is not yet connected with the public sewage system. The shortcomings of the sewage and treatment system became obvious by the early 1980s. A provisional rescue project was started to strengthen and renew the 175 pumping stations, and clean the major pipes which are 3,500 km long of deposits, which accumulated during many years. A comprehensive sewage project was planned to meet the requirements until the year 2000, when the population is estimated to reach 16.5 million. On the East side a tunnel 5 m in diameter is to extend from the South to the North East, with subsidiary feeding tunnels, to collect the sewage and then pump it into a large treatment plant before using the water to irrigate desertland. A similar project on a smaller scale is planned for the West bank. At present only 15 % of the sewage is treated fully, while 25 % is treated partially and 60 % is carried raw for 200 km by open canals to lake Manzalah and then to the sea.

Solid waste collected from Cairo is about 4,000 tons/day from private houses plus about 1,000 tons from establishments. It contains personal and household garbage, street garbage, building debris and other. It is being collected mostly by hand, horse and donkey carts, and heavy trucks. Dry household garbage is composed as follows :

- paper	16 %
- organic	60 %
- metals	2 %
- dust	2 %
- glass	2 %
- other	6 %

There is an intricate system of door-to-door daily collection, then transport to a central area at the outskirts, where the main components are picked by hand, and re-cycled, or used as feed for pigs in nearby farms. There is a very autocratic system of management, which generates high income to the top chiefs, and very little to the rest of the workers. Several attempts have been to devise more humane systems of garbage collecting, but they never worked as efficiently. Plastic bags are being distributed now at low cost to households to keep the garbage until the (Zabbal) comes in the morning to take it. A special factory for plastic bags manufacture has been established by the Cairo Governorate. For many years, there were projects to process the garbage into organic fertilisers, with a lot of failures. The most recent is a factory established in Shubra district, processing 160 tons built in 1985, another of capacity of 100 tons daily is under construction in Salam district. It is hoped that one third of the garbage will be eventually processed like that in the next five years.

shortage in supplies from the nearest sources led to the planning of the vast twin project of Keddara-Beni Amrane, in principle sufficient for needs at the end of the 1980s, estimated to represent some 250 million cubic metres a year. But the needs of the conurbation in 2000 have been estimated at some 540 million cubic metres a year including 450 million for the city-dwellers) and will call for fresh solutions, especially since the existing groundwater will be virtually depleted : other dams on the wadis of the hinterland, recycling of waste water, desalting of seawater? As extreme as it may be, the example of the Algiers area illustrates the competition between urban and agricultural needs, and the problem of investment priorities.

The evacuation of sewage : drainage

In most of the southern countries, environmental health is related to delays affecting the housing stock and urbanization and to the inadequate evacuation of waste water.

Diseases due to the water supply, in particular cholera, typhoid and dysentery, are especially significant in that they still occur in the countries south and east of the Mediterranean (including in well-to-do circles) where some populations suffer from insufficient food supplies or malnutrition. Many studies denounce the inadequacy and poor quality of the networks for water supplies and purification.

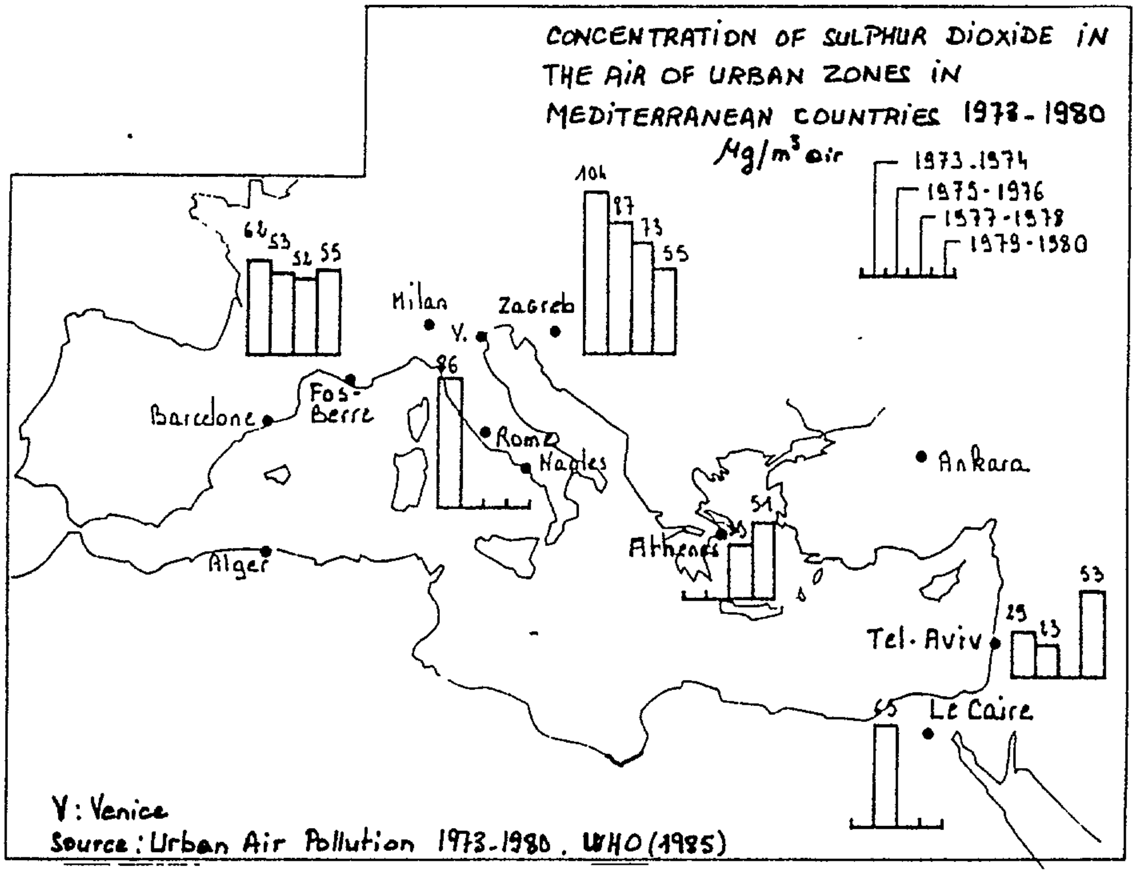
As regards the evacuation of large quantities of domestic sewage and the pollution flows to be treated, the problem will be dealt with in the fourth part, in respect of Mediterranean coastal regions, and significant variations will be seen between the different scenarios.

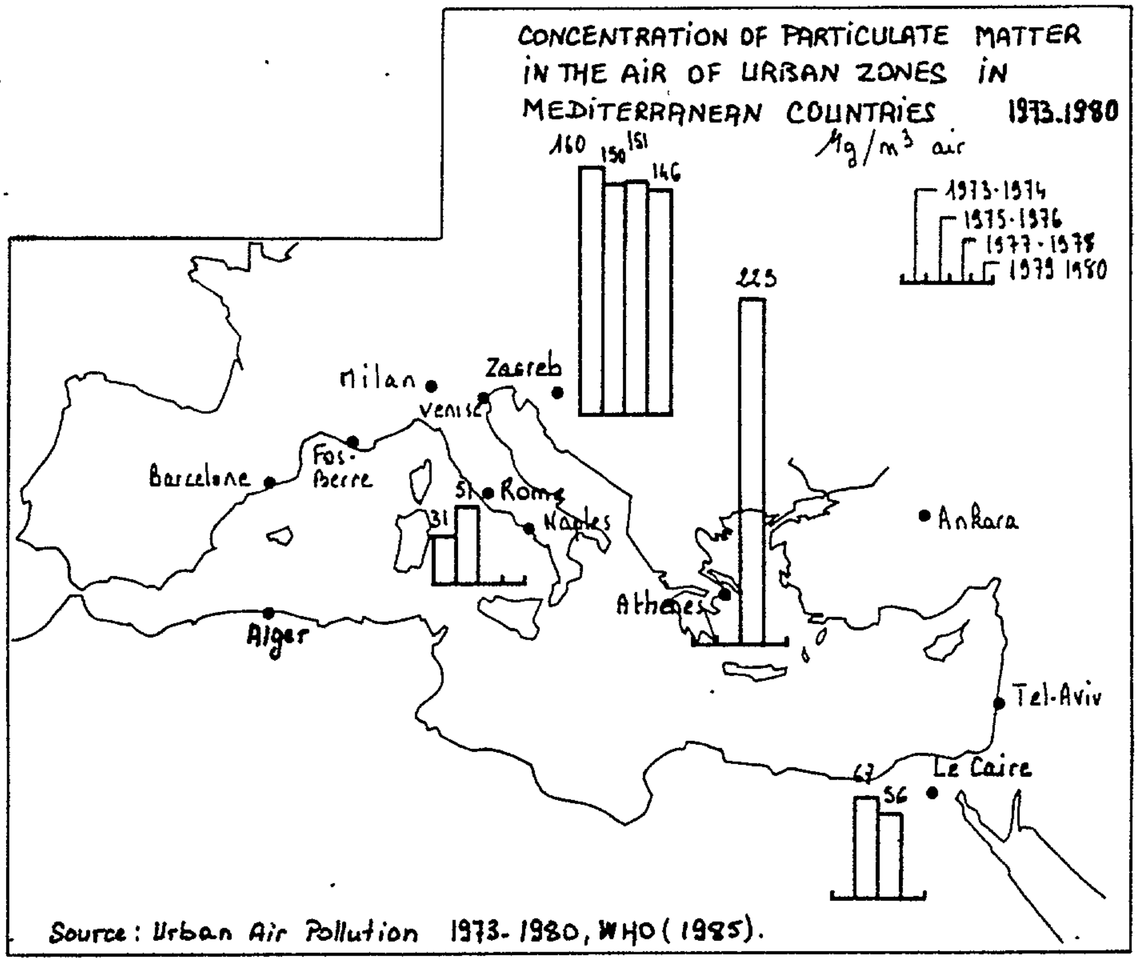
If there is one area where the extrapolation of trends has little meaning for the environment, it is clearly that of the urban environment. The authorities responsible for a conurbation or a city can do a great deal to change the course of things, and in 40 years the effect can be felt. Of course, the degree of effectiveness will largely depend on the funds earmarked for investments, but this is not by any means the only factor. Just as importance is the way in which the environment is, from the outset, internalized in studies and town-planning documents. The presence of public health specialists, biologists, meteorologists and ecology specialists in town-planning teams is altogether decisive (and effectively assumed in the alternative scenarios). And also very important is the way in which specialized institutions are set up - preferably with responsibility for several administrative areas - for the management of water, waste and sanitation, in other words the public, private or semi-public 'secular arm' to ensure management in a practical, day-by-day form.

C. SOLID WASTE

Urban households, distribution and service activities, and industrial enterprises produce solid waste. Their nature
and quantity vary by type of city and by neighbourhood and in time. They necessitate the establishment of services responsible for management and collection : destruction, recycling, utilization and processing. These questions will be mainly dealt with in the chapter devoted to the littoral.

The parameters involved, apart from urban growth and the pattern of consumption of households, are largely linked to the hypotheses of waste management policy, whether in regard to waste discharge or to investments for recovery and processing.


CONCENTRATION OF SULPHUR DIOXIDE IN THE AIR OF URBAN ZONES IN MEDITERRANEAN COUNTRIES 1973-1980
Mg/m³ air
1973-1974
1975-1976
1977-1978
1979-1980
Milan
V.
Zagreb
Barcelone
Fos-Berre
Rome
Naples
Ankara
Athenes
Alger
Tel-Aviv
Le Caire
V: Venice
Source: Urban Air Pollution 1973-1980, WHO (1985)


CONCENTRATION OF PARTICULATE MATTER IN THE AIR OF URBAN ZONES IN MEDITERRANEAN COUNTRIES 1973-1980
Mg/m³ air
1973-1974
1975-1976
1977-1978
1979-1980
Milan
Venise
Zagreb
Barcelone
Fos-Berre
Rome
Naples
Ankara
Athenes
Alger
Tel-Aviv
Le Caire
Source: Urban Air Pollution 1973-1980, WHO (1985).

It should be stressed that the creation of a large number of jobs can result from environment-related measures (in Cairo 50,000 people are employed in activities to do with solid wastes), and from measures to economize on raw materials (salvaged) and the rational use of energy (incineration, compost).

On the other hand, in order not to transfer urban pollution of water and soil to urban pollution of the air (through evacuations and discharge from incineration factories), "clean" technological investments, introduced into the processes used for the recycling and processing of solid waste, may reduce the effects produced in this area by half or even more.

D. AIR POLLUTION AND NOISE

The quality of the air in towns is a real problem in the Mediterranean, but of course it offers sharp contrasts due to meteorological conditions that vary a great deal according to site, season and degree of human concentration. By and large, the following points may be emphasized :

- The first decisive factor for the next 20 or 30 years is automobile traffic (cf. chapter on transport). Pollution will depend on the efforts made in respect of public transport and traffic flow, which everywhere today leave a great deal to be desired. It will also depend on the stock of motor vehicles, standards of manufacture, the type of propulsion used (gas, for instance, causes far less pollution than petrol or the gas-oil used for diesel engines), the life-span of vehicles (nearly twice as long in the Mediterranean as in Europe) and their maintenance (here there does not yet exist any real obligation in respect of periodic maintenance).
- The second factor is the consumption of domestic energy for heating the home and for water. The development of electricity should make for real progress, especially in regions that up to now have been using coal with a high sulphur content or low-grade coal. The effort made in Ankara is exemplary in this regard, and the quality of the air in that capital will be very substantially changed by the measures taken in 1986 and 1987 to treat domestic coal.

Where domestic heating is concerned, the Mediterranean region is fortunate to have a temperate climate and to require only auxiliary heating in the winter. But many improvements will depend on the way in which buildings are put up in the future (active or passive architecture).

The development of solar technologies, mainly for the heating of domestic water, already used in particular in Greece, Italy, Turkey and Israel, could be speeded up.

- Lastly, as industry is largely concentrated in or near conurbations, the atmospheric discharge from industrial activities is to be taken into consideration, especially in the southern and eastern regions which, in the next 40 years, should undergo significant industrial development.

- The future of urban quality will hinge very large on town-planning policy in this regard and the means available to direct new structures to selected sites so as to minimize their effects. Before any installation scheme, studies in environmental micro-meteorology, discussed publicly with the local authorities and environmental protection agencies, could reduce the impact of industry.

Noise, which is often linked to activities that pollute the air, is one of the nuisances most keenly felt in cities : domestic appliances, noises from neighbours and from within apartment blocks, and the background noise of road traffic. If measures are not taken, we can expect a doubling of the noise level within twenty years. But preventive action is possible, particularly at the source (fixed or mobile sources). This action may take the form of building regulations but will largely depend on the Mediterranean populations' awareness of this nuisance.

E. THE CITY AND NATURE

Generally speaking, as great as is the importance attached to gardens in Mediterranean culture, the type of urbanization in the Mediterranean has not led to the development of "nature in the city". Here again, then, one can only note the diversity of situations and merely mark out the way for an evolution eagerly awaited by the populations. For prospective studies in this regard, the statistics available hardly allow us, as in Northern Europe, to quantify the surface area in green spaces incorporated into towns and suburbs.

The creation of large conurbations will, however, make it increasingly necessary to offset increased urban density in situ. The demand for green spaces, for spaces for young people and for spaces where people can meet, will tend to become more pronounced with the declining function of the street, formerly so important and still so today in small towns, but increasingly taken over by car traffic. The tradition of Mediterranean gardens for private use or for the use of small communities will have to develop in such a way as to integrate higher densities ; and when thought is being given to gardens and parks, account should also be taken of plant pathology in the Mediterranean area. The recent diseases affecting town trees (planes, cypresses...) should be the subject of research ; exchanges between the authorities responsible for green spaces in towns in the basin could be very profitable.

Action to develop the awareness of young city-dwellers increasingly out of touch with animal and plant life should be envisaged and here too exchanges of experience would be useful : nature halts, environmental study centres, school-farms, gardens for disabled persons, courses in local farms..

F. LAND-USE PLANNING AT THE DIFFERENT LEVELS

Spontaneous tendencies towards the territorial distribution of populations will largely determine the forms of the settlement pattern in the Mediterranean countries. The challenge is to achieve the growth of large conurbations in harmony with that of small and medium-sized towns which might increase in size with no change in category.

Increasing mobility, social changes and the intense redistribution of the population towards the cities are only part of the picture where regional disparities are concerned (which is a problem of fundamental importance for the environment). The other side of the picture should also be examined, i.e. the spatial redistribution of the population in respect of the coastal area (and, more precisely, what was defined in the first part as "mediterranean regions").

Generally speaking, the rise in the population in the Mediterranean regions is bound up with their economic development : the persistence of marked disparities between the hinterland and the coastal fringe in the densely populated and highly urbanized countries north-west of the Mediterranean illustrates the fact that the Mediterranean regions form a specific zone which will continue to exert consideable attraction owing to the amenities of climate and the economic opportunities that it offers (Alpes Maritime, Liguiria, etc.). The redistribution of the population there in the past 20 years, through economic and social development, has mainly benefited the attractive urban areas (especially the coastal areas sufficiently dynamic to counteract the influences of the inland cities). In the countries north-west of the Mediterranean (Spain, France and Italy) the growth of the population of the coastal regions remains slightly higher than the national average, migration balances being distinctly positive, although these figures conceal the demographic decline and, in particular, the ageing of the populations.

South and east of the Mediterranean, the poor areas, often situated in the hinterland, have often functioned as reservoirs of people destined to swell out population numbers in the cities. It is these rural areas which, through the flow of their emigrants abroad, partly account for the relative decrease in the population of certain Mediterranean administrative regions. Looking at the matter in more detail, the level of development in these countries varies a great deal from one coastal area to another : the decrease in areas under cultivation (under the effect of the population explosion, the growth needs of cities, tourism and industry), the resulting drop in agricultural production and the siting of industries capable of providing work for those who have left the agricultural sector have left a not inconsiderable proportion of the labour force without employment, who have therefore gone off to the cities and to foreign countries. But the excess of births over deaths makes up for the generally negative migration balances.

In Mediterranean Morocco for instance, the attraction of the province of Tangiers (a major pole of industry and tourism) results in a positive overall migration balance for the rural area of nearly 16,000 between 1975 and 1982, whereas the other provinces show a deficit : Tetouan (-19,000), Chefchaouen (-12,400), Al Hoceima (-18,000), Nador (-19,000) and Oujda (-19,700). But even though the migration balances for these regions are negative, the fact remains that, from one census to another, the total population continues to progress as a result of natural growth. The majority of the migrants go off to the cities situated along the Casablanca-Fez urban axis.

In Tunisia, the migratory component of the governorates of the district of Tunis and the north-west observed between 1979 and 1984, showing a surplus in Tunis (+8000) and a deficit in the north-west (-6,4000), represents more than a quarter of the natural growth of each of those regions, or respectively +27 % and -26 %.

These examples concern land-use planning at the level of countries or regions. But it must be realized that the future will also depend on"micro-planning" at the level of conurbations, cities and neighbourhoods.

Regulatory town-planning, but especially operational town-planning, will be altogether decisive, for the future of cities ; frequently action will have to be "made to measure". There can be no question here of putting forward the slightest recommendation, given that the Blue Plan exercise is a comprehensive one geared to quantitative forecasting. But, even quantified, the future will depend on the policies carried out in the field, at the level of the conurbation or network of towns, at the level of city centres and neighbourhoods. This is what may be understood as land-use "micro-planning". This type of planning, this attention given to all that constitutes the design for everyday living, is not a luxury reserved for towns that have alreay got over the main hurdle. It is something else, involving architecture, colours and the participation of the people, particularly the young. These considerations should be stressed, especially when the concern is with budgetary choices. Close attention to the quality of urban life, to the proper use of urban facilities and to "environmental protection" in cities ("urban ecology" exists) costs relatively little and may prove extremely productive in respect of societal balance, security and health. In this connection, "cost-benefit" analysis in terms of urban management and health, for instance, conducted in certain cities of the world, could be a useful exercise in the Mediterranean region ; intra-Mediterranean exchanges in regard to the monitoring of health, for example, could be a necessary stage towards the study of society and its relations to urban change.

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The future of cities in the Mediterranean will depend first and foremost on the efforts made at the national level (e.g. land-use planning) or at the municipal level. The efforts to be made regarding building, urban transport, landscape protection and the quality of architecture will stem primarily from the policies implemented in situ, involving populations so far as possible in the factors that affect how they live. They will also depend on the institutions set up, often on the initiative of States : associations serving several districts, waste-processing agencies, agencies responsible for water, air or parks...

But intra-Mediterranean co-operation may also be beneficial, mainly through exchanges of experience on such themes as earthquake engineering, the dynamic management of historic centres, the technology and running of public transport, water supply and drinking water distribution, sewage management, the control of air pollution, etc.

The "twinning" of towns, which is a frequent practice among cities in the north, could be developed to a greater extent between the south and the north. It is too infrequent among cities of the south. Experience has shown that it is especially profitable when it concerns not only political authorities but also the personnel of technical services. However, only ten or so cases of such twinning exist today.

PART FOUR :

PROTECTION OF MEDITERRANEAN ENVIRONMENTS : A NECESSITY

CHAPTER IV.1

THREE RESOURCES OR ONE ?

The prospective studies on sectoral activities stressed the chief impacts of these activities on the Mediterranean environment, such as accumulated fertilizer pollution stemming from agricultural development, the risk of pollution linked to industrial growth, atmospheric pollutant discharges from thermal power stations or automobile traffic, tourist water requirements and their impact on coastal resources, the surface area covered by transport infrastructure, etc. When these basic data so permitted, an attempt was made to quantify a number of these emissions and/or impacts.

In an effort to advance further, a number of "environmental chains" were constructed which link emissions or direct impacts to indirect effects through either casual relationships or feed-back loops. Thus environmental chains were formulated for domestic pollution, the forest, soil erosion and degradation, and agricultural pollutant discharges (fertilizers and pesticides). When chains are short and simple, they can furnish interesting and fairly cohesive findings, likely to provide indications on the scale of the Mediterranean basin or of a rather large region (the case of the domestic pollution chain, for example). The more complicated they are and the more factors taken into account, the less these chains can finally be used at the global level. Findings lose their reliability: aggregated data at the level of the basin or of a large region have no real significance, local data are not available for all the countries. On the other hand, these chains are valuable tools for smaller areas, when the necessary data can be obtained and are moreover fairly homogeneous and consistent. This is the case, for example, of the chain developed for the Mediterranean forests.

But this approach is all the more difficult because, at the end of the chain, the effects themselves are very poorly known (for pollution from heavy metals or the long-term effects of hydrocarbons in the sea, for instance).

An addition of the impacts caused by various sectoral developments, without considering mutual exclusions or, conversely, the synergies of these impacts, can only have an indicative value, but it nevertheless seems to be a worthwhile exercise where conflicts exist, and will be done for the coast.

After a brief recall of the chief impacts, the focus here will be on the aspects which gradually seemed to be the most important, namely interactions, and the risk of major degradations, for which action is most urgently required.

ABOUT INTERACTIONS

With respect to interactions among environments, or between environments and sectors, an initial observation is the existence of simple "loops" between development and the environment, which can be described as the "mining" type : the over-exploitation of a forest, groundwater or a tourist site more or less destroys these resources to the point that destruction becomes irreversible. In all cases, disappearance of the resource will curb, even bring to a standstill, the development based upon it.

More difficult to grasp -and even more difficult to control because they are usually the responsibility of different institutions- are the relationships and/or loops among the main environments (soil, water, the forest) and the various sectors of activity.

Urbanization, energy, industry, tourism, or transport, for example, involve land use (some of which has been quantified in terms of the various kinds of scenario). Conflicts may arise where space is limited, such as in the coastal regions or the Nile valley. This growing coverage of surface area, however, brings into play factors other than the mere "gross" area used, expressed in hectares or square metres. The role of topography has been stressed in the case of cities. This coverage also materializes in the form of the waterproofing of land, which leads to a considerable increase in runoff in the case of storms or heavy rain, characteristic of the Mediterranean climate. As a result, there is a growing risk of floods, landslides, or interference with water resources.

With regard to air, growing conflicts exist in a number countries south and east of the Mediterranean basin between the needs of industry and urbanization and those of irrigation and agriculture. The two chief sources for urban and industrial requirements are pumping from groundwater and transfers from increasingly distant sites. These transfers require increasingly advanced techniques, rising energy consumption, and increasingly complex storage and distribution systems. However, sanitary installations advance far more slowly than connections to water systems. Hence the growing risk of polluting the groundwater that provides part of the urban supply. An additional risk is linked to the rapid over-exploitation of the supply aquifer, which may entail subsidences (the case of Venice in the past, or of Ravenna, Milan, etc.). One effect of these land subsidences is to damage the networks for the supply of water or the collection of waste water, whose leakage rates sometimes reach around 50 % and whose repair, when possible, is particularly difficult and arduous.

Over-exploitation of the forest is most often caused by either over-grazing (agriculture) or fuelwood needs (energy). Aside from the gradual disappearance of the resource itself, one of the most serious effects is the loss of regulating effect on the water regime: runoff increases, removes soil, and silts up dams. The disappearance of one resource (the forest) entails that of two others (soil and water), with negative reactions on the two economic sectors originally involved: agriculture (soil and irrigation dams) and energy (hydraulic dams), without counting the fact that runoff increases the risk of landslides (threat to homes and infrastructure) and of flooding in valleys or plains.

These examples of interactions and more or less indirect loops, among all those explored during the studies, illustrate one essential point: the interdependence between resources or environments. The speed of interaction seems to increase with the intensity of human activities. In reality, the soil - water - forest "system" should usually be considered as a single resource (as in fact illustrated in Figure II-5, "Diagram of relationships between environmental components and development activities"). Although the change or degradation of these resources has been tackled here from an "individual" angle, it should be recalled that they must never be dissociated, and that their evolution mechanisms are in fact closely related: the phenomenon of soil removal by runoff as result of deforestation clearly illustrates this interdependence between three resources, which in fact are only one.

ABOUT THE "SCENARIOS"

Although these interrelationships between resources and sectors can be rather easily examined, they are on the contrary extremely difficult to quantify in the future. So there is little justification for keeping a rigid distinction between the five different scenarios in this part. References will simply be made generally to the three main scenarios, the worst trend scenario T-2, the moderate trend scenario T-3, and an alternative scenario. This gives the general view :

- T-2 worst trend scenarios : economic difficulties, absence of a long-term view, lack of resources, priority given to certain emergencies (socio-economic rather than environmental), all leading to a case-by-case approach to attend to the most serious and visible degradations. Development assistance projects themselves are poorly designed, dispersed, and often have an adverse effect on the environment or societies ;

- T-2 type moderate trend scenarios : strong economic growth, an incipient long-term view, larger resources, an understanding of the need to protect certain resources or environments and to curb, even prevent, serious degradation, lead to corrective and preventive action. Unfortunately, these are characterized by delays in decision-making and implementation (which considerably increases their cost), and by intervention methods that do not go beyond sectoral action, so insufficiently co-ordinated and ultimately less effective than expected ;

- in contrast, the alternative scenarios feature the integrated approach, in other words the conviction that action must be taken on all resources simultaneously, starting with human resources : the centralized and "technocratic" approach of the trend scenarios is replaced by a concern to involve populations in both decision-making mechanisms and their implementation. This concern was reflected from the economic viewpoint by the growing role of small and medium-sized enterprises, inter alia in the integration alternative scenario A-2, or by the importance given to small-scale hydraulic installations, solar energy, etc. These alternative scenarios correspond to a real policy for physical planning and natural resources management, incorporated from the outset in economic development strategies.

Without being able to enter into overall quantitative assessments which, moreover, would scarcely have any spatial meaning in a given place in the region, an attempt is therefore made to provide a qualitative view of the future of the environmental components chosen and the issues involved, as well as a set of consistent deductions from the macro-economic scenarios on the possible or predictable evolution of these components.

CHAPTER IV.2

THE PROTECTIVE FOREST

The evolution of Mediterranean economies leads to the gradual marginalization of so-called disadvantaged zones, under-populated north of basin, over-populated in the south and east. In the north, the forest is gaining ground on abandoned agricultural land, but it is no longer used and its management is neglected because of lack of labour and financial resources (in particular, forest income). In the south and east, over-exploitation by poor and growing populations is slowly destroying stands which can not regenerate (due to the effects of the climate), together with clearing, organized or otherwise, with a view to extending agricultural land. In coastal areas, the forest is losing ground because of urbanization, industrialization, tourism, fire and too many visitors.

Generally speaking, the forest ecosystem has not yet found its place in the evolution of the Mediterranean basin (interesting lines are appearing for research but are still too isolated) : the functions attributed to the forest are neither clearly defined nor given an order of importance. The "normal" Mediterranean forest, especially in the countries south and east of the basin, is a wooded area whose many functions often compete with one another and are occasionally incompatible. In addition, they are likely to vary in relative importance and priority during the same management plan, whose financial balance-sheet is virtually always in deficit. Unlike the specific silviculture in temperate humid regions, forest management in Mediterranean areas is inseparable from the overall management of other neighbouring sectors, and must include not only biological considerations, but also social and economic considerations external to the forest.

In this report, the term "forest" includes natural stands (trees over six metres tall in "closed" or "open" forest), their various of degraded forms (maquis, matorral, and garrigue which often represent the largest part of wooded Mediterranean areas), reafforestation, and wooded wildland, characterized as a whole by its apparent heterogeneity. Although they play an ecological and often economical role (in Egypt, for instance), ribbon plantings, village woodlots (fuelwood, fodder), urban plantings and periurban parks, farm woodland and oasis trees were not included.

There is a certain degree of indefinition with regard to categories, as well as the surface areas actually covered and the standing volumes, especially in some countries. Despite the advance of scientific studies over the past forty years and the availability of a considerable volume of selective or specific information, there are still many huge statistical gaps, especially as regards the Mediterranean regions per se. This prevents the effective assessment of changes in natural wooded cover. The concept of woody biomass would be better adapted to the economic and ecological realities of the region, but for the moment only theoretical and local figures exist.

I. <u>RELATIONSHIPS BETWEEN THE FOREST AND DEVELOPMENT ACTIVITIES</u>

With regard to the development activities reviewed in the third part, Mediterranean forests fulfill a number of functions (the main ones being production and/or protection) and undergo a number of pressures.

As regards production functions, a clear distinction has to be made between :
- commercial production -the only kind taken into account, usually in official statistics- and whose gross product is low ;
- production understood in a broader sense, i.e. related to the supply of all kinds of goods that can be used by man ; in this respect the Mediterranean forest, including the maquis and bushland, is highly productive (between 3 and 10 tonnes per hectare per year for a healthy forest, between 1 and 4 tonnes per hectare per year for garrigue and coppices (figures which should be halved in semi-arid climates). This overall production capacity is very valuable for a number of countries (in the Maghreb, for instance).

<u>The forest and the agro-food sector</u>

Forest fodder production is an important source of indirect income, either at the end of the dry season for transhumant herds or for cattle feed in winter. A balance can be established between plant withdrawals and animal inputs ; if this balance is temporarily disrupted, the resiliency of the Mediterranean forest enables it to recover health and productivity following fairly long exclosure periods. If these pressures, however, exceed thresholds, because of excessive herd density or because herds remain too long in the forest (virtually year-round grazing), stands are damaged and become degraded, and fodder capacity declines. Ultimately, only few trees are left in the midst of bare and stony expanses. This kind of over-grazing, unfortunately, is becoming increasingly prevalent in the countries south and east of the Mediterranean basin, and is one of the basic factors of desertification starting from the arid and semi-arid desert.

Together with over-grazing, another factor is clearing to acquire new lots to cultivate, through often temporary ploughing because of rapid soil degradation, which can also lead to the definitive stripping of the parent rock. Without being able to provide accurate figures, it is estimated that several thousand hectares are stripped each year in the countries concerned.

<u>Industry</u>

Average timber production of the Mediterranean forest is low (less than 1 cubic metre per hectare per year for the basin as a whole), and considerably below industrial wood requirements. Plantations of fast growing species (eucalyptus, acacia, poplar) or high-quality species (walnut, cherry, chestnut) form artificial and particularly fragile ecosystems.

In addition to wood, the forest provides various products which have considerable economic importance for some populations, although their marketing is sometimes difficult, such as cork, tanning products, resins, aromatic plants etc.

Energy

A much heavier pressure is exerted on the forest by energy requirements, still partly met in a number of southern (Morocco, for instance) and eastern (Turkey) countries by fuelwood, inter alia because it is free (see chapter on energy). Considerable volumes of wood are consumed, but these are not recorded, unlike charcoal which is virtually always marketed. Over-exploitation of fuelwood is the second chief cause, along over-grazing, of the degradation and gradual disappearance of stands.

The growing lack of fuelwood induces rural population to burn crop residues or dung, depriving cultivated land of the organic matter and mineral nutrients essential for their regeneration.

The fuelwood productivity of natural Mediterranean forests ranges on average between 0.8 cubic metres per hectare per year for closed broadleaved stands and 0.1 cubic metre per hectare per year for bushy woodland. Population requirements are estimated at approximately 0.5 to 1 cubic metre per capita per year for rural population (and even more in some areas of the Maghreb or Turkey). Fuelwood (or fodder wood) plantations in soil conservation districts would provide a good solution, but there are not enough of them so far.

Energy consumption, and particularly the thermal production of electricity from fossil fuels, together with automobile transport, produce emissions (SO_2, NO_x, etc.) which may have considerable effects on the forest (problem of acid rain, experienced especially in central or northern Europe, although water acidification phenomena have been observed in Mediterranean Europe).

Tourism

Silviculture and management must take into account the increasing number of tourists in the forest, and concern about the landscape is growing in both the south and north of the basin. Automobile and motorcycle traffic, the continuous trampling of fragile species and increasing amounts of rubbish can cause significant damage. Negligence -rather than malicious intent- is a growing cause of fire, the number of which is rising rapidly in tourist areas.

Transport

Aside from the possible effects of pollutants already mentioned, transport infrastructure sometimes requires cutting across stands, disturbing ecosystems and wildlife habits. On the other hand, specialized infrastructure (roads or hydro-electric dams, for instance) can be protected by forests managed for this purpose.

Other pressures

Tourism is clearly not the only cause of fires, which each year affect, on average, about 200,000 hectares of forest for the Mediterranean basin as a whole (about 90 % of these fires currently concern countries north of the basin, and their irregularity pattern can involve a ratio of up to 1:100 depending on the year and climatic conditions). Repeated fires can have a cumulative sterilizing effect, to the point of mineralizing soils.

TWO ASPECTS OF A CORSICAN INLAND PROVINCE

At the beginning of the nineteenth century, the rural interior of Corsica was heavily populated and exploited. The richest crops, the kitchen gardens and orchards (particulary chestnut), were grouped together on mountain shelves around villages, at an altitude of about 600 metres. After this first zone, the land was cultivated on the basis of a biennal cereal-fallow crop rotation. The villages could also avail themselves of summer grazing in the mountains, and winter grazing on the eastern coast. Woods were exploited for fuel (In particular coppices of evergreen oak). Stockfarming, particulary sheep, was very important and supplied in addition to wool, meat and milk, large quantities of manure from the night enclosures, spread on the rich kitchen garden and orchard plots.

This system ended fairly recently, following a severe and massive exodus. The cultivation of cereals, in competition with cereals imported from the continent, was the first to be abandoned followed, more slowly, by market gardening and orchard culivation. Stockfarming, however, kept up better. Fallow land, as it was no longer ploughed, was invaded by the woody plants which form the maquis (heather, arbustus and cistus), little to the linking of sheep. To get rid of the maquis and have grass grow again, the simplest things is to set it alight. This is how the cereals-fallow system was replaced by the burning-stockfarming-maquis system which encourages the regrowth of non editle woody plants. Since erosion caused soil fertility to fall, increasingly large areas had to be set alight, especially since the economic exploitation of the east coast had virtually done away with winter grazing. The former cereal-fallow-rotation zone was finally covered by a maquis increasingly degraded by fire, until solutions were sought.

(Taken from J. de Mongolfier)

Finally, trees are normally host to parasites, fungi or insects, but the traditional balance may be broken: trees' resistance to parasite attacks can be reduced by poisoning associated with pollutants, and trees thus attacked are also more prone to fire.

II. ECOLOGICAL EFFECTS OF THESE PRESSURES

Of all the forest systems throughout the world, those around the Mediterranean (together with those of mainland China) have been the most degraded by human action. The combined action of clearing, over-grazing and use of wood as fuel and building material have caused inestimable damage. It is estimated that in Mediterranean Europe (including Turkey), the forest currently covers no more than 5 % of its original surface area. In the Maghreb and Near-East, deserts now exist in areas formerly covered with huge forests.

Regardless of the considerable loss of natural living resources, deforestation can be considered as a major ecological threat because it causes disturbances in the water cycle and contributes to soil erosion. It leads to an increase in disasters that can no longer be described solely as "natural", such as floods, landslides, the rapid filling up of river beds (and dams), changes in deltas, etc. It is considered that worldwide deforestation is basically responsible for the increase in the frequency of disastrous floods occurring during past decades.

The most serious effect of deforestation is to upset the water cycle, basically dependent on the nature of the soil and vegetation, and by the interplay of evapotranspiration and infiltration through the surface layer and parent rock, feeding groundwater and subsequently water courses. Trees foliage reduces the kinetic energy of drops and the depth of the humus and litter acts as a sponge (rapid absorption and slow restitution). Deforestation reduces evapotranspiration and infiltration, and above all it substantially increases runoff. According to FAO, nearly one-fifth of the world's arable land would be destroyed by the beginning of the next century solely by water erosion resulting from deforestation, if it continues as its present rate. In the Mediterranean watershed, deforestation and subsequent soil removal are responsible for dams silting up much faster than expected: Serre-Ponçon in the Haute-Alpes (three million cubic metres per year), dams at Hamiz and Cheurfa in Algeria, which had to raised etc. Because of very irregular rains, steep slopes and rapid silting up, the hill lakes in Algeria need walls over 15 metres high, whereas 7 metres is sufficient for the same type of construction in southern Italy.

In areas where the forest has been destroyed, excessive precipitation often causes disastrous mud or landslides after soil erosion.

III. THE MEDITERRANEAN FOREST IN THE SCENARIOS

The complexity of forest issues in the Mediterranean is illustrated in Figure 4-1. This complexity, together with the statistical shortcomings already mentioned and the quantification difficulties mentioned above, make it clear that the prospective approach had to remain basically qualitative with respect to the basin. In addition, the horizons of the Blue Plan macro-economic scenarios seem fairly short with regard to the forest, if not for degradation phenomena, at least for the real effects that can be expected from protection and/or rehabilitation measures which may be decided upon and implemented in the light of the various scenarios.

A simplified environmental chain has been drawn up (Figure IV-2) in an attempt to understand better the effects or pressures of the most significant factors in terms of the scenarios, notably fire, clearing, over-

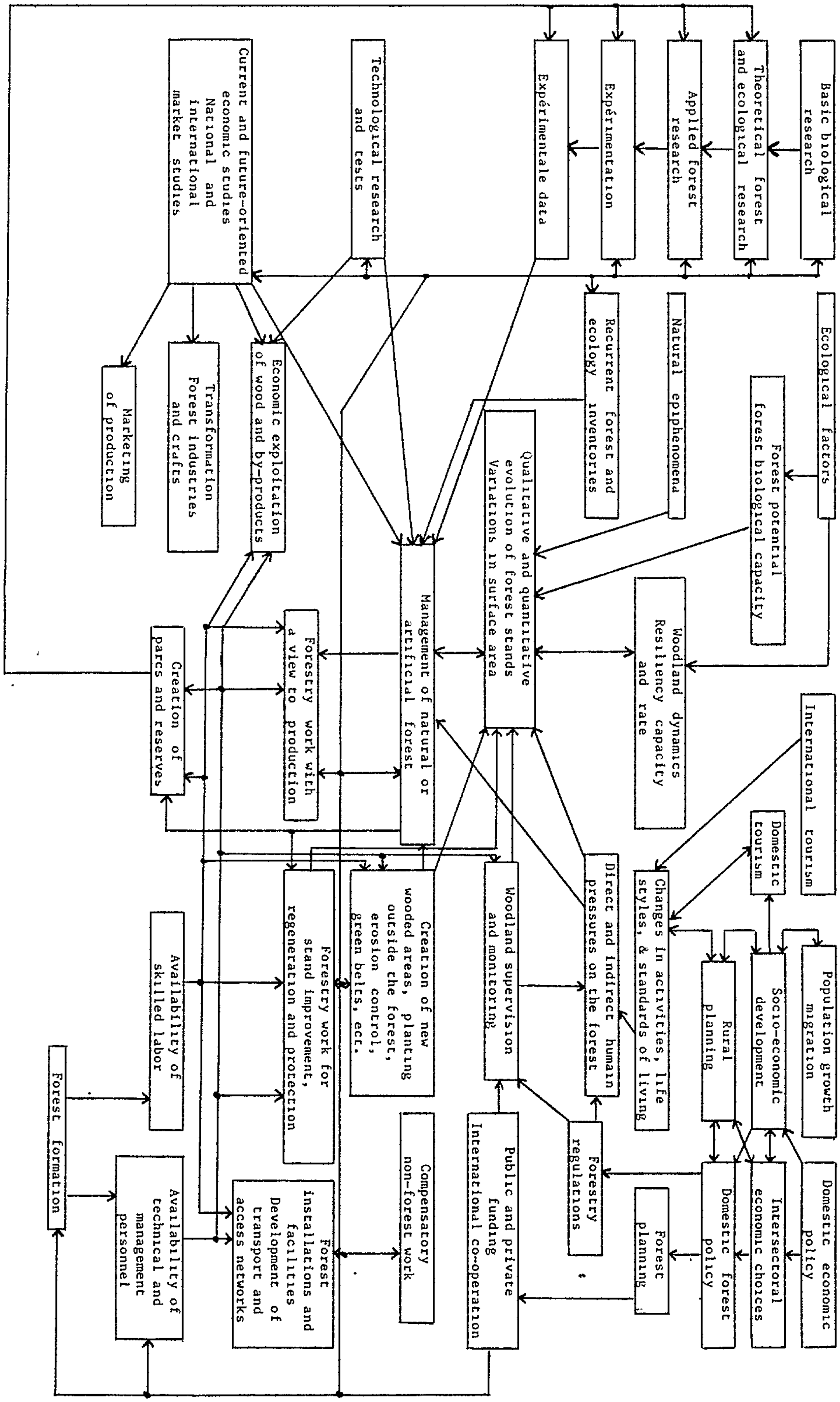

Figure IV-1 Flowchart of Mediterranean forest problems grazing, fuelwood removal and plantings, in order to identify tentatively how much of the forest is disappearing, how much is gradually being degraded and the counteraction undertaken through plantings and pressure control. Five natural kinds of stand have been considered : closed, managed forest, closed, non-managed forest, open forest, forest fallow and bushy woodland, for most of the Mediterranean countries with forests. Lack of detailed data for a number of countries prevented the Mediterranean regions from being considered independently (such as Spain, Yugoslavia, or Turkey where non-Mediterranean forests represent a considerable forest capital, less fragile than that located on the Mediterranean seaboard). In addition to indications supporting the próspective study, the model constructed can also provide interesting findings for forest areas where pressures are accurately known; however, it cannot be quantitatively applied to a very heterogeneous country, nor a fortiori to a region as huge and diversified as the Mediterranean basin.

A. TREND SCENARIOS

According to the findings of this chain, in the worst trend scenario T-2, characterized by slow and difficult economic growth, population problems will increase in the countries south and east of the Mediterranean basin (a fortiori in the hinterlands and arid zones, partly because of growing difficulties in international migration). The requirements of larger populations will rise sharply, leading to the increasing over-exploitation of fuelwood, the clearing of marginal woodland (on slopes, unsuited to cultivation and very sensitive to erosion), and to a real devastation of rangelands, including forest ranges. Trends towards forest degradation (increase of open forest and bushy woodland) speed up disastrously, and by 2025 a large part of still existing woodland would have disappeared, often irreversibly (possible reduction of surface area by one quarter by 2000 and by a half by 2025), heightening the effect of desertification from the south.

As a result, runoff will increase, removing soil and filling up dam reservoirs, whose upkeep or replacement will be hampered by lack of financial resources (without mentioning the shortage of appropriate sites). In the worst cases of silting up, dams will be raised, not without increasing the risk of accidents.

In the countries north of the basin, private forests in Mediterranean regions will be virtually abandoned, except those close to agglomerations, whereas public forests will be managed at "minimum" expense, notably on the coast where resources and personnel will be insufficient to combat forest fires, a situation aggravated by the poor maintenance of entry roads. Non-rehabilitated burnt areas and the encroachment of low-cost constructions on the coast will contribute to the degradation of natural areas and landscapes.

In the moderate trend scenario T-3, characterized by vigorous economic growth and the consideration of environmental impacts (unfortunately often too late and too sectoral), considerable planning efforts will be made in countries south and east of the basin, and the improved availability of energy (replacement of fuelwood by possibly subsidized fuels, and subsequently by electricity) will tend to limit the increase of pressure on the forest. These pressures will nevertheless remain heavy (as on other natural resources) because of vigorous economic development and the needs of agricultural intensification, industrial growth, infrastructure, urbanization, as well as the sharp rise in domestic and international tourism. The effect of rehabilitation or conservation measures, still too sectoral and centralized, will be delayed, and the measures themselves will be more costly because they have been postponed. In fact, the forest situation will continue to evolve adversely, at least until the beginning of the next century, with the reduction of wooded areas, then possible stabilization due to multipurpose plantings. One of the risks of delayed reforestation can be

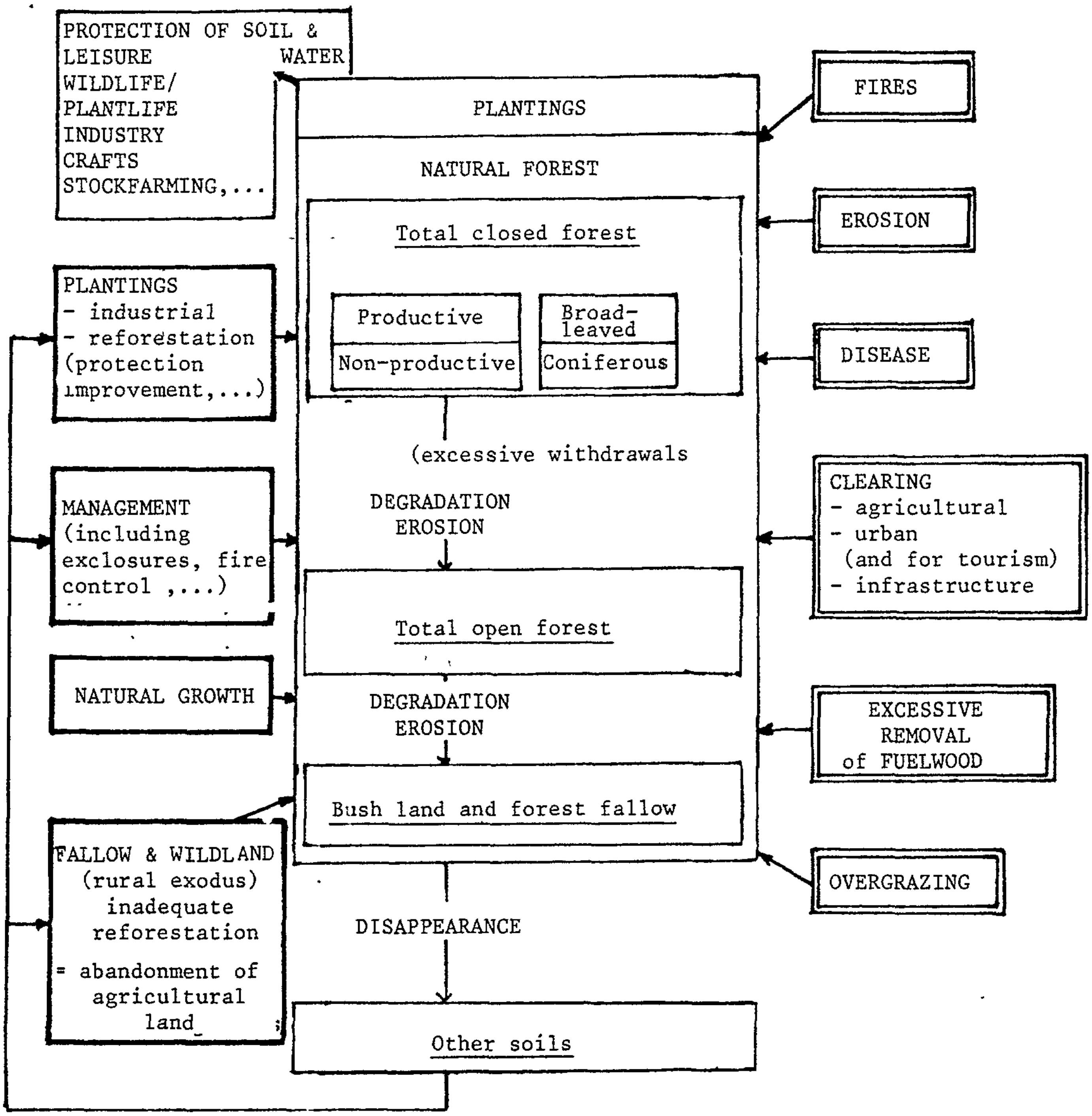

Figure IV-2 The forest model or "chain" (interactions between pressures and forestry systems) illustrated by the fact that trees planted in destroyed soil will never again reconstitute a forest, nor assume its many functions for all the resources.

It will be easier for the countries on the northern shore to set up the legal, financial and land tenure measures required to resume gradually economic exploitation of abandoned land, and increase the number of protected zones. Forest fire detection will be quicker and fires better cut off and controlled. Although the surface area of Mediterranean woodland will not increase, its quality will finally improve, and the extra financial cost will borne by the taxpayer and user.

Depending on the kind of scenario, the findings indicative of the model for the environmental chain show that by 2025, for the Mediterranean countries as a whole, fires could have destroyed between 10 and 12 million hectares of forest, clearing between 5 and 6 million hectares, overgrazing between 2.5 and 3 million hectares, and fuelwood removals between 0.5 and 1 million hectares (considering the substantial fuelwood shortage, this means that all needs will be far from satisfied.

B. THE ALTERNATIVE SCENARIOS

The alternative scenarios are characterized by an integrated approach, which is less centralized and involves greater participation on the part of local populations. Forest management and protection are considered as an inseparable element of other environmental components, starting with the soil and inland water, in the context of a long-term physical planning policy, an integral part of economic and social development.

In the reference alternative scenario A-1, countries' efforts will be better co-ordinated and more consistent, with the European Community and specifically Mediterranean organizations (inspired by international organizations such as FAO, Unesco, etc.) playing an important role. The effectiveness of these efforts will be quickly felt as regards the gathering, processing and dissemination of the data necessary for sound management, and with respect to research and training. Increased technical and financial co-operation among countries in the north and those in the south and east of the basin will considerably increase the operational potential of southern and eastern countries, and the number of pilot projects in the field will rise, in the light of longer term dynamic and sustained reafforestation policies and efficient protective management.

In the northern countries, the general situation of woodland in the two kinds of alternative scenario will be fairly similar to that of moderate trend scenario T-3, as policies inspired by the European Community would only produce effects gradually (rehabilitation of depressed areas would not start, for example, until after 2000 and would benefit from long-term and effective support). As fires do not affect such large surface areas (effectiveness of prevention and partitioning), bushy woodland will recede towards the end of the period. Forest exploitation will however, remain limited, without any noticeable development of wood products, aside from some regional lines. On the other hand, the network of parks and reserves (in particular biosphere reserves) will tend to expand, as well as rural forest tourism, both summer and winter.

In the integration alternative scenario A-2, the country groups south and east of the Mediterranean basin, after an initial period, will experience more rapid and effective progress, with less duplication in what could be termed the "preliminaries" for forest development (statistics, inventories, training and research), and the harmonization of regulations will make a positive contribution. Pressure on forest areas would, nevertheless, persist at least until 2000, even 2010, with its consequences on water cycles.

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A "GREEN" DAM IN ALGERIA

This large-scale planting and retimbering operation, geared to combating the phenomena of dry-zone desertification, covers a surface area of 3 millions hectares (1,500 km long by 20-30 km wide).

The establishment of green dam and regeneration of degraded plant cover, within the framework of an integrated development including the introduction of forest, fodder and fruit tree species, is backed up at the thechnical level by small-scale hydraulic works and the construction of rural housing.

The aim of the operation is to etablish an ecological balance beetween man, flocks, agriculture and the comparatively fragile plant cover threatened with desertification.

In the area where degradation is most advanced, efforts consist of the mechanical and biological fixation of inland dunes. The methods and thecniques used are followed up by the national green dam office, together with forestry and university research departments, working in close co-ordination.

From this study, it can be deduced that, regardless of the type of macro-economic scenario and environmental protection, the anticipated evolution of Mediterranean forests is more than worrying -even in the absence of any unpleasant surprise- and that negative trends are speeding up. This kind of development could become truly disastrous for a number of countries, and could only be counteracted by considerable and prolonged efforts on their part, acting either individually or preferably in a co-ordinated and collective way, but absolutely as soon as possible if the increase of irreversible changes is to be avoided. Even if the shift adverse trends is felt gradually, the true benefits of these possible efforts will not be evident in the best of cases until during the second period of the Blue Plan scenarios, i.e. between 2000 and 2025.

CHAPTER IV.3

THE THREATENED SOIL

Two very different kinds of pressure are exerted on Mediterranean soil :

- on the one hand, the land coverage of non-agricultural socio-economic activities, which means an increasingly manmade soil, following use for these purposes only ; this results in a change in soil surface properties, often towards impermeability. When this involves farmland or land suitable for agriculture, it means a net loss in surface area for agriculture ;

- on the other hand, trends in the properties of arable land under the direct or indirect effect of agricultural activities (for example, loss of arable land removed by runoff following deforestation for energy needs or the degradation of chemical and physical properties through the excessive intensification of agriculture). This trend corresponds more often to degradation, which could lead to the definitive loss of agricultural potential (stripping of rock, desertification). As will be seen further ahead, this kind of pressure is the most serious cause of concern in the Mediterranean.

I. NON-AGRICULTURAL LAND COVERAGE

In the third part of this report, devoted to the activities of the major economic sectors and their impacts on Mediterranean areas and the environment, a number of figures were given concerning land coverage related to prospects for these activities according to the various scenarios and in the light of a number of hypotheses. It should be noted that the starting values (1980 or 1985) are comparatively poorly known for most countries and do not always correspond to identical definitions.

In order to compare or incorporate the findings obtained, a few observations should be made about the hypotheses chosen. Findings generally stem from two factors, one obtained on the basis of the scenarios, the other, the "unit value" deduced from knowledge of the current (or recent) situation and extrapolated to 15 or 40 years by experts in a rational but naturally arbitrary way. For example :
- urban population, multiplied by the per capita-unit coverage ;
- accommodation capacity, multiplied by the "bed-unit" coverage ;
- road length, multiplied by the average width of roads etc.

In the case of industry and energy, the diversity of plants and their sizes prevented identification of unit or average values. In some cases, only a few available figures for certain categories (power, plants, refineries etc.) or for specific installations, or rather sites, could be given, as will be seen especially where problems are most serious, i.e. in coastal regions or on the coast. When national inventories were available, it seems that in total this coverage was not very important (industrial coverage represented about one quarter percent of the national territory of an industrialized country, like France for example) and many other factors have to be taken into account for siting (populations and/or labour, water resources, waste evacuation, transport networks, etc.). At the regional and a fortiori local level, the problem was quite different.

Tourism particularly concerns the coastal regions and the coast, and will therefore be dealt in one of the following chapters.

This leaves two kinds of coverage, which seem to be the most important, distributed (sometimes very unevenly) over the whole of the national territory, and usually involving agricultural land : urbanization and transport infrastructure (chiefly road).

At the 2025 horizon, the prospective scenarios for urban population and road and motorway development for all the Mediterranean basin countries gave similar coverages, in the region of 70,000 kilometres. It is noteworthy that the ratio between the levels of urban population at the 2025 horizon in the extreme case (i.e. 1.17 for the worst trend scenario T-2 and reference alternative scenario A-1) is virtually the same as the ratio between the length of road and motorway networks in the extreme case (i.e. 1.18 for the moderate trend scenario T-3 and worst trend scenario T-2). The final results concerning land coverage will therefore be especially sensitive to the choice of "unit values".

As regards coverage per urban inhabitant, the values chosen for 1985 vary according to the country between 40 and 250 metres (Mediterranean average 171 metres) and for 2025 between 75 and 250 metres (Mediterranean average 183 metres). A better knowledge of the starting situation could lead to changes in these figures as the 2025 values depend closely on socio-economic development conditions and more especially on town planning and housing strategies.

In the same way estimates for the road network were made with an "average width" of 20 metres (banks and shoulders included, significant in the Mediterranean region), with no change between 2000 and 2025 (although the 1985 value is more likely to be closer to 10 metres). Real values will depend on spatial and transport management strategies (distribution among means of transport and respective shares of roads and motorways).

It seems clear, however, that even honing down knowledge, hypotheses and projections, urban development and the development of road transport infrastructure will remain the two leading consumers of land (aside from agricultural activities), and that for some scenarios, the area covered by roads could even exceed the urban area at the 2025 horizon for the countries south and east of the Mediterranean basin as a whole, and a fortiori for some of them.

II. SOIL DEGRADATION

Soil can be degraded by different mechanisms: degradation of physical and chemical properties, waterlogging, salinization, wind and water erosion (the most widespread and most serious phenomenon). In most cases, several of these mechanisms occur at the same time.

Degradation of physical properties. The destruction of soil structure over huge surface areas is often the result of the poor land use, such as inappropriate ploughing methods, shortening of fallow periods, loss of organic matter without restitution in the case of arable land. The adverse change of soil hydro-dynamic properties leads to the appearance of crusts both on and below the surface, which delay or prevent plant growth, intensify runoff -hence erosion- and reduce infiltration and water retention capacities. Trampling by cattle and overgrazing produce similar results.

Degradation of chemical properties. Reduction of fallow and the separation of stock and arable farming reduce the restitution of organic matter (manure, plant matter) and consequently soil fertility. Moreover, the adverse effect of disturbing calcium dynamics should be noted, the role of which is predominant in a number of exchange phenomena which could affect nutritive elements.

Waterlogging. Many soils are poorly drained: alluvial soil, soil in low ground and valleys with a shallow layer, as a result of floods, infiltrations and also poor irrigation practices, in which case waterlogging is often accompanied by salinization.

saline soils are limited (sebkhas), according to FAO there is a strong risk of secondary salinization from irrigation when the land involved is poorly managed or insufficiently drained :

- Egypt has the highest risk in terms of surface areas, i.e. 32 % of its Mediterranean watershed (coast and Nile delta up to Cairo) ; 30 % of soil in the Nile valley (i.e. 80,000 hectares of agricultural land) are already affected by salinization and waterlogging, an additional 40 % shows signs of it ;
- Syria comes second, with 12 % of its Mediterranean watershed threatened ; it is estimated however that 50 % of irrigated land is affected by salinization and waterlogging in the Euphrates valley ;
- 5 % of Mediterranean territory is undergoing salinization, 3 % in Algeria, 1 % in Morocco ;
- in Greece, 33 % of irrigated land is similarly affected.

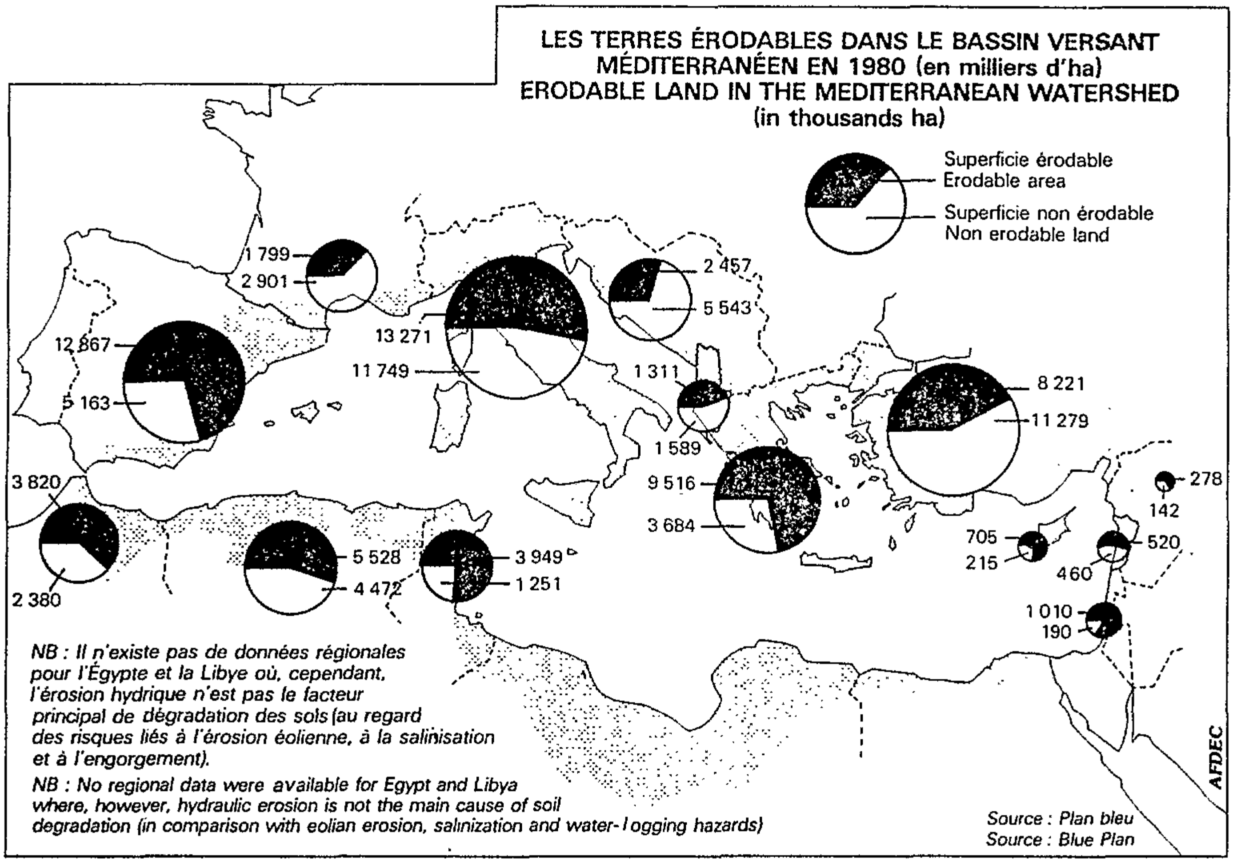
At the world level, salinization will develop each year over surface areas equivalent to the fresh areas brought under irrigation.

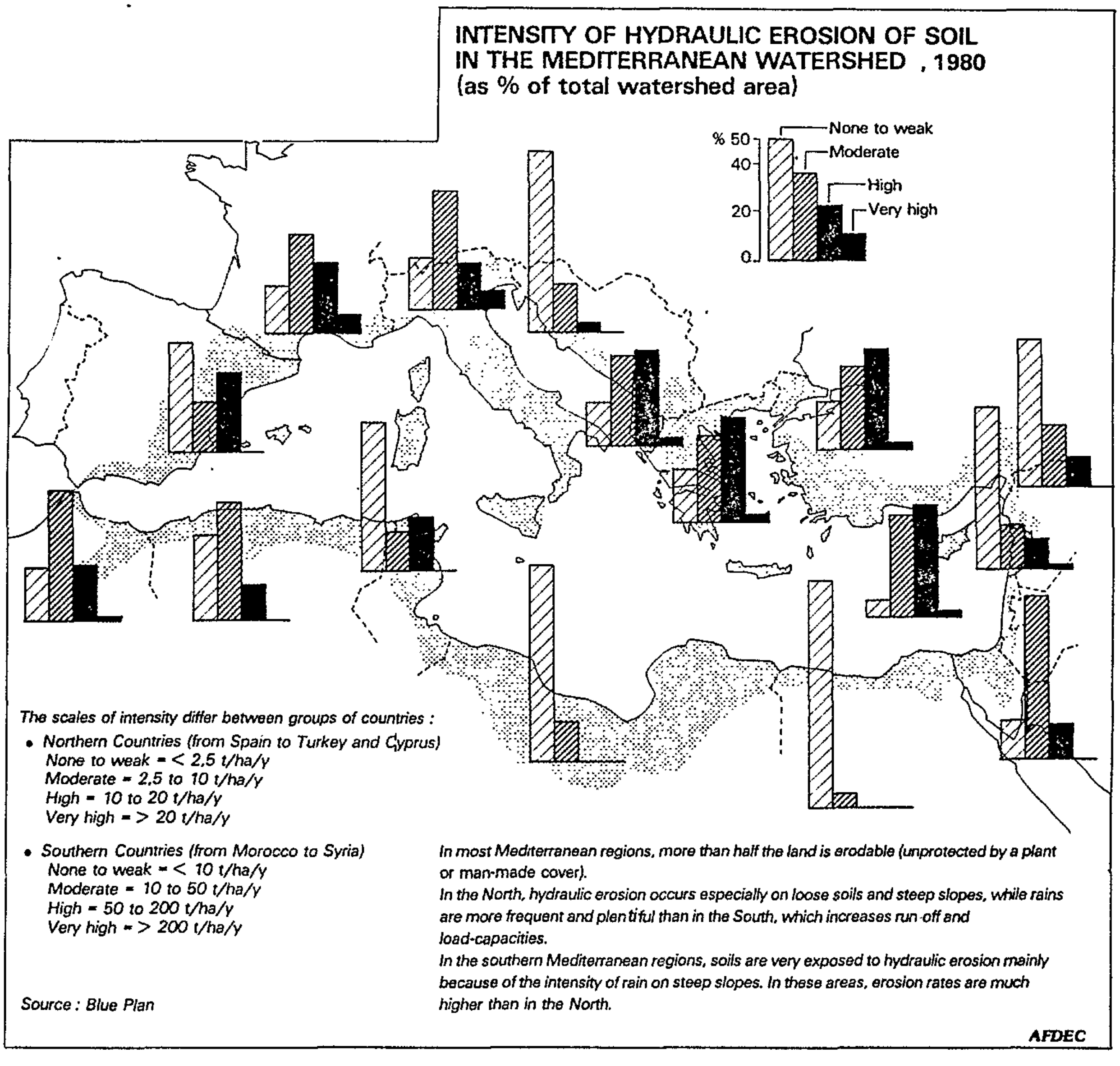
In the Mediterranean basin, salinization would be further aggravated by the conditions of economic and agricultural development characteristic of worst trend scenario T-2. On the other hand, this trend would be reduced in moderate trend scenario T-3, and in the alternative scenarios the phenomenon would be eliminated in some areas and reduced in others, following investment in drainage and the appropriate management of crop husbandry.

Wind erosion. Wind erosion involves marginal agricultural and rangeland in the south and east of the basin. The Maghreb desert, for example (375,000 km), is naturally destined for pastoralism, but ranges are deteriorating because of over-grazing. Moreover, crops have been extended considerably there over the past two decades, based largely on mechanization. Soil systematically worked, with its structure destroyed, is now bare during most, if not all, of the year. Wind action, hitherto limited, is becoming widespread and extended.

III. WATER EROSION

This is clearly the most serious threat to the soil in the Mediterranean countries, resulting from both geological and human action. It particularly affects bare soil and soil on slopes, either following deforestation or during the crop cycle. Only high density forest or grassland can moderate or eliminate it ; arable land, on the other hand, can be fairly well protected by fallowing, alternating crops (also effective against physical and chemical degradation), management, mixed tree crops, etc.


LES TERRES ÉRODABLES DANS LE BASSIN VERSANT MÉDITERRANÉEN EN 1980 (en milliers d'ha)
ERODABLE LAND IN THE MEDITERRANEAN WATERSHED (in thousands ha)
Superficie érodable
Erodable area
Superficie non érodable
Non erodable land
1 799
2 901
2 457
5 543
13 271
11 749
12 867
5 163
1 311
1 589
8 221
11 279
9 516
3 684
278
142
3 820
2 380
5 528
4 472
3 949
1 251
705
215
520
460
1 010
190
NB : Il n'existe pas de données régionales pour l'Égypte et la Libye où, cependant, l'érosion hydrique n'est pas le facteur principal de dégradation des sols (au regard des risques liés à l'érosion éolienne, à la salinisation et à l'engorgement).
NB : No regional data were available for Egypt and Libya where, however, hydraulic erosion is not the main cause of soil degradation (in comparison with eolian erosion, salinization and water-logging hazards)
Source : Plan bleu
Source : Blue Plan
AFDEC


INTENSITY OF HYDRAULIC EROSION OF SOIL IN THE MEDITERRANEAN WATERSHED , 1980
(as % of total watershed area)
% 50
40
20
0
None to weak
Moderate
High
Very high
The scales of intensity differ between groups of countries :
• Northern Countries (from Spain to Turkey and Cyprus)
None to weak = < 2,5 t/ha/y
Moderate = 2,5 to 10 t/ha/y
High = 10 to 20 t/ha/y
Very high = > 20 t/ha/y
• Southern Countries (from Morocco to Syria)
None to weak = < 10 t/ha/y
Moderate = 10 to 50 t/ha/y
High = 50 to 200 t/ha/y
Very high = > 200 t/ha/y
Source : Blue Plan
In most Mediterranean regions, more than half the land is erodable (unprotected by a plant or man-made cover).
In the North, hydraulic erosion occurs especially on loose soils and steep slopes, while rains are more frequent and plentiful than in the South, which increases run-off and load-capacities.
In the southern Mediterranean regions, soils are very exposed to hydraulic erosion mainly because of the intensity of rain on steep slopes. In these areas, erosion rates are much higher than in the North.
AFDEC

In Mediterranean regions, 31 % of land suffers losses from erosion, amounting to over 15 tonnes per hectare per year. Overall, more than half the land in the watershed is prone to erosion because it is not protected by a continuous plant cover, the risk increasing with the slope of the ground, the nature of the rock and the distribution and intensity of precipitation. The breath of the northern watershed explains why nearly two-thirds of removal and sediment input into the sea occurs there, but the consequences of erosion are much more serious for the countries south and east of the basin. In some watersheds with fragile rock, such as flysch or marl in Italy, Morocco, Syria, etc., erosion rates may sporadically exceed 250 tonnes per hectare per year. They can reach 200 tonnes per hectare per year in some region of Andalusia, and advancing erosion seems irreversible in parts of Mediterranean Spain. In Turkey, where 70 % of land is affected by erosion, it is estimated that 1,000 million tonnes of fertile land is lost from runoff (and wind) each year.

It should be stressed that it is difficult to take stock of erosion : figures have been given to quantify sediment loss, either in centimetres removed per watershed or in millions of hectares lost each year by country. But these assessments are far from considering all the elements at play and remain approximative. The loss of ten centimetres of soil has a different implication if it exposes the impermeable layer of a soil with calcareous crusts or if it represents one-tenth of the depth of a vertisol. Nevertheless, it can be observed that the effects of erosion are increasing ; accurate observations on watersheds, comparison between aerial photographs taken on successive dates, increasing speed of rising water during floods, all confirm that erosion phenomena are speeding up in the Mediterranean watershed.

Only the first of the three different phenomena related to wind erosion, namely soil loss, carriage (and partial retention) of sediment in hydrographic networks, and discharge of sediment into the sea, will be considered here.

In the same way as for Mediterranean forests, an "environmental chain" has been formulated to explore some of the important factors of soil evolution under the effect of water erosion in the light of the various socio-economic development scenarios. Confining observations to the watersheds, the following data were determined :
- erodable surface area, on the basis of FAO data and maps : these is non-forest land, not covered with grassland nor built over, therefore largely cultivated arable land ;
- actual eroded surfaces : a coefficient was deduced on the basis of the situation observed in 1980, and applied to each country and scenario. Unfortunately, it was not possible with available data to adapt this coefficient in terms of time and/or other factors (an initial approach to the volumes of sediment actually discharged into the sea, taking into account time and transport conditions was, nevertheless developed with the help of another coefficient).

A distinction was made between two categories of eroded surfaces, depending on whether erosion can be considered as light (values never less than 5 tonnes per hectare per year) or heavy (values never less than 10 tonnes per hectare per year), the actual limits of these erosion rates varying with the country under consideration. The breakdown between slightly eroded and heavily eroded arable land was partly based on the amount of land on slopes, i.e. on the morphology of the watershed. Erosion rates were adapted in the light of the scenarios, increasing by 20-60 % for instance, depending on the country in worst trend scenario T-2 and, on the contrary, falling by 10-30 % in the moderate trend scenario T-3 (some action taken which helps to restrict sediment removal), and by 30-60 % in the alternative scenarios (more conservation action is taken and becomes increasingly effective). In fact, in a given watershed, action to combat soil erosion can restrict sediment removal by as much as 50-80 %.

This model indicated that some Mediterranean regions would lose nearly 1 % of their "agricultural land capital" each year. Worst trend scenario T-2 would generally speed up losses considerably (except in Turkey and in France), combining increases in agricultural surface areas involved and in losses per hectare. In order to stabilize, even reduce, major degradation related to moderate trend scenarios T-3, huge biological and mechanical conservation and rehabilitation efforts should be made, at a very high cost (which would not prevent some irreversible trends), considering the growing agricultural pressure in countries south and east of the Mediterranean basin. In other words, and considering all the factors of degradation, the two trend scenarios would in fact spell doom for Mediterranean soils, the T-2 because of real pressure on land, the T-3 for economic reasons. And this, according to experts, would occur within 5 to 15 years, i.e. within the first period of the Blue Plan scenarios.

With the abandonment of agricultural land in the north and lower growth of agricultural areas in the countries south and east of the basin through increased co-operation, the alternative scenarios give a slow down in the loss of agricultural land compared to 1980, through effective biological soil conservation efforts and reafforestation or forest protection measures, whose implementation could require 10 to 25 years.

*

It should be noted that even in the most propitious case, the loss of agricultural land would remain a permanent problem which could worsen at any time in the most threatened countries (Syria, Lebanon, the Maghreb etc.) as a result of the lack of soil potential analyses. The inability to check soil erosion and degradation processes clearly seems to be one of the most serious threats.

All degradation processes, starting with wind and water erosion, in a climatic context in which dry periods are increasing, contribute to the advance of desertification both in the countries south and east of the Mediterranean basin (annual loss of about 20,000 hectares per year in Tunisia, for example) and in Spain, the most threatened country on the northern shore (nearly 10 million hectares threatened in the medium or long-term in its Mediterranean region).

CHAPTER IV.4

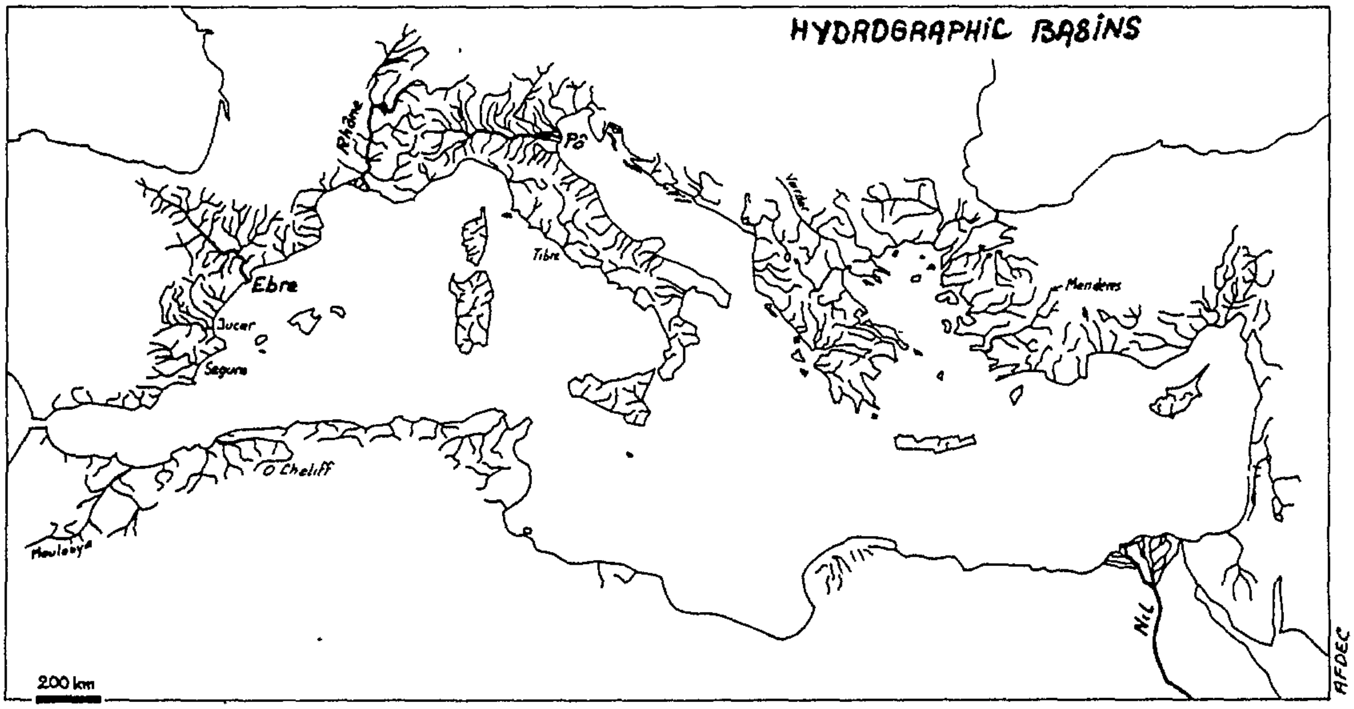
THE WATER CONSTRAINT

The distinctive physical conditions obtaining in the Mediterranean environment and the inherent features of water use in the basin are such that they confer very specific shades of emphasis on the interactions between development activities and water

The marked relief of the greater part of the basin offers considerable scope for water-control schemes, especially storage reservoirs -although their useful life is liable to be curtailed in the long run by silt encroachment- but it has the effect of compartmentalizing the land areas into a very large number of independent basins differing widely in size, and it is not easy to transfer water from one basin to another in order to tailor resources more closely to demand. Even so, such transfers are possible in a number of cases, notably in the Mediterranean coastal plains of Spain, France, Italy, Greece, Cyprus, Tunisia and Morocco, among other countries. The relative lack of major systems of ranking importance, but with converging aims, is a factor complicating the water-use conditions and makes the use of water for local purposes less interdependent.

Tourism generates a sharp seasonal peak demand (cf, chapter on "The futures of tourism"), which is largely concomitant with the irrigation demand and adds to the drinking-water of local communities. As a result of the effect of its agricutlural and tourist components, the water demand is subject to a marked seasonal pattern that runs counter to the surface runoff pattern. This exacerbates the tensions between requirements and resources in the summer season and justifies the extensive development of water storage and control schemes. However, the low inflows that are a fairly widespread feature of the dry season magnify the relative impact of the discharge of waste water into the surface water at the very time that demand is at its peak, on account of tourism, and this entails making a very special effort to provide sewerage and purification facilities. This problem is compounded in the semi-arid regions of the South, such as the Tunisian Sahel, which have no permanent water-courses, and in the offshore islands.

The concentration on the seaboard of growing urbanization, tourist activities and a substantial proportion of the irrigated land is responsible for generating an aggregate water-supply demand in such areas that is much higher than the local resources available, and indeed these tend to be further reduced by the impact of that demand. In addition to the fact that conflicts over the use of the water sparked off by the build-up in demand become more widespread, the coastal regions exert a marked pull effect on the inland water resources, and this may extend so far as to cover all the upstream catchment areas, without being offset by the recovery of waste water in return, since this is largely discharged into the sea. The reduction in water resources, owing to urbanization and the growing density of coastal land occupation, is, in fact, the outcome of the artificial channelling of rivers and streams and of the depletion and contamination of the groundwater table. In other words, the coastal regions tend to monopolize and consume a large proportion of the basin's water resources, while it bases part of its own resources. This pull effect may even extend beyond the basin, through transfers of water from outside sources, as is possible in a number of Mediterranean countries, such as Spain, Israel and Libya. However, the urbanization of the coastline can also be said to generate a by-product in the form of the discharge of waste water collected. This represents a significant secondary water resource whose renewed use -although still very slight at the present time- could be developed in future : it would have a beneficial induced effect on the marine environment into which it is discharged, and could also contribute to reducing the conflicts over urban versus agricutlural uses.


HYDROGRAPHIC BASINS
Rhône
Pô
Ebre
Jucar
Segura
Tibre
O Cheliff
Vardar
Menderes
Nil
200 km
AFDEC

There are grounds for believing that the very large number of small and medium-sized Mediterranean islands that are the focal points of acute tension between local water demand and resources -and have little prospect of being able to draw on mainland resources- will prove to be eminently suitable testing-grounds for the development of non-conventional water resources, starting with the desalinization of seawater for domestic uses.

This is only one example pointing to the fact that, in future, the mobilization and use of water in many Mediterranean countries can be expected to entail sharply increasing costs in terms of funding and energy, owing to the need for transfer pumping, long-distance conveyance systems, deep boreholes, desalinization plants, and so on.

I. IRRIGATION

Irrigation is very widespread in the Mediterranean basin and it occupies a predominant place in the overall demand for water in almost all the countries, although there are significant differences depending on the parts of the basin concerned. In the north, for example, irrigation is more in the nature of an adjunct to the river inflows than it is in the south. Two very different irrigation methods -the traditional method and the modern method- often exist side-by-side, and hence the water requirements per hectare are rather different. The considerable volume of water used for agricultural purposes boosts the final consumption figure compared with the total offtake, since the bulk of the offtake used for the other purposes is recovered.

A study has been carried out on a country-by-country basis in an attempt to set possible theoretical limits for the devleopment of irrigation. In the north of the basin, from Spain to Greece, the water resources would make it possible -although the schemes required would be costly in some instances- to increase the irrigated areas by about 3.8 to 4 million hectares by the year 2025 (at an estimated cost of roughly US$ 70,000 million at 1985 prices). Turkey also offers very considerable potential for increasing the area under irrigation by about 2.5 million hectares (at a cost which might amount to as much as US$ 30,000 million). Syria and Egypt have to contend with very special situations, and the cost of increasing the irrigated area would be very high (as much as US$ 30,000 per hectare in Syria compared with some US$ 12,000-13,000 in Turkey). In the Maghreb, by 2025 the increase in the irrigated area could amount to some 1.6 million hectares, 60 % of the total being in Morocco. (The cost for the Maghreb as a whole could work out to as much as US$ 28-30,000 million).

These limits could only be lowered by means of very substantial improvements in the specific water consumption per hectare, such as those obtained in Israel.

In any event, the progressive tapping of new water resources from the natural cycle will entail a considerable increase in the cost of the water available for irrigation, especially in the countries on the southern and eastern seaboards of the basin. So high a cost will influence the choice of crops grown, which will tend to go to high value-added produce, perhaps to the detriment of a cropping pattern that would ensure satisfactory soil conservations, with the added risk of salt-logging. All studies show that if high yield intensive agriculture is introduced, water-saving techniques will have to become more widespread and drainage will have to be provided so as to enable part of the water to be recovered, among other things. Salt encroachment on the land would accordingly spread less quickly than expected, although this would not necessarily be true of the impregnation of the inland water and the subsequent pollution of the seawater.

STATISTICS AND FORECASTING METHODS FOR IRRIGATION

Concepts relating to irrigated areas are unfortunately far from precise, and statistics fail to provide the necessary data. The form of irrigation is almost never stipulated. Depending on countries and circumstances, it may involve :

- traditional random irrigation, by submersion, broad irrigation. or division of spate water, or melted snow in mountain areas, along a channel ;

- steady gravity irrigation, along furrows or creeks, from absolete structures, reservoirs, canals, trenches, towers, etc. ;

- pressure irrigation by spraying, from a system of buried pipes and with overhead distribution by sprinklers or spouts or by trickle, or any similar process, from a closed pipe circuit, with distribution through the soil, next to the plant.

Similarly, the surface area stated in statistics is not defined with any precision. Depending on the methods of irrigation defined above, there are several possibilities. The area may be :

- Area equipped, in other words with a water circuit or supply that enables the user to water when he likes (for spraying, this is usually the only precise fact stated) ; for gravity irrigation, the same concept exists, being the surface area of plots where access to water is possible through the existing channel network.

- Area irrigated each year, corresponding to the portion of the equipped area that can be watered each year, whether because of available water supplies or, more usually, because the farmer has been unable to sow irrigated crops over the whole of his land, for lack of labour. For sprinkler irrigation systems in French Provence, for instance, the irrigated area is only between 35 and 60 % of the area equipped - whereas for gravity irrigation it is always above 70 %.

- Area harvested, when several crops are sown each year on the same plot. This area is usually defined by a cropping intensity coefficient, applied to the physical surface area actually irrigated. With crop rotation and fallowing, this coefficient is less than 1. When there is multiple cropping, it is above 1 (it is usually taken to be 1.5 or 1.6 for Egypt, which offers a striking example of multiple harvesting).

As for volumes used for irrigation, the consepts given above affect estimates. As can be imagined, they are very much influenced by the scarcity of rainfall and degree of evaporation (with consumption higher in the south and desert zones than in the north and coastal zones).
All these remarks explain the reticence concerning results, in view of the many imponderables in available data.

The intensive use of water from the natural cycle could cause a substantial decline in outflows to the sea. This is clearly illustrated by the example of the Nile : at the beginning of the century, the volume of water emptying into the sea amounted to some 60,000 million m^3 a year, whereas now that the river flow is regulated, it only discharges 5,000 million m^3. This is the minimum volume of water needed to ensure flow conditions that are capable of "sweeping" the river bed. (Indeed, those minimum flow conditions were dramatically threatened in 1988, following several years of drought, when the level of Lake Nasser fell very close to its critical elevation of 174 metres, below which electricity generation could no longer be guaranteed. Most of the rivers and streams will suffer a similar fate, in that the volumes discharged will decline and will at the same time be more heavily silt-laden. The role performed by the Atlantic (and the Balck Sea) in compensating for evaporation in the Mediterranean will be enhanced.

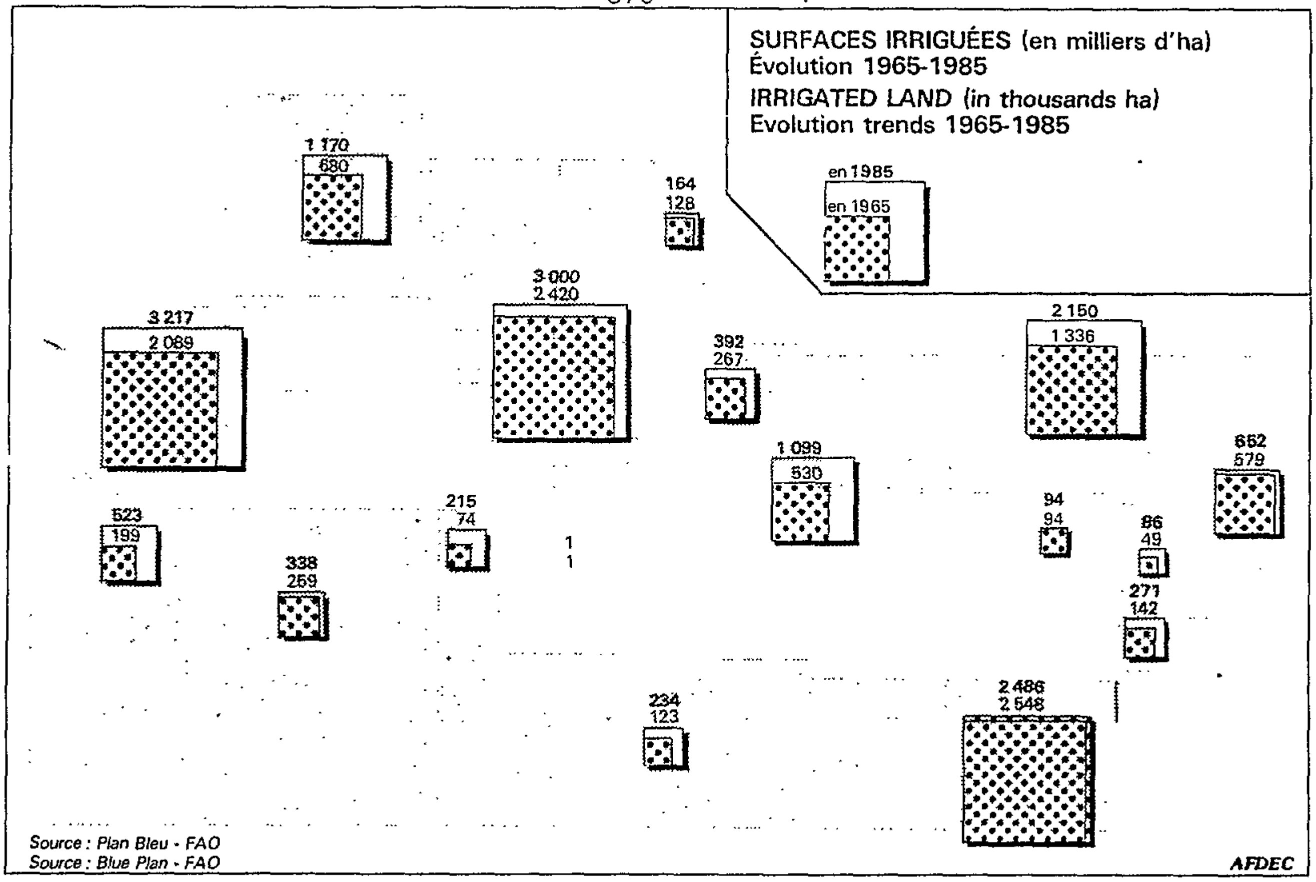
In amy countries, the problem of treating urban and industrial waste water is already become urgent. This problem is crucial for the Mediterranean countries, especially those in the south and east, and it can be reported that water re-utilization plans actually exist already in several countries.

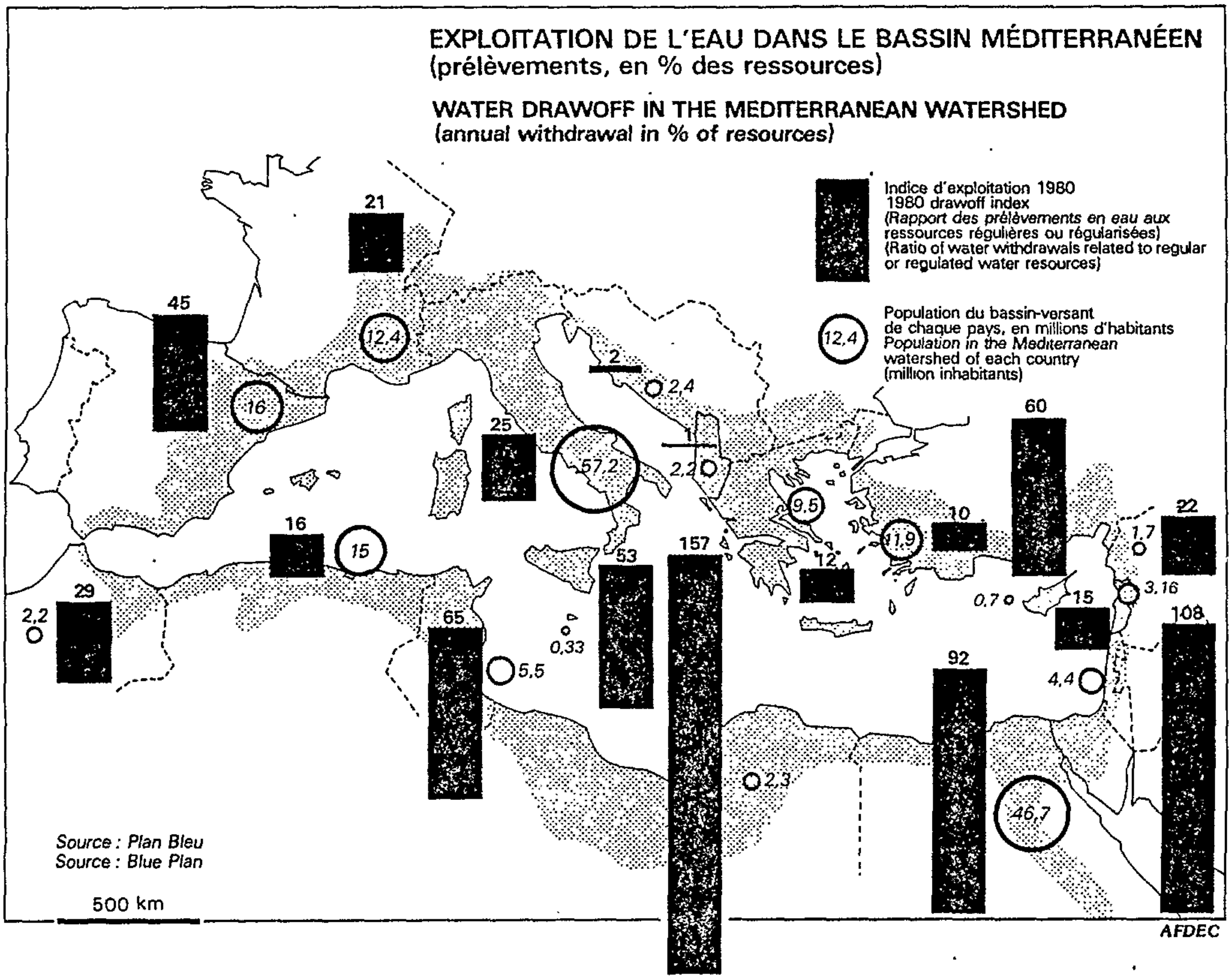
Depending on the scenarios, water will be used with varying degrees of efficiency in the year 2000, but the differences in its use for irrigation purposes will not be very significant (in the 10-15 % range) as between the two most sharply contrasting scenarios, i.e. the worse trend scenario T-2 and the integration alternative scenario A-2. Moreover, the depletion of water resources can plainly be seen from all the scenarios. Hence, efforts have to be focused on exploring the possibilities of cutting down on wastage, making use of technology in the most suitable and effective way possible, increasing retreatment capacities, etc.

In the alternative scenarios, a positive answer to these points is expected to be provided through technological and financial co-operation. At the present time, techniques for water saving, waste water treatment, precise fertilization and drainage are known and are already operational. However, their large-scale use calls for an effort to train skilled labour and for the availability of investment funds, in addition to very firm political determination, both nationally and internationally, based on a clearer perception of the issues involved.

On the subject of the types of irrigation used, mention has to be made of the questions that have recently come to be asked about projects connected with large dams. Since the end of the last war, considerable sums have been invested in the construction of large hydraulic dams, and the results in terms of agricultural performance are regarded as not always having lived up to expectations (as in the cases of Algeria, Syria, Tunisia and Egypt, among others). Apart from the ensuing salinization of the land (one of the secondary effects arising out of badly supervised irrigation), the main reasons for this lie in the fact that investments downstream of the dam were not as effective as they ought to have been, priority was given to providing drinking-water supplies, agricultural pricing policies were not suited to the purpose, or the population was not sufficiently involved in either the project decisions or implementation and was not properly prepared for it. The areas scheduled to be irrigated were not all fitted out and the areas actually irrigated are often even more limited, while water losses from the distribution systems tend, moreover, to increase with the course of time (to the extent that they account for 50 % of the inflow, or even more). By contrast, in many countries, "small-scale" irrigation has proved particularly dynamic and could be developed to a notable degree.

In addition to the role they play in irrigation and possibly in electricity generation, dams perform an important flood-control and prevention function. This need for protection will most probably grow sharply





Un fort indice d'exploitation des ressources en eau nécessite le recours à des ressources non conventionnelles : nappes fossiles non renouvelées, recyclage d'eaux usées, multiples utilisations de l'eau, réduction des pertes, dessalement de l'eau de mer...
A high water drawoff index calls for utilization of non conventional resources : non-renewable fossile resources, recycling of used water, multiple water uses, reduction of losses and seawater desalination.

in many of the countries in the Mediterranean basin, where the flow patterns are extremely irregular (as in the case of the Maghreb. The bulk of the inflows occur at floodtime, sometimes in the space of only a few hours or a few days, and the morphology of the landscape changes at the same time. In the Maghreb, for example, some 15 to 20 % of the annual discharge of the Medjerda occurs in a single day, while the stream flow of the Moulouya rises from one to several hundred m^3/sec in several hours. In October 1969, the flow in the Oued Zeroud, in central Tunisia, rose to 17,000 m^3/sec, whereas its normal floods scarcely ever exceed 200 to 500 m^3/sec.

Laden as they are with sediment and debris from the scouring effects upstream, the swollen torrents cut into the banks and may carry down up to 15-20 % of solid matter, or indeed as much as 30 % (as in the case of the Medjerda in 1973). As a result, the dams are clogged with silt and, in other instances, there is catastrophic flooding. The Kaitouan plain, for example, was covered by silt deposits more than one metre thick, which removed all trace of the crop layouts. In the city of Sfax, which is located in the middle of a large basin measuring 800 km2, the lowest-lying districts were flooded in 1975. In Annaba, where the problem is a complex one, the districts situated on the plain were completely destroyed by the floods in November 1982. Unless extensive protection works are carried out, it will not be possible to integrate many low-lying flat areas into the urban fabric.

In connection with the silting-up of dams, all the reservoirs in Algeria are estimated to be losing 2 to 30 % of their storage capacity, or some 90 million m^3 of water each year. In other words, the "siltation margin" entering into the calculation of the dead storage is in the 30-50 year range. Owing to the scale of the floods on the Oued Zeroud and the susceptibility of its catchment area to erosion, the size of the reservoir was generously designed to provide for additional storage of 60 to 70 million m^3, so as to allow for silting. The Chiba dam, likewise in Tunisia, which was brought into service in 1963, had a siltation rate of 35 % some 12 years later, in 1975, and the rate is now thought to be about 70 %.

II. DIFFICULTIES INVOLVED IN THE LONG-RANGE FORECASTING OF REQUIREMENTS

The growth in water requirements to keep pace with urbanization has already been mentioned, the capital cities being by far the most demanding, with Algiers needing 540 million m^3 in the year 2000 and Greater Tunis 235 million. Like land occupation, domestic water consumption is the product of two factors : the population, which can be estimated to within an accuracy of $\pm$ 10 % by the horizon 2025, and the unit consumption, to which it is currently difficult to put a figure and which it is much more difficult to evaluate for a horizon several decades ahead.

Demand for domestic uses has to compete with that from industry, to which it is even more difficult to put a figure for the medium or long run. In point of fact, while demand, which should not be confused with actual "consumption", is fairly well known in the case of certain large consumer industries, such as steel, pulp for paper-making and some branches of the agro-food sector, etc., the figures may vary significantly, depending on the features or the age of the plant being used. Some industrial sites are substantial consumers, like the Gabes area, in Tunisia, which consumes more than 28.3 million m^3 a year, and the pulp mill at Mostagenem consumes a similar amnount. However, the medium or long-term demand is still very difficult to estimate for the country as a whole, since the consumer industries are becoming increasingly divided into those that are connected up - usually to the urban mains distribution system - and those that are not. One method of

THE POLLUTANT ABSORPTION CAPACITY OF THE NILE

The River Nile is Egypt's main - and virtually only - source of fresh water. Apart from the Mediterranean Sea in the north, it is also the main outlet for the dumping of polluted effluents. Some of these effluents may be mixed with the topsoil and be absorbed by the sub-soil, especially by the pervious sandy layers underlying the upper alluvial layers. However, some of the effluents will eventually be completely recycled if the economic and technical conditions permit. It is accordingly of the utmost importance to continue to monitor the Nile water, in order to ensure that it is still capable of absorbing, diluting and precipitating all kinds of pollutants. The polluted water is used several times over for industrial purposes and for the country's irrigation needs before it is finally discharged into the sea.

Pollution monitoring stations have been installed along the navigable waterway. Between Aswan and Cairo, there are 22 collectors discharging more than 300 million cubic metres of industrial effluents into the Nile, while there are 45 other sewers discharging some 400 million cubic metres of waste water from agricultural uses. In addition, it is reckoned that there are 800 vessels plying the Nile, and these are required to be fitted with water-treatment equipment, while 6 land treatment plants have been built to take the effluents accumulated by vessels while they are at sea. Measures have been taken for cleaning up oil and grease spillage in localities that have been seriously affected by pollution.

It is important to engage in the periodic analysis of the water quality at different locations and times of the year. It should be possible to identify pollutants that are dangerous in terms of both quantity and quality and to draw up a reasonable effluent-treatment programme, so as to be able to deal with difficult cases, especially in instances where the river water is drawn off by pumping for domestic uses.

estimation is based on the average consumption per job, but this can scarcely be used for long-term projection purposes.

As a rule, a distinction also has to be made between two levels in respect of demand (and waste disposal) : the level of consumer demand (and waste disposal) which the economic sectors require from the agencies responsible for water, such as distribution companies, and the level of demand (and waste disposal) required of the natural environment. Both these levels can, moreover, be expressed in terms of both quantity and quality. Although the two last-mentioned aspects, i.e. quantity and quality, cannot be dissociated, it is usually difficult to gauge the impact which economic activities have on the quality of the water from the natural environment on a macroscopic scale. Almost the only measurements available are those made on a local scale, and it is virtually impossible to determine what relationship these bear, in quantitative terms, to action to combat pollution or attempts at purification.

The following considerations are accordingly confined to taking a globalizing approach, in an endeavour to estimate the water requirements of the different countries and to compare them with the resources available.

III. MEDIUM AND LONG-TERM OUTLOOK

In order to obtain an overall long-range view of the situation, it was considered useful to tackle the questions of future water requirements in the countries of the Mediterranean basin by means of a globalizing method, after having checked it for consistency against the straightforward summation of the sectoral requirements. This method made it possible, in the first instance, to classify the countries in three groups, according to how acute their water supply problems will be at the horizon 2025.

The first assumption adopted was that the determining variable would be the size of the population. The second assumption was that the per capita requirements would remain constant in the year 2025, in other words that the growth in requirements would keep pace with the population growth. Although this assumption may appear surprising, it was verified from a number of sectoral requirements furnished by the scenarios. For example, the irrigation water requirements in Algeria were estimated as being likely to grow by a factor of 2.5 by 2025, while, according to the scenarios, the population is expected to grow by a factor of 2.5 to 3, i.e. by virutally the same amount. Generally speaking, the variances proved to be in the 10 to 20 % range. This is not very significant, considering that the multiplier factors were approximately from 2 to 3.

It is true that it is possible to identify a number of factors which should give rise to an increase in per capita requirements (although these display some short-term inertia). These factors include the following :

- the growth in the drinking-water supply rate, especially for the rural population in the countries in the south and east of the basin ;
- the growth in the population urbanization rate ;
- the growth in the per capita drinking-water demand for the population being served, which is largely bound up with the growth in household incomes ;
- the development of industrial output per capita ;
- the growth in the share of agriculture in the total water requirements ;
- the growth in the active population as a proportion of the population as a whole ;

WATER TRANSFERS BETWEEN DRAINAGE BASINS :
AN EXAMPLE

In Cyprus, a project for transferring surface water from the drainage basin of the Dhiarizos River to that of the Komis River through a 15 kilometre-long tunnel, is the solution envisaged for the future water supply in the towns of Limassol, Larnaca, Famagusta and Nicosia.

In the coastal area to the south-east of Mesaria, offtakes from the aquifer amount to 25-27 million cubic metres, whereas natural renewal only amounts to 14 million cubic metres. This overexploitation produced a drop in the water level and the seepage of sea water into the aquifer.

The only apparent solution is therefore to import "surplus" water from other regions. The solution will be complemented by measures to recycle water within the towns concerned, depending on its use (water for some household uses does not need to be potable).

In this region the demand for water is between 150 to 170 litres per day for tourism and 130 litres per day for households in rural areas.

- the worsening of water conveyance and distribution loss rates ;
- the possible development of water exports.

There are, however, other factors that could also give rise to a decline in per capita water consumption or, more precisely, could prove to be an impediment to the above-mentioned growth factors.
These include the following :

- advances in the introduction of water-saving techniques, especially in agriculture (through sprinkler systems and micro-irrigation) and in energy production (the progress made in using closed-circuit cooling systems as a substitute for open circuits) ;
- the extension of waste-water re-utilisation methods ;
- the development of "non-conventional" water resources (such as the desalinization of brackish water or seawater) ;
- the reduction of water losses and leakage in conveyance and user systems ;
- the cutting-back of drinking-water supplies by means of rationing ;
- the development of water imports, especially from outside the Mediterranean basin (cf. the cases of Spain and Libya?) ;
- changing attitudes and behaviour patterns ;

An "exploitation index" has been defined as being the ratio of the sum of all water offtakes to the total volume of physical water resources. This index should only be regarded as being a macro-indicator of the "pressure" which the demand exerts on the resources. It may exceed the value of 100 %, in which case it would point to the re-use of the water after it has gone to replenish the volume of resources, or to the tapping of non-renewable stocks, such as the depletion of the groundwater table. In the event of the water being re-used, an exploitation index of more than 100 % is significant in a further respect, in that it is bound up, to some degree, with the quality of the water, since it indicates that a growing proportion of the overall water flow is recovered after having been used. Thirdly, the index has an economic significance, since the water production costs and consumer prices tend to increase in parallel with one another, and this could eventually have an effect on demand.

The findings (for the Meidterranean regions or for all the countries, depending on the case) show that there are no very significant variances in the different scenarios for a given country -this is the outcome of the method itself- but that, by contrast, the countries have to contend with very differing situations and can be roughly classified in three groups, as follows

1) Countries where water availability will remain adequate up to 2025 and beyond, and where there is even a fairly comfortable margin for increased per capita offtakes. This group of countries include those with low population growth (France, Italy, Yugoslavia) and with stronger population growth (Albania, Turkey, Lebanon). Maintaining this margin will require efforts to develop and manage water, and to preserve appropriate quality, which will be necessary in any event, especially in the last-mentioned countries.

2) Countries where water availability, although still adequate at present, will drop considerably (Spain, Morocco, Algeria, Cyprus), but where the global demand for water could be met up to 2025, chiefly with new water-resource development or through major interregional water transfers in countries where the resources are distributed very unevenly, provided that the per capita offtake remains close to current levels. Any significant growth in the per capita offtake would put these countries quite quickly in the critical

WATER IN ALGERIA : THE PLANNING OF A SCARCE RESOURCE

In October 1980, the then current water uses were estimated to amount to 3389 hm^3, divided between domestic uses (700 hm^3) and industry (14 hm^3), although the latter probably accounted for much more (as much as 2540 hm^3). This is by no means sufficient to meet the requirements either in towns, where there are frequent interruptions in supply, or in agriculture, where the amounts applied are inadequate. At an approximation, out of the total of 3380 hm^3, the groundwater table supplies 1870 hm^3 and dams 700 hm^3, while the remainder is obtained from runoff.

The potential certainly exists and can be evaluated as follows :

- the surface water available amounts to 13580 hm^3, and this could be mobilized by building dams at an acceptable cost. (This would represent seven times the currently controlled storage of 700 hm^3) ;
- the total groundwater resources are estimated to amount to 3300 hm^3, out of which 1870 hm^3 are already used. However, these resources are chiefly located in the Sahara (with its estimated resources amounting to 1600 hm^3, only 600 hm^3 of which are already used). The Sahara is a region where the use of the water, especially when drawn from the Albian, whose groundwater resources are estimated to amount to 1700 hm^3, is already using 1270 hm^3, thereby leaving very little spare capacity (430 hm^3).

The water requirements for the horizon 2000 have been the subject of projections worked out by the Ministries of Hydraulics and Planning on the basis of estimates for urban population growth, the average rate of satisfaction of the demand for drinking water, and the norms for the use of water in agriculture and industry :

- the drinking-water requirements will range between 2000 hm^3 (with the high assumption of 300 litres per inhabitant per day) and 1600 hm^3 (with the low assumption of 200 litres per inhabitant per day) ;
- water supplies for industry account for 465 hm^3, but industrial requirements generally are not well known ;
- in the agricultural sector, 4700 hm^3 would be needed to irrigate 700,000 hectares with average applications ranging between 3500 m^3 per inhabitant and 8000 m^3 per inhabitant, depending on the region (excluding the Sahara).

This represents a total demand at the horizon 2000 of between 6765 and 7165 hm^3, or double the amount used in 1980 (3380 hm^3 according to the above estimate).

Source : the review "Maghreb-Machrek" and the Algerian Development Plans.

situation being faced by the countries in the next group and would call for solutions other than the construction of conventional development scheme.

3) Countries where the current water availabilty is already limited or negligible. As from the year 2000, the exploitation indexes will exceed, or will have already exceeded, 100 %. These include countries where population growth is low (Malta), average (Israel, Tunisia) or high (Egypt, Syria, Libya). If the per capita offtake from conventional resources is to be met, it will resort either to drawing on non-conveitonal resources, such as fossil water or the desalinization of seawater, or to importing water.

The above classification can be enlarged on by the following comments, which shed some light on the specific situations obtaining in various countries :

- In the north, the exploitation indexes are increasing, although they have not yet reached 100 % in Spain and Cyprus, for example, where they are already quite high (currently 45 and 60 %). In both cases, irrigation is a very predominant component of the water demand, and is likely to remain so.

- The exploitation indexes are likewise growing in Turkey, although they started out from a moderate base, and they only exceed 15 % in the year 2000 and 20 % in 2025 in the worse trend scenario T-2.

- Malta is a special case, in that the low rate of the per capita offtake is already the outcome of the limited volume of resources. The index will level off in all cases at around 100 %, and it will only be possible to meet any further demand by means of non-conventional resources, such as desalinization.

- In the Maghreb countries, the index is growing sharply, without any very appreciable variance between the scenarios, and it will increase twofold or more by 2025 (the maximum for T-2). However, it only reaches and exceeds 100 % in Tunisia, from a current base value that is already high (more than 65 %). The index is liable to exceed 100 % by the year 2000 and could range to as high as 130 % to 155 % in 2025. Tunisia is the country where the re-utilization of water will be developed to the greatest extent, in conjunction with water savings, irrespective of the scenario.

- In Israel, where the index has already topped 100 %, it could rise to 160 % in 2000 and to more than 200 % in 2025 (the maximum in scenario A-2). It will obviously not be possible for the per capita offtake to continue at the present level, even with the increased remobilization of water and the tapping of reserves. Even if the demand is held down by water savings, a growing proportion of the requirements will have to be met by turning to non-conventional resources and/or imports.

- In the Mediterranean part of Syria, the same pattern is taking shape. Starting from a base value that is already high (currently 65 %), the index will in all cases be higher than 100 % in 2000 and higher than 200 % in 2025 except for alternative scenarios A-1 and A-2). It is unlikely that the record per capita offtake of 1,500 m^3 a year, which is due to the large scale of irrigation compared with the small size of the population, can be maintained.

- Likewise in Egypt, where the per capita offtake is almost as high, the current exploitation index of almost 80 % would in all cases exceed 100 % in the year 2000, with wider variances in 2025, depending on the scenarios (the maximum being 200 % in scenario T-2 and the minimum 175 % in scenario A-2). Since the water resources are virtually all imported (via the Nile), the growth in the index points to the need to

EXPERIENCE OF THE USE OF LOW-QUALITY WATER IN TUNISIA

The state of the soil and the high degree of salinity of the irrigation water make farming difficult in the lower part of the Madherda valley, in Tunisia. The Medjerda is a river which flows from west (in Algeria) to east, before emptying into the Mediterranean in the Gulf of Tunis. Some 40 km west of Tunis, the river enters a broad coastal plain formed of heavy clay soil with a lime content ($CaCO_3$) of up to 35 %. The rate of seepage into this soil is very low and the winter rainfall, which is not very saline, may remain on the surface for very long periods. During the growing season,the soil dries out quickly and it shrinks and cracks (with the cracks being more than 5 cm wide in places). The water is quick to penetrate into the soil through these cracks, and the soil then swells and closes up again. The quality of the water from the Medjerda fluctuates to a considerable degree over the course of the year, ranging between 1.3 and 4.7 dS/m. During the greater part of the year, the water from the Medjerda can be used for irrigating crops that are capable of withstanding a medium to high salt content, such as dates, sorghum, etc. The leaching of the soil in summer is not sufficient, owing to the large cracks that are formed, and the winter rains only partially wash out the salt in the soil top-layer. As a result, the soil structure is poor and the seepage rates are very low.

The Government of Tunisia and Unesco have carried out a field research programme since the end of 1960s for the purpose of identifying this region's agricultural management needs, and the findings of this programme have proved very useful both for Tunisia and for other Mediterranean countries having to contend with the same problems involved in using poor-quality water on heavy coastal soils. The main proposal made in the study aimed at choosing the most appropriate period for leaching the soil, in order to save water, and the cultivation of certain types of crop, such as those capable of withstanding the expected salinity build-up.

Taken from "Bulletin de la Qualite des Eaux : l'eau et l'agriculture - lere partie" - March 1987.

increase the inflow in the short or medium run -perhaps by means of development schemes in Sudan and Ethiopia - but it also suggests that there is a need to reduce the per capita demand in the long run, especially by stepping up the efficiency of irrigation.

- Libya records the high growth in the index : it is already well above 100 % (standing at almost 250 %), in spite of a not unduly high per capita demand similar to that of Tunisia and Israel. This is due to the fact that widespread use is already being made of non-renewable resources and, indeed, the theoretical index could exceed 500 % in 2000 and stand as high as 900 % or even 1200 % in 2025! Even if this were to prove possible to some extent through the further drawing-down of reserves, as is actually planned, it will certainly be necessary to develop water-saving methods and non-conventional resources, such as desalinization, in this country, whose renewable stocks of water are very limited.

In order to fill out these overall figures, the scenarios have made it possible to identify three possible types of evolution in the Mediterranean basin. These are as follows :

- the slow economic growth of the worst trend scenario T-2, which would add to budgetary constraints and cut back investments to a minimum, would make it difficult to meet the particularly marked growth in consumer demand for water, especially in the south and in sewerage requirements, on account of the structural shortcomings due to the lack of amenities ; the reduction in the volume of water distributed per capita ; the stagnating, and indeed declining rate at which sewerage systems are being connected and purification plants are proving effective ; and the slow pace at which the irrigated areas are being increased, coupled with the inadequacy of the efforts being made to modernize irrigation methods that would be conducive to saving water. All this would tend to level out the pressure of demand for water in terms of quantity, but generally at the expense of efforts to provide sewerage facilities and protection both in the north and in the south and east. The outcome would be further and more widespread instances of local deteriorations in quality, and these would be above all numerous in the industrialized countries of the north.

- Stronger growth, but showing insufficient or belated concern for the environment (moderate trend scenario T-3), would cater more readily for growing water-supply demands of consumers in the different economic sectors. The water supply would be increased primarily by stepping up the number of conventional water management schemes -with a consequential escalation in mobilization costs- including provision for increasing the safety features in respect of sources of supply, flood protection, and so on, rather than by "adjusting" demand through efforts that would fall on consumers to a much greater degree than they would on the community (as is the case with large-scale schemes). Since the only water savings would be those that would be of immediate advantage to consumers, the wastage, in terms of both quantity and quality, would increase.

As a result, growing pressure would be exerted on the resources and the environment and, in particular, the risk would be incurred, in the medium term, of depleting some of the non-renewable water resources of the countries in the south and east of the basin. Conflicts between users over the control of the most accessible resources could become more widespread, especially in regions where water is scarce and, more generally, in coastal areas - above all between sectors whose economic and social impact is not the same (say, as between the provision of a drinking-water supply for towns and the tourist industry as opposed to water for irrigation). Efforts to provide sewerage and water protection facilities would not follow at the same pace and the water quality, including that of the offshore seawater, would deteriorate in many sectors both in the north and in the south and east. Little allowance would be made for these external costs, except in cases where they would have feedback effects on drinking-water production costs, when they would be regarded more as a disamenity than as a shortcoming in environmental management. Levying a charge to remedy those disamenities, on the "polluter pays" principle, might often degenerate into the acquisition of "rights to pollute" in the settlement of conflicts over water uses, although this would work to the detriment of the environment. As in the case of other environments, this scenario accordingly appears to be the "best" from the development standpoint, but it would probably be the worst as far as safeguarding water resources are concerned.

- Medium to strong economic growth, accompanied by a more action-oriented policy for safeguarding the environment and managing water resources, of the type depicted in the alternative scenarios, would enable a better balance to be struck between :

- water management and mobilization, though the institution of a system of "earmarked" flows and quality goals, which would be monitored by resource-management authorities with the powers and the means to ensure compliance and a clearer understanding of those goals ; and

- the adaptation or "tailoring" of demand, in terms both of usage, through water savings, enhanced efficiency, recycling and re-use, all of which would make it easier for competing uses to exist side-by-side, and of the restoration of water to the environment through efforts to provide widespread sewerage and purification facilities, by improving the quality of the aquatic environment and thereby reducing drinking-water production costs.

Similarly, in the specific case of the mobilization of non-renewable water resources in the Saharan regions of the countries of the south, a management approach displaying a greater awareness of the natural "inheritance" would lead to a more moderate rate of exploitation in favour of a longer time-scale and the use of water for purposes enhancing its value.

*

Whatever the outcome, it appears likely that the contrasts will become more marked between :
- those countries or regions where the overriding problem will be to reconcile the maintenance or moderate growth of the costs entailed in meeting consumers' demand for water -which is generally growing at a relatively slow pace- with the protection and, indeed, the restoration of the natural environment ; and
- those countries which are already engaging in -or will be compelled to engage in- "scarcity management", in which water economics will be progressively separated from the exclusive harnessing of natural resources. "Primary" per capita offtakes, which must of necessity be reduced, will have to go hand-in-hand with more efficient and sequential water uses -"with the same water having to be used several times"- and with recourse to artificial resources.

CHAPTER IV.5

THE COVETED COAST

Social and economic development in the past few decades has wrought far-reaching changes in the Mediterranean seaboard, and the foreseeable population trends and the development outlook for the different sectors of activity identified in the Blue Plan scenarios appear to presage even more far-reaching unheavals for the horizons 2000 and 2025.

As a narrowly circumscribed dividing-line between land and sea, the Mediterranean coastline is a place where countless new development sites are being contemplated, whether it be for heavy or processing industries on the southern or eastern shores or high-tech industries in the north, energy generation through the construction of power stations, aquaculture, multi-mode transport, the creation of technology parks, and so on.

However, as the cradle of original civilizations, the Mediterranean seaboard is not merely a "convenient location". It also represents a cultural heritage common to all the riparian countries, on account of the prodigious wealth of its history and its incomparable and still more or less untouched landscapes ; a fragile natural inheritance, with intense exchanges taking place between land and sea ; and a specific haitat for flora and fauna that are being increasingly threatened. It is therefore imperative that be safeguarded.

The variety of the shorelines is so great and the contrasts in relief, geology, climate, population, activities and other features are so marked that the exploration of their possible futures only becomes meaningful when it is narrowed down to a very local level. The Blue Plan scenarios accordingly have to be pursued on the coastal strip or belt proper, which may extend from a few hundred to several thousand metres on either side of the coastline, provided the necessary statistics become available. In the present long-range forecasting exercise, it has been necessary, in most instances, to limit the approach to much broader coastal regions, such as those defined on the basis of administrative units in the first part of this report. In some of the areas studied, the scope has been extended to cover the catchment areas (as in the case of water resources). However, wherever possible, attention has been focused, if only in qualitative terms, on the coastal strip proper.

Failing the existence of "coastline scenarios", an attempt will be made to spell out a number of specific features pertaining to the fundamental factors that have made it possible to define the scenarios (cf. Table IV-1), as follows :
- the coastal features of the "environmental components" are of a physical and biological nature and include the saline and alkaline soils and river deltas ; coastal or submarine aquifers, imported water and floods and flooding in coastal plains ; the Mediterranean thermal forest stage and the re-afforestation of coastal dunes ; specific coastal ecosystems ; and the structure of the offshore seabed ;
- the coastal features of the "activity sectors" are of a spatial nature, on account of their location, which may be mandatory or a matter of choice, and include fishing and aquaculture ; seawater desalinization ; imported raw-material processing ; cooling facilities for thermal power-resorts and offshore yachting ; land/sea transport interfaces ; and international transit facilities.

The "coastal system" operating pattern gives rise to particularly complex interactions and feedbacks, owing to the density of the activities involved. An attempt has been made to analyse the consequences of possible future trends in these activities, as outlined in the scenarios, on the specific environmental components of

	SPECIFIC COASTAL FEATURES OF THE SCENARIOS	SPECIFIC IMPACTS	FEEDBACK
International context	- World strategic region - Role of transnational corporations and of capital from outside the region	Conflicts - Region of competing great-power influences Setting-up of business activities	International agreements
Development scenarios	- Attempts to strike a balance between the interior and the coast - National priorities		Interior/coastal balance
Population	- Retired residents (from the north) - Seasonal population - Population growth as a result of the positive migratory balance - History	Population and economic imbalances Clash of cultures Domestic waste	Staggering of leisure-time activities
Land use	- Land status - Access - Competence - Urban planning rules - Development legislation		Reforms
Environmental management	- Rules and standards - Protected areas and sites - Maritime pollution control laws - Cross-frontier pollution : the sea and international agreements		
Soil formations	- Land-sea interfaces - Sedimentation in balance with catchment area	Erosion Impact on upstream developments	
Water	- Coastal or submarine aquifiers - Imported water - Islands: precipitations lower than elsewhere - Floods	Inflows of seawater if balance destroyed by pumping. Imported pollution. Seasonal water deficit	
Forests	- Dune stabilization by re-afforestation - Endemic diseases - The Mediterranean thermal stage (300-500 metres)	Forest fires Threats to species	
Coastline	- Lagoons - Cliffs - Dunes - Deltas - Islands - Insalubrious coastal plains		
Sea	- Structure of the offshore seabed - World strategic region	Cross-frontier pollution	
Food and agriculture	- Fisheries - Aquaculture	Over-fishing Competition	
Industry	- Desalinization - Processing of imported raw materials	Coastal location Toxic wastes	
Energy	- Powerstation cooling systems - Loading/unloading of petroleum products	Disturbance of coastal water temperatures Oil pollution	
Tourism	- Seaside resorts - Yachting	Tourist amenities : excess capacity design and use of concrete Marinas	
Transport	- Load transfer zone : land/sea transport interface - International transit region	Restructuring. Stoppage of physical land/sea exchanges if amenities are on coast	

Table IV-1 SPECIFIC COASTAL FEATURES OF THE SCENARIOS the coastal regions at the horizons 2000 and 2025. In the first instance, these analyses focus on the population and its growth and distribution as between urban and rural areas, and on seasonal population migrations.

I. POPULATION, URBANIZATION AND TOURISM

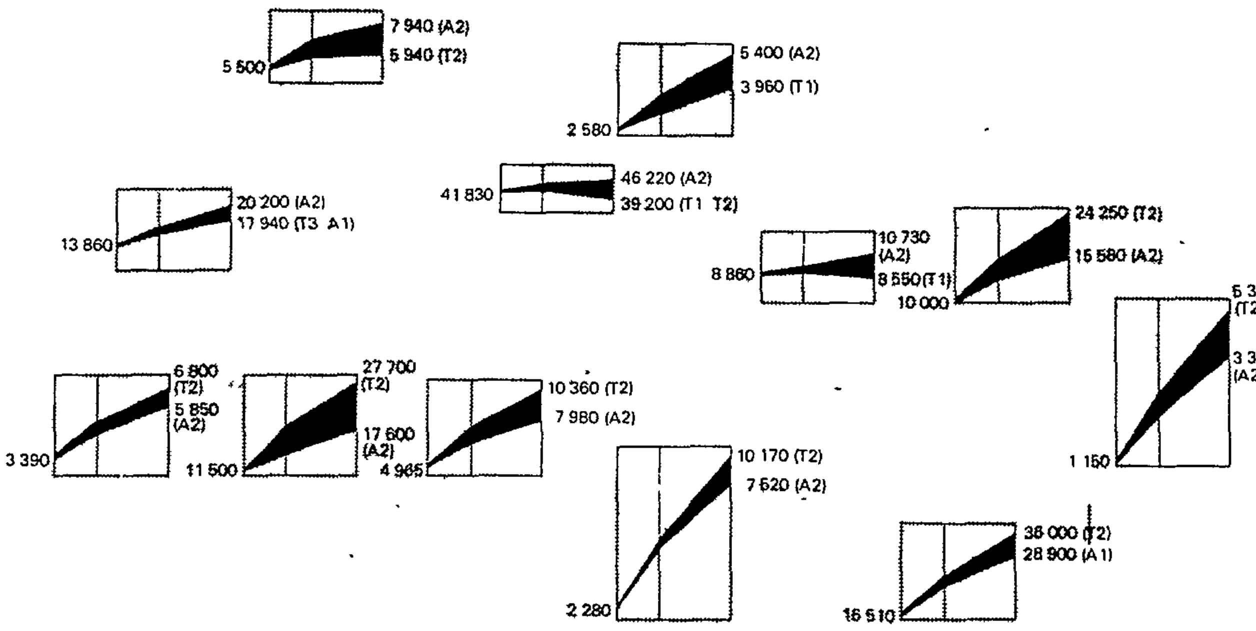
A. COASTAL POPULATION CONCENTRATION

In 1985, the population of the Mediterranean coastal regions was estimated at more than 133 million inhabitants, i.e. on average, some 37.5 % of the total population of the riparian countries on 15 % of the land surface (cf. Table IV-2).

	AREA (1000 km2)			POPULATION (1000 INHAB.)			DENSITY (INHAB./KM2)		
	TOTAL	MEDITER.	MED./TOT. (%)	TOTAL	MEDITER.	MED./TOT. (%)	TOTALE	MEDITER.	MED./TOT. (index)
SPAIN	504.800	95.504	18.92	38500	13860	36.00	76	145	1.9
FRANCE	547.000	46.248	8.45	54600	5496	10.07	100	119	1.2
ITALY	301.200	226.685	75.26	57300	41829	73.00	190	185	1.0
GREECE	131.900	100.278	76.03	9880	8862	89.70	75	88	1.2
YUGOSLAVIA	255.800	42.448	16.59	23200	2582	11.13	91	61	0.7
REGION A	1740.700	511.163	29.37	183480	72629	39.58	105	142	1.3
MONACO	0.002	0.002	100.00	27	27	100.00	13500	13500	1.0
MALTA	0.316	0.316	100.00	383	383	100.00	1212	1212	1.0
ALBANIA	28.748	28.748	100.00	3050	3050	100.00	106	106	1.0
CYPRUS	9.251	9.251	100.00	669	669	100.00	72	72	1.0
LEBANON	10.400	10.400	100.00	2670	2670	100.00	257	257	1.0
ISRAEL	20.770	20.770	100.00	4250	4250	100.00	205	205	1.0
REGION C	69.487	69.487	100.00	11049	11049	100.00	159	159	1.0
TURKEY	780.600	122.612	15.71	49300	10000	20.28	63	82	1.3
SYRIA	185.200	4.190	2.26	10500	1155	11.00	57	276	4.9
EGYPT	1001.400	103.894	10.37	46900	16511	35.20	47	159	3.4
LIBYA	1759.500	313.500	17.82	3610	2284	63.27	2	7	3.6
TUNISIA	163.600	45.712	27.94	7080	4965	70.13	43	109	2.5
ALGERIA	2381.700	68.294	2.87	21700	11500	53.00	9	168	18.5
MOROCCO	446.600	41.950	9.39	21900	3390	15.48	49	81	1.6
REGION B	6718.600	700.152	10.42	160990	49805	30.94	24	71	3.0
MEDITERRANEAN BASIN	8528.787	1280.802	15.02	355519	133483	37.55	42	104	2.5

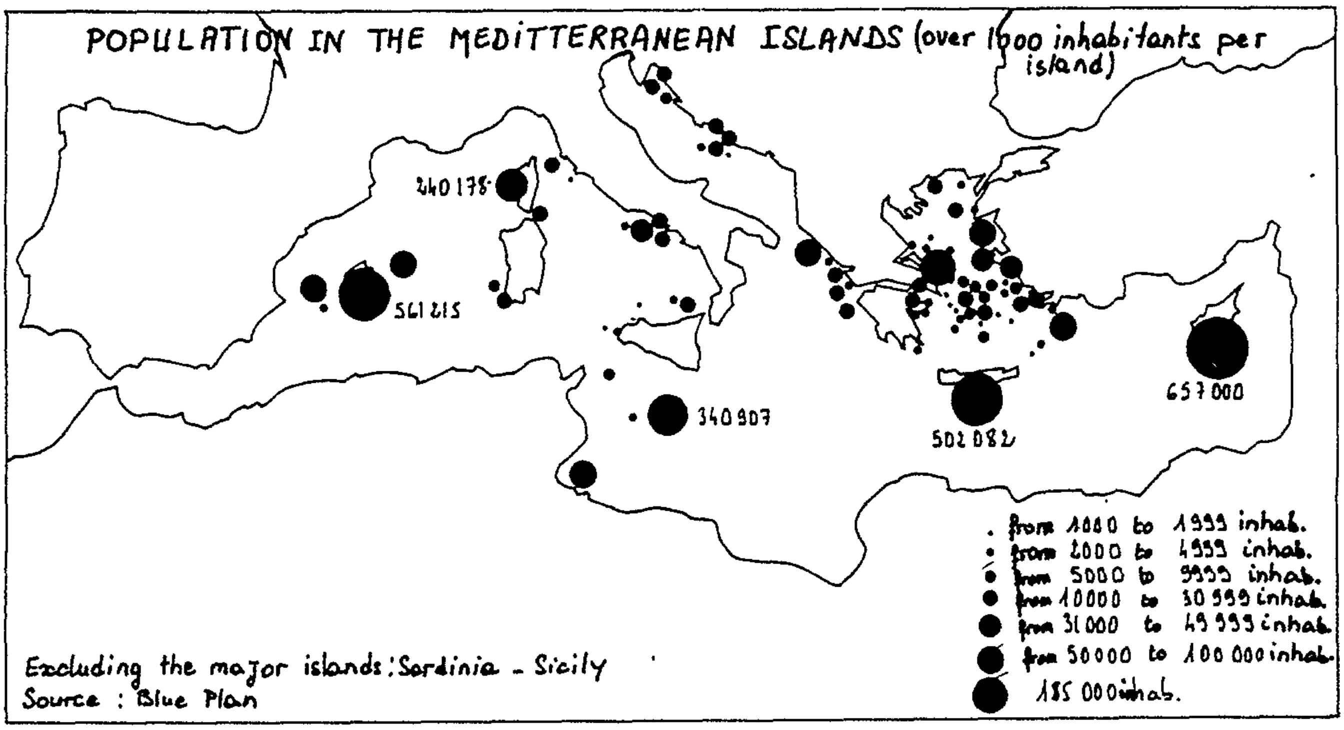
Table IV-2 1985 SITUATION

POPULATION LITTORALE EN MÉDITERRANÉE (en milliers)
Scénarios extrêmes 1985-2025
COASTAL POPULATION IN THE MEDITERRANEAN COUNTRIES (in thousands)
Extreme scenarios 1985-2025



Albanie, Malte, Chypre, Liban : population littorale proche de 100 %.
In Albania, Malta, Cyprus, Lebanon and Israel, the coastal population accounts for almost 100 % of the total population.
Source : Plan Bleu
Source : Blue Plan

AFDEC



The space-distribution of the population differs widely from country to country. In Yugoslavia, for instance, the coastal regions account for 17 % of the country's total land area, but have only 11 % of the population, and the population density (61 inhabitants/km^2 against 91 inhabitants/km^2) is lower than in other parts. These figures are a clear reflection of the importance of the development axis represented by the valley of the River Danube, which comes outside the scope of the Mediterranean region. By contrast, in Algeria, 53 % of the population live in the coastal regions, which accounts for barely 3 % of the country's total land area, and the population density is 18.5 times higher than in the rest of the country. Almost 20 % of the population lives in the Algiers region, which covers only 17 % of the national territory, and the population density there is close on 700 inhabitants/km^2. These striking percentages are obviously bound up with the overwhelming presence of the Sahara desert, but they nevertheless point to the very heavy concentration of population on the coast.

Depending on the scenarios, the population of the coastal regions of the Mediterranean is expected to stand at between 195 and 217 million inhabitants in 2025, representing an increase of between 45 % and 62 %. The most marked growth is liable to occur in the case of the worst trend scenario T-2, according to which there would be 83 million additional inhabitants compared with 1985, some 85 % of whom would be living in the coastal regions of the Zone B countries, where the population is expected to have increased 2.5 times. In reference alternative scenario A-1, the population would still increase by 60 million inhabitants, notwithstanding a lower growth rate. This increment would admittedly be more evenly distributed, since only 72 % of the new inhabitants would belong to the coastal regions of the Zone B countries.

Apart from Monaco and Malta, which are special cases, the population density in coastal regions would be highest in Syria, with an increase from 272 inhabitants/km^2 in 1985 to 1271 inhabitants/km^2 in 2025 in the case of scenario T-2. It would be followed by Lebanon, Algeria, Israel and Egypt and, to a lesser extent, by Tunisia.

The concentration of the population on the coast, defined as the percentage of the total population living in the coastal regions, would record a slight increase in the regions of the Zone A countries (from 39 % in 1985 to 40-41 % in 2025). This is particularly true of Yugoslavia, where the Mediterranean population would rise from 11 % in 1985 to 17-18 % in 2025. In the coastal regions of the Zone B countries, this phenomenon is magnified in the trend scenarios, but levels out or even declines, compared with 1985, in the alternative scenarios, except in the case of Libya. Algeria is an exception, since in 2025, the coastal population concentration is much lower than in 1985 in all cases, and especially in scenario A-2.

B. URBANIZATION

This population growth in the coastal regions is accompanied by the growth of the urban population. In 1985, this stood at 82 million urban dwellers. It is expected to rise in the year 2000 to 113 million in the case of the worst trend scenario T-2 and to 105 million in the case of the reference alterantive scenario A-1, while in 2025 the corresponding figures will be 170 million for scenario T-2 and 144 million for scenario A-1.

The current urbanization rate is slighly more than 61 % for the coastal regions as a whole, but it is expected to range between 74 % and 78 % and upwards at the horizon 2025. The worst trend scenario T-2 is that in which urban growth is at its highest :

- in the coastal regions of the Zone A and C countries, more than 85 % of the population would be urbanized, with maximum values topping 96 % in Spain and Israel ;

- in the Zone B countries, 74 % of the coastal population would be living in urban areas, with rates of 87 % in Tunisia and 85 % in Libya.

In other words, there are liable to be more than 88 million additional urban dwellers compared with 1985, i.e. more than the total population growth of the coastal areas. Three-quarters of these new urban inhabitants would be in the Zone B countries.

Table IV-3 illustrates this literal explosion of the urban population. It shows, alongside the figures for 1985, the net growth of the coastal population and the coastal urban population for each scenario at horizon 2025. Urban growth will clearly be a major phenomenon in the coastal regions of the Mediterranean in the coming decades.

	Coastal Population						Urban Coastal Population					
	1985 Pop. million	Growth 1985-2025 million					1985 Pop. millions	Growth 1985-2025 millions				
		T-1	T-2	T-3	A-1	A-2		T-1	T-2	T-3	A-1	A-2
Region A	72.6	3.7	4.1	8.7	8.7	17.9	50.6	12.7	14.9	15.3	15.3	21.2
Region C	11	8.2	8.2	8.2	8.2	10.9	7.7	8.1	8.7	8.1	8.1	10.4
Region B	49.8	56.1	70.8	53.1	43.6	37.8	23.4	51.9	65.3	45.7	38.7	35
Total	133.4	68	83.1	70.1	60.5	66.6	81.7	72.8	88.9	69.2	62.2	66.7

Table IV-3 GROWTH IN THE COASTAL POPULATION AND THE COASTAL URBAN POPULATION FROM 1985 TO 2025 (in millions)

From the standpoint of jobs, housing, education, health, transport and other facilities, this phenomenon will generate considerable requirements in terms of amenities and infrastructure, and these will present a formidable challenge for land-use planning.

Under the trend scenarios, the added urban burden would be a significant contributory factor in the deterioration of the coastal environment, and indeed in its destruction, through growing urban sprawl into the surrounding countryside in the north and virtually uncontrollable growth of outlying suburbs in the south and east. In all cases, regardless of whether the pace of economic growth is fast or slow, the lack of proper long-term view of the situation and the failure to engage in long-range thinking would lead to the limited and fragile natural resources of the coastal strip proper being improperly used, unless adequate precautions are taken.

Under the alternative scenarios, urban growth would be less liable to cause damage. owing to the population pressures, land-use policies would have to be highly action-oriented and a very considerable volume of funds would have to be mobilized, among other purposes for ensuring that the concepts of the optimum use and rational management of natural resources are built into projects right from the outset.

C. TOURISM

It will be recalled that there were some 51 million international tourists in the coastal regions of the Mediterranean in 1984, in addition to which there were 45 million national tourists or holiday-makers. There is likely to be a considerable increase in this figure of a hundred-odd million, and it could double or even triple. Table IV-4 sets out the estimates for tourism in the coastal regions in the light of the different scenarios at horizons 2000 and 2025.

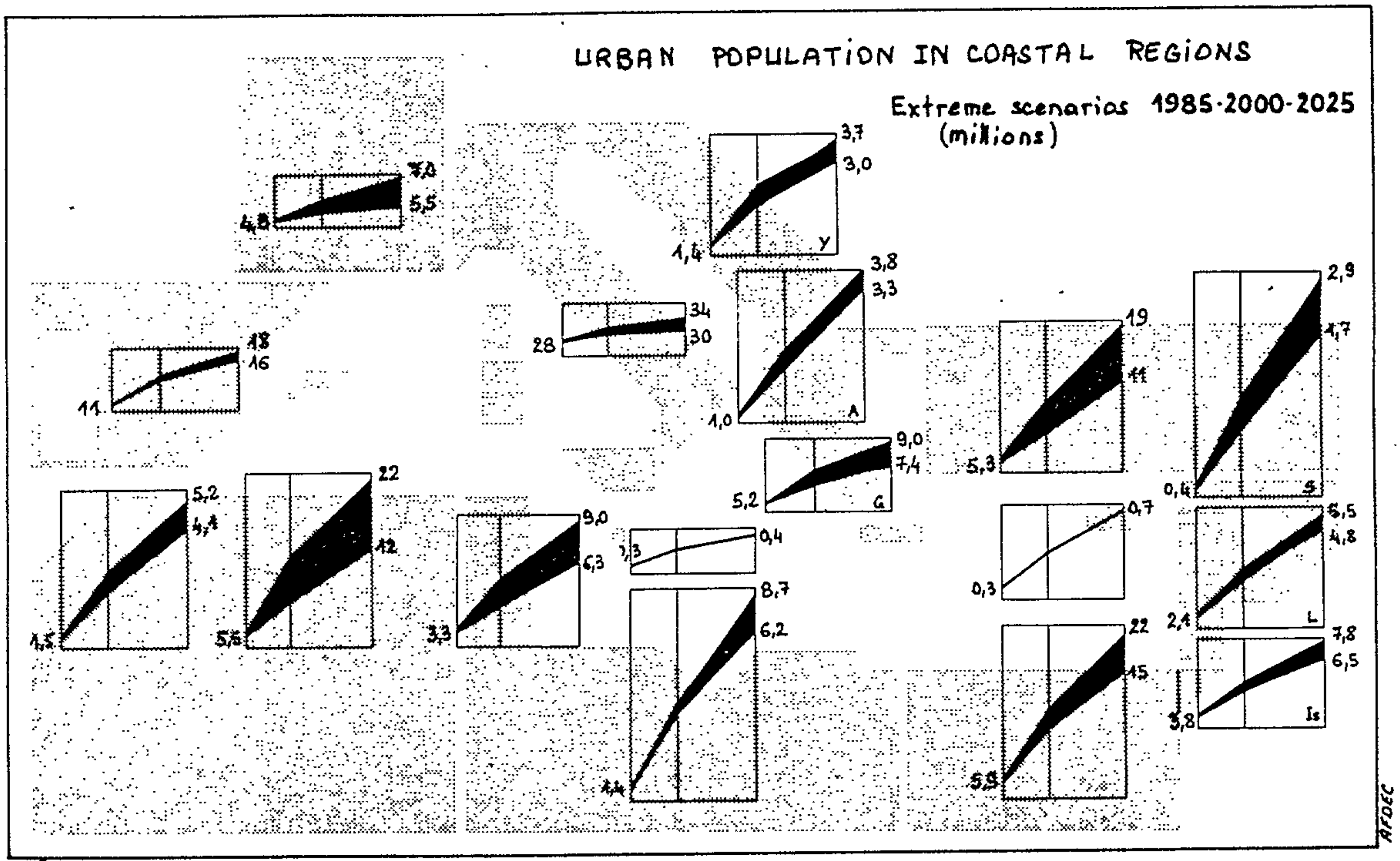
	2000		2025	
	International tourism	National tourism	International tourism	National tourism
T-1	85.4	53.9	147	72
T-2	76.4	45	125	48
T-3	94	64.1	162	98
A-1	97.7	71.4	168	130
A-2	107	77.3	193	148

Table IV-4 NUMBER OF TOURISTS
(in millions)

The effects of tourism on the coastline will largely depend on the measures taken to foster the staggering of holidays and leisure-time activities It is assumed that the peak-period pattern, whereby some 20 % of the tourists all congregate on the coast in the space of 4 to 5 weeks each year - and that pattern seems likely to become even more marked - were to continue in the case of the trend scenarios, there would be between 35 and 52 million visitors at the height of the tourist season in 2025. This figure would be equivalent to the present population of countries like Spain, France, Italy, Turkey or Egypt. The requirements in terms of amenities and infrastructure would be considerable and, if they were to be met, would entail providing systematically for extra spare capacity in respect of water supply, sewerage, transport facilities, and so on. This seasonal population overflow would also be instrumental in causing pollution and congestion, by affecting standards of hygiene on beaches, traffic flows, visits to certain natural or historical sites, etc. All this could engender negative attitudes among the host population. These disamenities would be made even worse by the fact that, during such peak periods, the vast majority of the tourists are concentrated on the narrow coastal strip.

Although this would not necessarily lead to extremes of anti-social behaviour, the social and cultural impact is by no means the least important factor entering into the phenomena of acculturation and disparagement of cultural identity caused by the too wide a gap separating the tourists' life-style from that of the local population, especially in some of the trend scenarios.

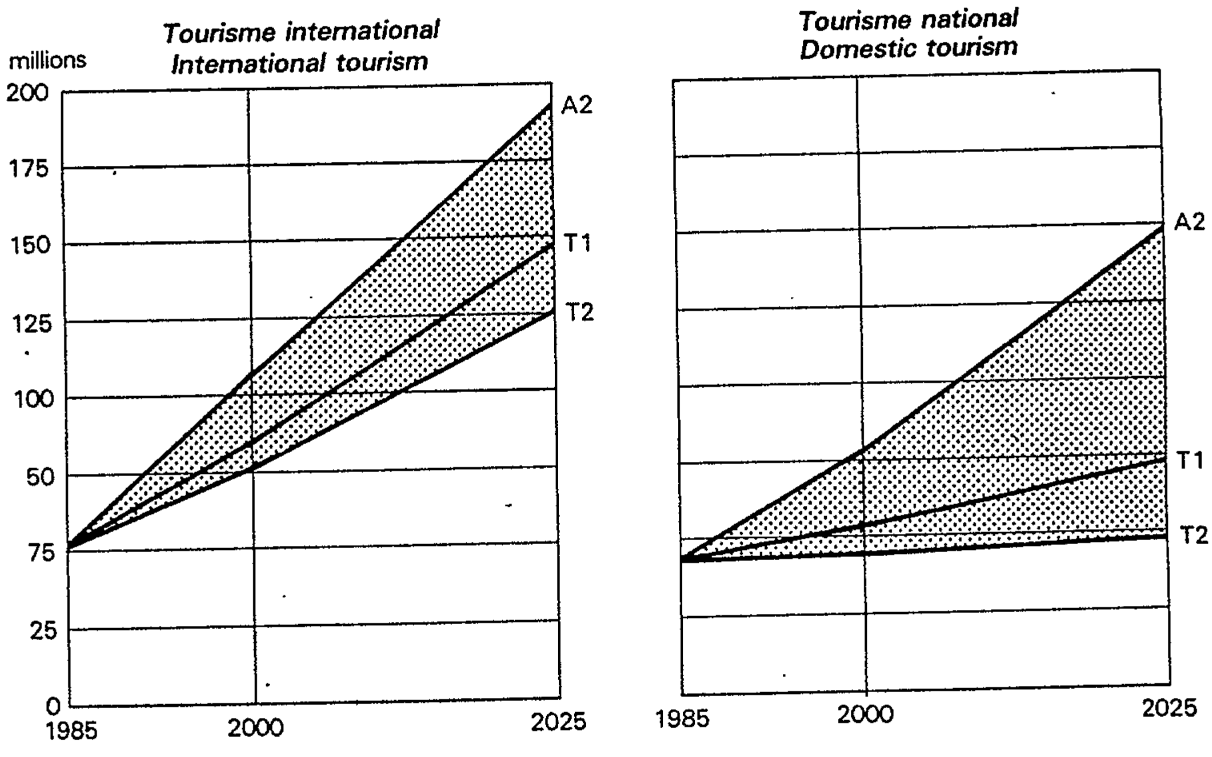
Space-use strategy would accordingly not be the only consideration in contending with the growth of the tourist population : the construction of unobtrusive amenities that would at the same time be available to the local population and the promotion of "soft" tourism and new forms of leisure could prevent too great a strain being placed on societies and environments alike (as in the case of the alternative scenarios).



Source : Blue Plan

NOMBRE DE TOURISTES INTERNATIONAUX ET NATIONAUX SUR LE LITTORAL MÉDITERRANÉEN EN 2025
Scénarios T1, T2 et A2, 1985-2025

NUMBER OF DOMESTIC AND INTERNATIONAL TOURISTS IN THE MEDITERRANEAN COASTAL REGIONS
Scenarios T1, T2 and A2, 1985-2025



Source : Plan Bleu
Source : Blue Plan

II. IMPACT OF THE POPULATION AND ACTIVITIES ON THE ENVIRONMENT

Population growth and the developmnent of sectors of economic activity in the coastal regions are instrumental in drawing down natural resources and generating pollutants in the form of waste, and in launching ventures and uses of the environment that are bound to have some destructive effect.

A. SITE COVERAGE

In 1985, the land area covered by urbanization in the coastal regions of the Mediterranean was estimated at 14,000 km^2. Almost 90 % of this urbanized land area is located in the coastal regions of the Zone A countries.

At horizon 2025, the urbanized land area is expected to cover between 28,000 and 31,000 km^2, depending on the scenario, and some 27 to 33 % of this would be in the coastal regions of the Zone B countries. Although these findings do not, at first sight, suggest a very significant difference, they stem from the fact that the highest urban growth scenario assumes that there would be fewer amenities, infrastructural facilities and green spaces than in the scenario where growth is lower but ecoonomic wealth is greater. The overall land area consumed by urbanization accordingly appears to be relatively slight. For the coastal regions as a whole, it accounted for little more than 1 % in 1985 and would represent almost 2.5 % in 2025. It has to be borne in mind, however, that this land area is primarily taken from the coastal strip.

With the exception of Monaco, the two countries occupying proportionally most space would be Malta and Syria, with 10 % and 9 % respectively in 2025 (in scenario T-2). In other countries, where the percentages are lower (especially in the Zone B countries), it should be stressed, however, that the urbanized areas would grow very steeply : by 2025, they would increase 20 times in Libya, 9.5 times in Egypt, 8 times in Algeria, and 6 times in Morocco, Tunisia and Turkey (trend scenarios).

These gross figures give only a partial picture of the qualitative impact of the extension of the urbanized land area, such as the gradual whittling-away of the most productive agricultural land ; the transformation of the traditional landscape as a result of growing encorachment and the construction of buildings out of all proportion to their surroundings ; and the use which some countries are making of standardized materials and of plans that were designed for other climates and other cultures, etc.

In 1984, the land area occupied by tourist amenities, which can be likened to a specific form of urbanization, was estimated to cover 2,000 km^2 in the coastal regions of the Mediterranean and could rise to 4,000 km^2 in 2025 according to the alternative scenarios and the moderate trend scenario T-3. Although this is a negligible figure compared with the overall land area of the Mediterranean regions, the space taken up by tourism chiefly affects the narrow coastal strip, which is the prime attraction for the regular inflow of tourists.

As already noted, the siting of industrial activities will follow two patterns :

- In the north, the basic industries will go into decline or will be phased out, as a result of which a large number of shut-down industrial facilities could be rehabilitated, while new high-tech industries will be

PROTECTION OF THE SPANISH COASTLINE

The tourist and population boom that has affected the Mediterranean coast in recent years has made it necessary to adopt protection policies, planning and sewerage schemes to reduce the amount of pollution discharged into the sea.

Such measures include :

- the Costa Brava Sanitation Infrastructure Plan, which has been implemented and is now fully operational ;
- the Costa del Sol Comprehensive Sanitation Plan, which is now being implemented ;
- the Barcelona,Valencia and Benidorm Eastern Coastal main sewer systems (the largest).

All in all, 77 of the 190 local authorities on the Spanish Mediterranean seabord have water purification plants, with 36 more under construction, and immediate action is being considered in 96 other cases. Accordingly, in the very near future, 60 % of the local authorities will have sewerage plants capable of treating 90 % of all urban pollution.

The sewerage plans on the Mediterranean coast that have already been approved represent an investment of 48,000 million pesetas (2,500 million francs), 80 % of which had already been invested by the end of 1984.

There are also sea pollution monitoring and lookout programmes, which are co-ordinated by the "Autonomous Communities" (the regions) and the central government.

Source : *Spanish national scenarios.*

developed and will give rise to new sites taking the form of technology parks or "science cities", as in the case of Sophia Antipolis.

- In the south and east, there will be a sharp growth in basic industries, either through the extension of existing production capacities or the setting-up of new industrial zones.

In recent years, the areas made available for new industrial zones have been quite large and have included, for example, 7,000 hectares at Fos near Marseilles, 3,500 hectares at Arzew and 2,000 hectares at Skikda, both in Algeria. In the above cases, however, the sites were completely new and were located outside the urban area proper, whereas a very large number of industrial establishments are closely interwovern with the urban fabric. This is why there are no reference documents giving an inventory of the industrial use of the land area, although this can be said to be smaller than the urbanized land area in the industrialized countries (in France, for example, industry occupies 1,300 km^2, or about 0.23 % of the country's total land area). In the indusrializing countries, new sites have primarily affected productive agricultural land, since it has presented fewer drawbacks, in that it is flat and well-drained, and is often even equipped with a water supply. The eastern Mitidja valley, in Algeria, is estimated as having lost some 10 to 12 % of its cultivated area for that purpose in the space of 12 years. This trend would only really change in the case of alternative scenarios.

A fairly comprehensive estimation in respect of 1987 is available for 157 major industrial facilities (cf. Table IV-5) located on the Mediterranean seaboard from Turkey to Morocco, as well as for 67 facilities at the project stage. The coming-on-stream of these facilities would be consistent with a moderate scenario (T-3) in 2000 and the production capacities should increase even further at the horizon 2025.

The number of coastal power plants in the same regions is currently estimated to amount to 170 plants already in service and 43 at the project stage (cf. Table IV-6).

	Petrochemicals		Steel		Chemical industry		
	existing	projects	existing	projects	existing	projects	Total
Turkey	17	2	10	1	13	7	50
East shore & South	56	29	18	7	43	21	174
Total	73	31	28	8	56	28	224

Table IV-5 INDUSTRIAL SITES : NUMBER OF ACTIVITIES 1987

	NOTH	TURKEY	SOUTH	TOTAL
Oil terminals	31	5	22	58
Refineries	32	3	15	50
projects	0	1	10	11
Thermal power stations	28	11	23	62
projects	4	5	23	62
Total plants projects	91	19	60	170
projects	4	6	33	43

Table IV-6 ENERGY SECTOR SITES

N.B. The findings set out in the above two tables were obtained from a study specially carried out for the Blue Plan. In the case of some countries, notably Turkey, the findings obtained from other sources are different. These differences may be due to the way in which the industrial facilities were counted, i.e. by the number of sites or by the number of major units.

In the case of industry, and to an even greater extent in the case of energy production, these facilities located in the coastal regions cater not only for the needs of those regions, but often for those of the countries as a whole. The coast is obviously bound to be the location for oil and mineral ports, besides being an eminently suitable location for thermal power stations and refineries. The question is how many of the extensions or new plants in the energy sector provided for in the scenarios will be located in the coastal regions. This all depends on the policy decisions, the technical courses adopted (i.e. whether they are water-cooled or air-cooled), the funds available, etc. According to the findings of the energy scenarios, the situation would be as follows :

- there would be between 90 and 120 offshore drilling operations a year, together with considerable shore-based installations for logistical back-up purposes ;
- there would be from 150 to 250 thermal power stations on the southern and eastern shores alone, depending on the electricity growth rates and the unit size of the power stations, some of which could be nuclear-powered ;
- there would not be any great change in the volume of oil traffic, but more products would be carried by smaller vessels unloading at a larger number of ports ;
- the oil refining capacities on the southern and eastern shores and the number of dispatching and landing areas for gas pipelines crossing the Mediterranean might be doubled ;
- coal imports would amount to between 200 and 500 million metric tonnes a year, depending on the type of development.

Road transport networks take up a great deal of space and can be almost compared with urbanization. In 2025, the total length of these networks may have increased 3.2 times and even by a maximum of 4.3 times in scenario T-3. In the coastal regions, they would cover a land area ranging between 10,000 and 20,000 km^2, part of which is already on the coastal strip.

All in all, to simplify matters somewhat, in 2025 between 3.5 and 4.6 % of the land area of the coastal regions would be taken up by urbanization, tourism, industry and transport, as follows :

	Low assumption	High assumption
Urbanized land area	28,000 km^2	31,000 km^2
Tourist amenities	4,000 km^2	4,000 km^2
Industry	3,000 km^2	4,000 km^2
Transport	10,000 km^2	20,000 km^2
Total	45,000 km^2	59,000 km^2

Here again, the percentages at the scale of the coastal regions of the Mediterranean may seem small, but it has to be emphasized that perhaps half of the land occupied will be on the coastal strip. If this 46,000 km-long strip is arbitrarily considered as being one kilometre wide, then half of the strip's area will be occupied in the case of the low assumption and two-thirds in the case of the high assumption. Added to this, there would be 68 refineries, some 50 to 75 nuclear "tranches", 100 to 150 thermal power stations, etc.

B. IMPACT ON WATER

The consumption of water by the urban and rural populations of the coastal regions has been calculated in respect of Zones A and B for the different scenarios at the horizons 2000 and 2025 (cf. Table IV-7). When these figures are compared with the estimates for 1985, it will be seen that the total consumption would not greatly increase in the coastal Zone A regions ; the multipliers over the period 1985-2025 vary from 1.36 (scenarios T-1 and T-2) to 1.43 (scenarios T-3 and A-1) and 1.58 (scenario A-2).

The situation would be very different in the Zone B coastal regions. At the horizon 2025, the lowest consumption figures would still be three times higher than those in 1985 in the cases of scenarios T-2 and A-2. It is interesting to note that these very similar findings have been arrived at from a set of assumptions that are diametrically opposite to one another, namely those in scenario T-2, in which the population and urbanization growth rates are very high and the specific consumption remains stable ; and those in scenario A-2, in which population growth is more moderate but is more evenly distributed as between urban and rural areas and between the interior and the coast, with the specific consumption on the increase. The scenario showing the highest water consumption would be T-3, in which it would be 3.5 times higher in 2025 than in 1985, while population growth would continue to be high and the specific consumption would still be increasing. However, these findings do not make it possible to conclude that the resources would have to be drawn down, since no data forecasts are available for the efficiency of the networks.

The consumption of water for domestic uses, especially in urban areas, would compete with its use for other purposes, above all for agriculture, and could give rise to a difficult problem in respect of priorities and funding. Indeed, the provision of a water supply for large coastal connurbations may mobilize a substantial proportion of a region's water resources and financing capacity, as in the case of Athens, Algiers, and other cities (cf. the chapter on "The Water Constraint").

	Region A urb.	Region A rur.	Region A Total	Region B urb.	Region B rur.	Region B Total	Total Regions A+B
1985	4.6	1.2	5.8	0.84	0.47	1.31	7.1
T-1 2000	6.3	1.2	7.5	1.6	0.61	2.2	9.7
T-1 2025	6.9	1	7.9	3.4	0.7	4.1	12
T-2 2000	6.4	1.2	7.6	1.6	0.56	2.2	9.8
T-2 2025	7.1	0.8	7.9	3.2	0.57	3.8	11.7
T-3 2000	6.4	1.3	7.7	1.57	0.63	2.2	9.9
T-3 2025	7.2	1.1	8.3	3.7	0.9	4.6	12.9
A-1 2000	6.4	1.3	7.7	1.5	0.6	2.1	9.8
A-1 2025	7.2	1.1	8.3	3.4	0.8	4.2	12.5
A-2 2000	6.6	1.3	7.9	1.42	0.59	2	9.9
A-2 2025	7.8	1.4	9.2	3.15	0.79	3.9	13.1

Table IV-7 ANNUAL CONSUMPTION OF DOMESTIC WATER WITHIN MEDITERRANEAN COASTAL REGIONS IN Gm3/YEAR

The volume of water consumed by tourism has been calculated from the number of overnight stays. The results show that, at the horizon 2025, the consumptioon of water for tourist purposes is expected to rise by between 100 and 350 % compared with 1985.

The one important factor that has to be stressed in this connection is not so much the amount of water consumed by tourists (since it is, in fact, relatively small and accounts for only 6 to 9 % of both urban and rural consumption) as the seasonal nature of the consumption, which usually occurs in summer - the dry season in the Mediterranean - when the demand for irrigation water is at its highest. In many locations along the coastal strip and in the offshore islands, such as along the Tunisian coast, on Malta and in the Almeria region, this situation currently makes it necessary to impose restrictions, and agriculture is the first to be affected. Moreover - and this is even more serious, since the dilapidation of a resource is involved - excessive pumping may lower the level of the groundwater table and the ensuing inflows of seawater cause salt-impregnation, as has happened in the Balearic Islands and along the coast of Catalonia. Since the querstion of the improved staggering of holidays is only considered in the alternative scenarios, the water situation in the coastal strip during the summer is bound to grow worse in the trend scenarios, and especially in scenario T-3.

The long-range forecast in respect of water consumption for industrial uses and energy production does not make it possible to put a precise figure to the findings. It can be said, however, that the consumption of water for industrial uses, compared with that for agriculture and domestic purposes (the population and tourism), is expected to decline, although not so much in volume terms as in its relative share, owing to improvement in manufacturing methods and the progress made in devleoping recycling techniques.

C. IMPACT ON FORESTS

It is worthwhile stressing some of the specific aspects bound up with the pressures to which forests in the coastal strip proper are subject. Those pressures are chiefly exerted by the urban explosion and by the development of tourism and transport.

The corollary of urbanization can be said to be as follows :

- A demand for building land, which has the effect of progressively encroaching on the neighbouring forest formations. While that demand is not very significant in terms of area, it may have catastrophic consequences in the event of fires. since the fire-fighting facilities are used, as a matter of priority, for protecting people and property, the more buildings there are to be protected, the larger the area of forest that is liable to be burnt down.

- The use of forests as recreational areas for the urban population causes the land to be héavily trodden down, and this jeopardizes the conservation of plant species, while significantly increasing the risk of fire.

Tourism had broadly the same effects, although these are exacerbated because they chiefly occur in summer, when forests are more vulnerable to fire. For example, during the summer holiday period, the tendency is for people camping outside authorized sites to prefer the wooded areas immediately behind the coastline, with the many adverse environmental effects that this implies as a result of the lack of hygiene, the trampling-down of the undergrowth, and the risks of fire. On the northern seaboard, the construction of holiday homes in the wooded areas on the coast has been very widespread, and although that trend now seems to have levelled out, it has to be strictly controlled.

The road and rail networks on the coast even have far-reaching effects on the forest ecosystems as they skirt the wooded areas and prevent natural exchanges taking place between the forest formations through which they have been driven.

The forests on the coastal strip may also be damaged or even destroyed by chemical pollution from the sea, which attacks them in the form of air-borne matter in suspension. This phenomenon is widespread on the western coast of Italy.

D. IMPACT ON THE COASTAL STRIP

The land area considered in this chapter generally covers the whole of the Mediterranean "coastal regions" and therefore embraces the coastal strip proper discussed in this section. More precisely, this consists of the land area formed by the coastal communities, which extends inland for a distance ranging between several hundred and several thousand metres, and the offshore sea area, whose limits are much less precise, but which may extend, in fact, up to the 12 nautical-mile limit of the territorial waters. The difficulty stems both from the complexity of the environment and from the many and varied pressures exerted on it by human beings and their activities, and their interactions and feedbacks. This restricted area, combining both land and sea, is made up of virtually all the environmental components and all human activities.

THE GOLDEN HORN PROJECT

The Golden Horn Project, implemented by the Istanbul Metropolitan Municipality, covers some 6.5 million m in the Southern and Northern coastal strips of the Golden Horn. The project comprises coastal landscaping and liquid waste works. Coastal landscaping work, started in 1984, is aimed at elimination of structures which are not compatible with the natural and historical characteristics of the Golden Horn and are in a dangerous position because having been built on land fill and because of their statics, removal of industries concentrated in the area against the regulation or because of wrong planning, re-arrangements of cleared coasatal strip as green space and recreational areas and restoration of historical works. An area of 600.000 m^2 has been expropriated for the above purposes and a park has been arranged on an area of 650.000 m^2.

As part of the above effects :

"Construction work of the facilities for arrangement of the area around the Golden Horn", with a project cost of TL 443,610 million has been completed.

The "Coastal clearing of the Golden Horn" project costing TL 151,450 million has been completed.

The "1st and 2nd region landscaping works for the area around the Golden Horn", with a project cost of TL 260 million.

It has been planned that efforts relating to liquid waste within the Golden Horn project will be made conclusive within the framework of the Greater Istanbul Sewerage master Plan. That project envisages collection, treatment and discharge of the liquid waste generated by some 2 million population and commercial and industrial units on an area of 10,000 ha through tunnels and open excavation tunnels to be constructed along the Northern Marmara and Southern Golden Horn coasts. The project cost is TL 30 billion in 1986 prices.

a) The Southern Golden Horn Project : Collectors to be installed on the Southern bank of the Golden Horn are 9 km long and will operate with a capacity of 7,500 m^3/day when commissioned. The liquid waste to be carried through those collectors from the Southern basin of the Golden Horn will be 4,000 m^3/day. The liquid waste after being 30 % treated at pre-treatment and pumping stations will be discharged into the undercurrent at a depth of 600 m, and at a 1,200 m off Aherkapi.

b) The Northern Golden Horn project, design stage of which is about to be completed, comprises tunnel and open excavation collectors and pre-treatment, pumping and discharge units.

c) Improvement work on brooks carrying liquid waste to the Golden Horn is underway.

d) The Golden Horn Coastal collectors will start operation with a 50 % idle capacity under current conditions. After completion of the improvement work on brooks, waste water volume (static capacity) of the Golden Horn may be assumed to be around 45 million m^3. The excess capacity will be used for emptying that volume of water and thereby replacement and cleaning of waters of the Golden Horn will be secured.

e) Bottom dredging is presently carried out with shovelling and removal of sticky mud.

Before an attempt is made to embark on a qualitative evaluation of the different possible futures of this coastal strip in the light of the different scenarios, it is important to recall the nature of the main factors having an adverse effect on the coastal environment, i.e. on the coast itself and the area immediately inland :

- Temperature pollution is caused by the warm water discharged by thermal power stations of large industrial complexes and can give rise to far-reaching ecological changes, which affect the marine flora and fauna and alter the sea's productivity.

- Bacterial pollution is caused by the domestic waste water discharged by urban areas along the coast, which contains particles of mainly organic matter in suspension. The self-purifying properties of the seawater and the choice of appropriate locations for the discharge points make it possible to reduce the pollution reaching the shoreline to a minimum and to protect people using the bathing resorts. However, this form of pollution may affect the food chain by contaminating shellfish and other fish varieties, and it then has very serious consequences for the human population.

- Pollution as a result of the dumping of solid urban waste in the sea may be significant in certain specific areas, owing to the influence of the sea currents. On the coast, this has above all an unsightly effect, but out at sea, plastic waste may be harmful to some species, such as turtles.

- Chemical pollution is caused by industrial waste, such as toxic products, detergents, petroleum products, pesticides, and heavy metals. These forms of waste are a serious source of pollution of the sea and marine products, even though the amounts discharged may be slight. Some of this waste, such as detergents, has adverse effects on both land and sea. The most disquieting effect of chemical pollution probably lies in the contamination of the food chain and the build-up of the most toxic substances in marine organisms.

- Secondary organic pollution, caused by the discharge of substantial amounts of organic matter, such as urban waste water, agricultural waste and factory effluents, gives rise to far-reaching ecological changes. In some rather enclosed sea areas like the Gulf of Tunis, these affect all the local natural scpecies and always result in the decline of a large number of species. In 1988, the eutrophization of the Adriatic, due to pollution originating on land, proved to be a major ecological phenomenon.

The road and rail transport infrastructure located in the vicinity of the coast inhibits the natural processes of shore formation and development and can cause significant coastal erosion, one of the feedback effects of which may be the destruction of the infrastructure itself, as has been the case with many railway lines in Italy.

In this connection, it should be noted that infrastructural facilities on rivers, although located far upstream, may have similar effects. This is what is now happening in Egypt, where the Aswan Dam holds back the alluvial silt that used to be carried down the Nile delta and, as a result, the shore is exposed to intense marine erosion.

- The reshaping of the shoreline, through the construction of harbours, backfilling, coastal-defence works and artificial beaches, has an irreversible destructive effect on the in-shore seabed (down to a depth of 40 metres), which is the habitat of the Posidonia sea-grass colonies that are literally the "nurseries" of the Mediterranean marine species. These construction works completely alter the flow pattern of the sea

POSIDONIA

Posidonia oceanica is a marine phanerogam that is a relic of the Mesogean flora. It usually covers broad expanses of the in-shore seabed, at depths ranging between 2-3 metres and 30-40 metres, and it is prevalent among the northern coastline in the western part of the Mediterranean. In addition to the important function it performs in the primary production and supply of oxygen to the shallow meritic zone close in-shore, Posidonia colonies form one of the richest biocenetic communities in the demersal zone from the biological, ecological and economic standpoints. In particular, they are feeding-grounds for many demersal fish species.

Urban and industrial pollution has plainly had an adverse effect on these plant colonies. In the Gulf of Marseilles, for instance, where they extended from depths of 4 to 35 metres in 1947, they are now only found at depths of between 10 and 25 metres, and the few remaining colonies are in a very poor state. The fact that their lower growing limits are now closer to the surface is clearly due to the decline in luminosity, as a result of the widespread increase in turbidity caused by the higher suspended-matter content and periodic bursts in plankton reproduction. Their disappearance from the upper ten metres or so is the direct outcome of their having been poisoned by pollutants, which is highly concentrated at that level. The pollution-induced effects, such as the increased turbidity, are accompanied by those created by the following factors, among others :

- the construction of infrastructural facilities, whether these be linear, as in the case of roads and embankments, non-linear, like airports, both of which may encroach on the in-shore seabed to varying degrees ;

- the anchoring of vessels at uncontrolled moorings along the coast.

The case of Marseilles is unfortunately not the only one of its kind.

Source: A. Augier, council of Europe.

currents and the coastal dynamics, and can be instrumental in the disappearance of beaches and the silting-up of harbour sites.

A long-range study of the pollution of coastal water by domestic waste has been carried out for the coastal regions, on the basis of the population figures and of assumptions in respect of water consumption and sewer connections for urban or rural habitats for the different scenarios at the horizons 2000 and 2025. The results, which provide a pointer to the treatment capacities that will be required, are set out in Tables IV-8 and IV-9 for the main countries of both the northern shore and the southern and eastern shores. They show that, in the most unfavourable cases, the amount of waste would double on the northern shore and would increase four times on the southern and eastern shores. These results are consistent with the more general findings presented in the following chapter dealing with the sea.

In a bid to safeguard a small portion of the Mediterranean seaboard from all these adverse effects, a hundred or so specially protected areas have been singled out by the riparian countries. They cover an extremely wide variety of ecosystems, including lagoons and humid coastal land, dune bars, rocky coasts, coastal forest formations, the in-shore seabed, etc. Although it is difficult to define the extent of the "protection", there is a growing tendency to step up the protective measures, to monitor the offtake of birds, shellfish and other fish varieties through hunting and fishing and the gathering of rare endemic plants, and to increase the number and coverage of the protected areas (cf. the Ministerial Declaration in Genoa).

One specific threat to the coastline is the rise in sea-level as a result of the "greenhouse effect" caused by the increased concentration of exhaust fumes and industrial gases released into the atmosphere. On a time-scale of some fifty years, the atmosphere may have heated up by between 1.4 and 4.5oC, and this would cause the sea-level to rise by some 40 to 140 cm. The widely-held expert view is that, in the event of any rise above 50 cm, the cost of taking protective measures would be considerable, and that a policy choice would have to be made between protecting some areas and leaving others to their fate. The areas most threatened include deltas and low-lying coastal plains which, although few in number in the Mediterranean, are the centres of population concentrations and of a large number of economic activities that are vital to some of the countries. Among the examples that can be cited are the mouths or deltas of the Rivers Ebro, Rhone and Po, the Venezia and Romangna regions of Italy, the Ceyhan delta in south-eastern Turkey, the Nile delta and the plain of Tunisia, etc. Within the next century, the combined effects of the quickening erosion caused by the interruption of the supply of silt retained behind the Aswan dam, the rising level of the Mediterranean, and the sinking of the geological formations by about 50 cm every hundred years, could cause the Nile delta to recede by about 30 kilometres. Although any attempt to quantify the phenomenon would be risky at this stage, the threat of the sea-level rising within the span of the next generation is a factor that can apparently no longer be discounted in any long-range study of the Mediterranean seaboard.

In conclusion, a few ideas for engaging in a more detailed study of the possible futures of the coastal strip, in the light of the Blue Plan scenarios or types of development, are suggested in Table IV-10.

III. CONCLUSIONS CONCERNING THE COASTLINE

Some of the areas of the Mediterranean seaboard are under serious threat. The Mediterranean cannot be effectively protected on a lasting basis unless a start is made by protecting and safeguarding its coastline.

HYPOTHESES :

	POPULATION (THOUSAND)	URBAN. RATE (%)	WATER CONSUMPTION URBAN (M3/CAP)	WATER CONSUMPTION RURAL (M3/CAP)	SEWAGE CONNECTION URBAN (%)	SEWAGE CONNECTION RURAL (%)
SCENARIO T1						
1985	72629	69	91	54	70	15
2000	76414	75	109	65	78	18
2025	76336	82	109	73	80	20
SCENARIO T2						
1985	72629	69	91	54	70	15
2000	76775	76	109	65	78	18
2025	76703	85	109	73	80	20
SCENARIO T3						
1985	72629	69	91	54	70	15
2000	77913	75	109	65	78	18
2025	81348	81	109	73	80	20
SCENARIO A1						
1985	72629	69	91	54	70	15
2000	77913	75	109	65	78	18
2025	88348	81	109	73	80	20
SCENARIO A2						
1985	72629	69	91	54	70	15
2000	80615	74	109	65	78	18
2025	90492	79	109	73	80	20

RESULTS :

	WASTE VOLUME (MILLION M3)	BOD	COD	SS	TDS	N	P
		..................(THOUSAND TONS)......................					
SCENARIO T1							
1985	2294.7	996.7	2246.0	1316.9	1413.0	127.8	15.5
2000	3281.6	1140.3	2563.7	1414.2	1748.2	158.1	19.2
2025	3583.3	1199.2	2692.3	1431.0	1918.2	173.4	21.0
SCENARIO T2							
1985	2294.7	996.7	2246.0	1316.9	1413.0	127.8	15.5
2000	3310.3	1148.3	2581.5	1421.7	1763.8	159.5	19.3
2025	3678.4	1220.9	2740.2	1443.4	1972.2	178.3	21.6
SCENARIO T3							
1985	2294.7	996.7	2246.0	1316.9	1413.0	127.8	15.5
2000	3324.4	1158.4	2604.6	1440.6	1770.3	160.1	19.4
2025	3760.3	1266.4	2843.9	1521.9	2010.6	181.8	22.0
SCENARIO A1							
1985	2294.7	996.7	2246.0	1316.9	1413.0	127.8	15.5
2000	3324.4	1158.4	2604.6	1440.6	1770.3	160.1	19.4
2025	3760.3	1266.4	2843.9	1521.9	2010.6	181.8	22.0
SCENARIO A2							
1985	2294.7	996.7	2246.0	1316.9	1413.0	127.8	15.5
2000	3415.4	1193.8	2684.4	1489.1	1818.0	164.4	19.9
2025	4118.4	1395.7	3135.1	1688.9	2199.5	198.9	24.1

Table IV-8 EVALUATION OF DOMESTIC POLLUTION ON THE NORTHERN COAST (SPAIN, FRANCE, ITALY, YUGOSLAVIA, GREECE)

HYPOTHESES .

	POPULATION (THOUSAND)	URBAN. RATE (%)	WATER CONSUMPTION URBAN (M3/CAP)	WATER CONSUMPTION RURAL (M3/CAP)	SEWAGE CONNECTION URBAN (%)	SEWAGE CONNECTION RURAL (%)
			SCENARIO T1			
1985	49805	47	36	18	50	10
2000	70514	56	39	20	55	12
2025	105914	71	45	23	65	13
			SCENARIO T2			
1985	49805	47	36	18	50	10
2000	75229	58	36	18	50	10
2025	120604	73	36	18	45	10
			SCENARIO T3			
1985	49805	47	36	18	50	10
2000	69753	54	41	20	55	12
2025	102931	67	54	27	70	20
			SCENARIO A1			
1985	49805	47	36	18	50	10
2000	66710	54	41	20	55	12
2025	93403	66	54	27	70	20
			SCENARIO A2			
1985	49805	47	36	18	50	10
2000	64502	53	41	20	55	12
2025	87641	66	54	27	70	20

RESULTS :

	WASTE VOLUME (MILLION M3)	BOD	COD	SS	TDS	N	P
		.................(THOUSAND TONS)......................					
			SCENARIO T1				
1985	544.2	527.3	1198.6	854.3	523.7	47.3	5.7
2000	887.8	806.4	1827.9	1228.2	912.1	82.5	10.0
2025	1777.9	1397.0	3152.0	1902.8	1899.8	171.8	20.8
			SCENARIO T2				
1985	544.2	527.3	1198.6	854.3	523.7	47.3	5.7
2000	881.7	840.6	1907.0	1304.1	916.8	82.9	10.0
2025	1474.8	1383.9	3136.5	2102.1	1573.2	142.2	17.2
			SCENARIO T3				
1985	544.2	527.3	1198.6	854.3	523.7	47.3	5.7
2000	900.0	790.7	1792.8	1212.7	882.2	79.8	9.7
2025	2018.8	1373.0	3096.6	1854.0	1889.8	170.9	20.7
			SCENARIO A1				
1985	544.2	527.3	1198.6	854.3	523.7	47.3	5.7
2000	857.6	754.2	1710.3	1159.2	838.1	75.8	9.2
2025	1820.8	1240.8	2799.0	1680.8	1700.6	153.8	18.6
			SCENARIO A2				
1985	544.2	527.3	1198.6	854.3	523.7	47.3	5.7
2000	827.4	728.1	1651.3	1120.5	807.2	73.0	8.8
2025	1711.2	1165.5	2629.0	1577.5	1599.1	144.6	17.5

Table IV-9 EVALUATION OF DOMESTIC POLLUTION ON THE SOUTHERN AND EASTERN COAST (TURKEY, SYRIA, EGYPT, LIBYA, TUNISIA, ALGERIA, MOROCCO)

	POPULATION URBANIZATION	FISHERIES AGRICULTURE AQUACULTURE	INDUSTRY	ENERGY	TOURISM	TRANSPORT
T-2	Uncontrolled restructuring of the coastline due to the urban explosion Discharge into the sea of untreated domestic waste	Loss of agricultural land through urbanization, industry, energy and transport Food supply problems Contamination of living marine resources	Pollutant waste Short-sighted view of industrial siting	Hot water outflows	Formation of tourist "ghettos" Financial circuits outside local control Takeover of coastal sites by affluent elites	Congestion and pollution due to network overloading Marine pollution by petroleum products
T-3	Deterioration of the coastal landscape by land encroachment and the use of standardized materials	Water shortages and the decline in water quality Loss of marine productivity through over-fishing and destruction of the in-shore seabed Destruction of potential aquaculture sites	Low-efficiency depollution Creation of high-tech industrial zones Land wastage due to inadequate control over industrial sites	Hot-water outflows containing effluents Pollution of coastal areas by petroleum products	Excessive water consumption at peak periods Intensive occupation of coastal sites at peak periods Restructuring of the coast through duplication of amenities such as ports and artificial beaches and islands	Widespread construction of coastal roads for serving seaboard sites Encroachment on the sea and coast for airport and motorway accesses
A-1	Controlled restructuring of coasts Treatment of domestic waste Rational water management	Fisheries : rational stock management Effective protection of productive land and aquaculture sites Rational water management	Depollution of waste Rational siting of industries	Marked reduction in hot-water outflows	Voluntary limitation on coastal developments Undue frequentation of areas of natural beauty along the coast	Ballast cleaning stations Access to the sea by slip roads Parking areas well away from the sea

Table IV-10 FACTORS IN THE EVOLUTION OF THE COASTAL STRIP IN THE LIGHT OF THE DIFFERENT SCENARIOS

All the work performed in connection with the Blue Plan shows that the long-range studies and thinking about the future relationship between development and the environment have to be pursued more thoroughly by means of a regional approach, if they are to cater for the aims of the Mediterranean Action Plan. The coastline calls for discriminating land-use planning, and this has to be prepared with the medium and long-term outlook in mind.

On the basis of the study of the global scenarios for the Mediterranean, which was the main purpose of the Blue Plan, it is possible to zoom in" on the local level by scanning each of the local areas in turn

- the area represented by all the countries of the Mediterranean basin, at a scale of about 1/1,250,000, by means of the global scenarios ;
- the area occupied by the individual countries, at a scale of about 1/500,000, by means of the national scenarios ;
- the "Mediterranean coastal area", at a scale of 1/100,000 to 1/200,000, by considering the coastal regions ;
- the local land area, at a scale of 1,2000 to 1/25,000, through a closer view of the coastal strip.

The first three areas have already been analysed to some extent, but the fourth area is still an "open book" and calls for a different approach. An exclusively global approach will be of little value for the studies conducted, even if they are bound to make use of the findings obtained for the other areas. It is true that those findings will influence the main guidelines and principal trends (in terms of population, economic activities, co-operation, environmental policies, etc.) in respect of the coastal strip and that they will affect the balanced occupation of the space available and the rational use of resources. However, for a variety of reasons - the physical features represented by climate, relief and vegetation ; the existing human activities, which may be primarily geared to industry, urban growth, tourism and agriculture ; the social problems connected with health, education and employment ; the financial, scientific and technical, and institutional resources that are available and can be mobilized - each community along the coastal strip has to contend with problems which differ from those faced by its neighbours and which cannot be solved in identical ways. Consequently, "scenarios" for the coastal strip can only be envisaged at the local level, although it must always be borne in mind that they have to be integrated into the much broader contexts represented by the parent coastal region, the country concerned, and the Mediterranean basin as a whole. The extremely complex problem of how the local, national and supranational levels tie in together will be a key factor in the process involved in planning, developing and managing the seaboard regions and their coastal strips.

CHAPTER IV.6

THE COMMON SEA

The task of the Blue Plan was not to analyse the situation and evolution of the marine environment as such, since this is studied in detail under the MEDPOL programme. But the prospective studies described above lead, nevertheless, to the sea itself, in two different ways :

- during the previous chapters and the study of possible trends of the economic sectors and environmental components, relationships with the marine environment were indicated, such as fertilizer input into the sea, marine pollution due to hydrocarbon transport, or domestic pollution in coastal regions. Although unsuited to incorporation with the rest, these data facilitate useful cross checks with other methods or throw light on some specific aspect ;

- this chapter makes an attempt to assess globally the possible trends of land-based pollution in terms of the different kinds of development or scenario.

In principle, the "scenarios" concerning the Mediterranean Sea itself should not be as "open" as for the other sectors or environmental components, considering the restraining effect of the Barcelona Convention and its protocols, as well as other international agreements on the sea, notably the Marpol Convention. In fact, very open "scenarios" could be formulated to compare two extreme trends, namely what would happen if no action were taken, or conversely, if all the protocols and conventions were applied to the letter, "immediately and without delay". Reality will no doubt lie somewhere between the two. Experience has shown, in a number of industrialized countries, that it sometimes took a decade for anti-pollution standards to be effectively applied at a rate of 30 or 50 %. Moreover, it is not enough to build powerful treatment plants : they also have to be maintained and operated, which was not always the case during recent years. It could therefore be assumed for a prospective approach that in the case of the most adverse kind of economic development, there would be little change in the number of treatment plants compared to the present situation and that, conversely, in the most propitious case, most of the installations needed would be built, would use increasingly efficient depollution processes, and would operate properly.

The task of formulating scenarios for trends in pollutant discharges into the Mediterranean is especially difficult for several reasons :
- it would have been worthwhile pursuing this approach on the basis of an updating of the MEDPOL X project up to 1985 (direct and indirect assessment of pollutant inputs into the Mediterranean which, despite its shortcomings, still remains the only global study on the subject), a process which, unfortunately, could not be carried out ;
- because there has been no systematic assessment over a long period, information was lacking on a "zero state" of pollution in the Mediterranean for example, the situation during the 1950-1970 period, one of rapid economic development with little concern about the environment, and that of the following period with weaker economic growth but which witnessed the incipient use of anti-pollution techniques. Although more data are available for this last contemporary period, they do not yet allow for an overall and reliable view on the real state of the Mediterranean because of their dispersion in both time and space ;

<u>Bacterial levels</u> : raw sewage : 3 million bacteria ml
sewage after conventional treatment : 30 % drop
sewage after new treatement : 90 % drop

<u>Organic matter COD</u> : raw sewage : COD 500 mg/L
sewage after conventional treatment : 60 % COD drop
sewage after new treatment : 90 % COD drop

N.B. Ratio between BOD and COD is COD = 2,5 in sewage.

<u>Particle load</u> : raw sewage : 280 mg/L
sewage after conventional treatment : 85 % drop
sewage after new treatment : 90 % drop

<u>Metals</u> : Mercury : without treatment 600 mg/L recycling - administrative measures
after treatment : 75 % drop

Lead : without treatment : 70 g/L
after treatment : 65 % drop
Copper : without treatment : 70 g/L
after treatment : 75 % drop

<u>Spatial distribution of populations and pollution sources</u> :

(desease through thorough use of available space and discharges into rivers).

50 % decrease in use of the coastline.
75 % decrease in the pollutant load through natural purification and sedimentation for bacteria, detergents, hydrocarbons and biodegradable pesticides, organic matter during its river transit.

<u>Atmosphere pollution</u>

Smoke filtration : 75 % drop.

Table IV-11 PROVISIONAL DEPOLLUTION COEFFICIENTS

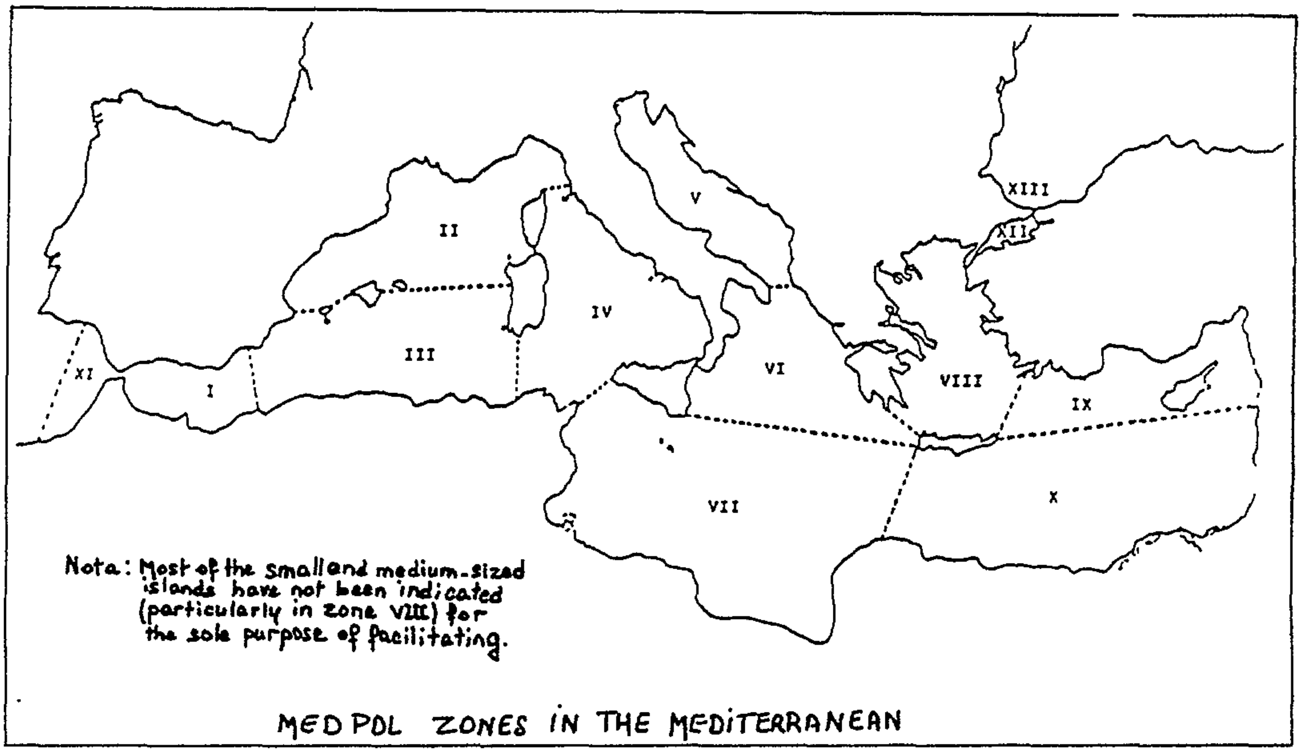


Figure IV-3

- consideration would also have to be given to pollution of atmospheric origin. Unfortunately, available data are very difficult to interpret and circulation models do not allow for a rigorous quantification of pollutant inputs, the sources of which may be very distant.

The overall method finally used by the Blue Plan consisted of adapting the MEDPOL X values for the ten reference zones covering the whole of the Mediterranean Sea (Figure IV-3) to the 1985 situation (because of population figures) and to validate the overall findings obtained by comparison with experimental values concerning mercury, lead and bacteria. Projections for various discharges in 2000 and 2025 were then obtained :
- through the population effect ;
- by attributing different reduction coefficients (possibly related to the spatial distribution of populations and industries, the development of manufacturing processes, changes in materials, etc.) and depollution coefficients, depending on the scenarios (Table IV-11). Clearly, depollution processes will make significant progress in the coming decades, and this expected technical progress can be used to distinguish between the scenarios.

The findings of this prospective study according to the scenarios are described briefly below :

T-1 scenario (reference trend) : The increase of land-based pollution in terms of population increase in southern and eastern countries would in general be more or less offset by depollution techniques under way (especially in the European Community countries on the northern shore and gradually in the countries on the southern and eastern shores). A slight improvement would be observed in the BOD-COD (biological oxygen demand - chemical oxygen demand), nutrients and detergents, pollutants for which depollutant techniques are the most effective.

T-2 Scenario (worst trend) : Gradual industrialization in the basin, without the spread of depollution techniques to the southern and eastern countries, would offset the reduction of pollution in the northern countries due to the decline of heavy industry, even for pollutants which showed a slight improvement in the T-1 scenario.

T-3 scenario (moderate trend) : Increased pollution stemming from rapidly growing economic activity and the demography of southern and eastern countries would be partly offset by an attempt to achieve a better distribution of activities tending to protect the coast, as well as by the spread of depollution techniques (resort to the "polluter pays" principle). This would lead to less land-based pollution than in 1985, but at a fairly high economic cost and without being able to avoid a number of (more or less localized) accidents.

A-1 scenario (reference alternative) : A similar situation to T-3, but with reduced pollution through the spread of depollution techniques to all the zones as a result of increased international co-operation, supplemented by increasing use of less polluting techniques (in the industry and energy sectors as well as for agricultural development through better mastery of inputs).

A-2 scenario (integration alternative) : A situation similarly improved throughout, also due to a better spatial distribution of economic activities, result of regional integration enabling better mastery of the spatial distribution of activities.

In the case of the trend scenarios, and chiefly the T-1 and T-2 scenarios, estimates show that the levels of polluting products coming from residual urban water, such as bacteria, viruses, organic matter, detergents, and products from hydrocarbon combustion are likely to rise, following population growth rate fairly closely. This overall finding is obtained by considering the fact that improvements in zones with populations and growing use of depollution techniques (and whose pollutant discharges will diminish) are offset by the situation in zones with high population growth, which encounter the greatest difficulty in devoting the necessary investment to depollution plants (and whose pollutant discharges will increase).

No doubt, technological progress in industrial processes could be the most striking as regards pollutant emissions, since a new plants in industrializing countries on the southern and eastern shores would in addition benefit from these advances more quickly in the alternative type scenarios.

In fact, these alternative scenarios assumed both the use of less polluting processes and the installation of urban water treatment plants (extending, even enlarging the objectives of the Genoa ministerial declaration) and deballasting stations (although this problem is presented differently insofar as crude oil will be replaced by oil products). A crucial factor for the success of these scenarios is clearly, as stressed above, the speed and the schedule with which these measures will effectively be applied. In this respect, the alternative scenarios make a distinction, not only through the special use of "clean technologies", but also by a much faster application of marine protection and conservation measures, compared to the T-3 type trend scenarios with strong economic growth but insufficient concern -and often too late- about the environment. In other words, the "findings" of the alternative scenarios, especially as regards the sea, provide an idea of the efforts to be undertaken (both in time and space) if certain depollution and environmental quality objectives are to be achieved (reduction of factors in the region of 3 to 5).

As regards the impact of these pollution on Mediterranean marine life, bacterial and viral pollution, which is an obstacle to tourist development or a hazard when it reaches shellfish breeding grounds, seems in fact to be heading for gradual control, and is less worrying than chemical pollution, whose harmful effects can be divided into three groups :

- those which have a direct toxic action on wildlife and plant life, reflected by a loss in the nutritional capital ;
- those which disturb interspecies relations and which will produce an ecological drift of the marine environment ;
- those which, through the fixation and concentration of residual pollution along the various links of biological chains, will be at the origin of pathoegenic disorders for seafood consumers.

Once in the marine environment, chemical products are subject to a dual process :

- attack by bacteria which withdraw the substances needed by their metabolisms. The product then disappears through "biodegradation" ; this is the case inter alia of hydrocarbons or biodegradable detergents ;
- concentration in biological chains, which counteracts this biodegradability.

Organic pollution caused by spills of large quantities of nutrients (phosphorus, nitrogen, etc.) agricultural runoff, and waste water from cities and industrial plants can cause the chaotic proliferation of some species through "eutrophization". An ecosystem modified in this way is invaded a very small number of extremely resistant species which proliferate. The Venice Lagoon, the "Lake of Tunis", Lake Maryut near Alexandria are choice spots for this kind of phenomena, especially in summer where the temperature encourages them. In 1988, a phenomenon of this kind covered a large part of the Adriatic (Fruili, Venezia, Emilia-Romagna, Marche and Abruzzi), a true ecological "alarm bell", the cause of which will take about a decade to eliminate: pollution discharged by the Po and other northern Adriatic rivers. Some pollutants (heavy metals, pesticides, detergents) can also encourage the chaotic productivity of some plant plankton species (dinoflagellates) : "bloom", sometimes described as "red water" when the plants composing it have a purple colour, which ends with the in situ decomposition of the algae. The Adriatic is not the only area affected : the Catalonian coast also suffer, the Languedoc lagoon areas, the Gulf of Izmir, etc. The insidious nature of this kind of pollution, its threshold phenomena, the length and cost of rehabilitation or elimination of causes, underscore the need for the urgent application of protection and conservation measures, as in fact assumed in the alternative scenarios.

PART FIVE :

SYNOPSIS AND SUGGESTIONS FOR ACTION

CHAPTER V.1

CHOOSING A SUBSTAINABLE FORM OF DEVELOPMENT

Slow growth of the world economy would be reflected by equally slow economic growth at the Mediterranean level because of the interdependence between this area and other regions. These development conditions would effect virtually all sectors (**worse trend scenario T-2 with low economic growth**). Economic stagnation in the countries north of the basin would produce **tremendous development difficulties** in the southern and eastern countries - starting with agriculture - to the extent that some countries would experience falling levels of production and/or per capita consumption in some sectors as vital as agriculture production or energy consumption, which means a gradual erosion of their socio-economic situation rather than an improvement. The financing of industrial growth would be curbed by the lack of resources and the burden of persisting debt. International tourism would be neither beneficial nor "healthy", involving both low-cost mass tourism and an "elitist" tourism, object of fierce competition among the different countries.

Environmental protection would have few resources for intervention or prevention, reflected by delayed and inadequate case-by-case measures adopted to meet the most urgent needs, within the context of poorly applied regulations and reticence at all levels. One of the most worrying environmental trends would be the **gradual disappearance of many forests** (fuelwood and grazing), causing **accelerated** (and sometimes irreversible) **soil degradation** and disrupting runoff patterns and water regulation. Marginal land in the southern and eastern countries would be subject to heavy pressure leading to their degradation (erosion), and water resources in the major agricultural regions of the northern countries would be threatened by growing pollution (nitrogen from fertilizers). In contrast, some pressures, as well as most kinds of pollution, would be lower than for other development patterns because of the stagnation or weak growth of economic activities. The Mediterranean **population** would reach its **maximum** level, and the very large population groups of working age would be faced with insurmountable underemployment. Urbanization would also be at its highest level (in absolute terms) and virtually uncontrollable, and a minimum of services and sanitary conditions would be a cause of concern in the cities.

Following the rules of the game for the scenarios, this kind of growth (T-2 scenario) was continued up to the end of the period, i.e. 2025. It is likely, if not certain, that **social or geopolitical disruptions** would occur well before the end of the period - since the situation would deteriorate faster after the turn of the century - and would impose a change of policy and behaviour, i.e. "a change of scenario".

The recovery of economic growth at the world level in the 1990s and better co-ordination among the major economic partners would have a definite spillover effect on the economies of the Mediterranean basin countries (**moderate trend scenario T-3, with strong economic growth**). The countries of the European Community, for instance, would gain on average about one half point growth - which is significant over a long period of four decades - which would have a positive effect on the development of the other basin countries. In the southern and eastern countries, the overall rise in production levels would be strengthened by less dynamic **population growth** (total and urban), leading to a noticeable improvement of per capita socio-economic indicators, i.e. of economic and social well-being. Agricultural productivity and yields would virtually double by 2025, and part of the output of highly intensified agriculture would be directed towards the major European and international markets, in a general atmosphere of trade growth. Industries in the countries north of the basin would increase their specialization in high-technology sectors (special materials, fine chemicals, information technology and process control, etc.). The basic industries in the southern and eastern countries - primary processing of raw materials, manufactured goods and agro-food - would undergo spectacular development, to the point of exceeding production levels of the countries north of the basin after 2000. Agricultural intensification itself would produce strong industrial demands in these countries: fertilizer, tractors, machinery, etc. Industrial growth, agricultural intensification, the ensuing development of transport, requirements for the population's well-being, would all lead to the vigorous growth of energy consumption (about 70 % higher than in the previous scenario), particularly for electricity. All sources of energy should be mobilized, both in the Mediterranean basin and at the world level (coal, oil, natural gas, uranium, and to a lesser extent renewable energies).

Although the legislative and financial resources and technical means to undertake environmental protection are easily available, this kind of scenario paradoxically proves to be **the most harmful** for the Mediterranean environment and the one which creates the most pollution, because of the high level of all economic activities and delays in the application of measures which, in any event, aim at combating the effects of pollution a posteriori rather than preventing them. Although this is not a case of "uncontrolled growth" as in the past - which populations and governments would no longer tolerate - this kind of growth is insufficiently concerned about the environment. Many effects will no doubt be felt after the end of the period but some trends could evolve rather quickly (forests, soil, water resources, coast and near-shore seabed) and would be virtually irreversible. **Pressures on the coast would be particularly heavy** and virtually impossible to control as most activities would be concentrated there and would provoke bitter conflict about resource uses (some of which are mutually exclusive). **Economic disruptions** - starting perhaps with hydrocarbon supplies - and even **irreversible ecological degradation** would be the inevitable alarm signals of later, but even more serious, dangers.

These two extreme kinds of scenario demonstrate the difficulties of development, especially in the countries south and east of the Mediterranean basin, in an international climate of fierce competition, whether economic growth is weak or strong (with its adverse effects), resulting in poor or inadequate attention paid to the Mediterranean environment. By contributing to a better distribution of effort, a sharing of knowledge, experience and practice, and to market organization, international co-operation in a multipolar and better balanced world, and more specifically north-south or south-south **Mediterranean co-operation**, could provide a fresh impulse to economies and to societies (**alternative scenarios**).

This desire for co-operation, based on the solidarity of coastal countries, would promote **strong agricultural growth** (tripling of production) through the increase of irrigated land (doubling), fertilizer use and mechanization (tripling for the basin as a whole), as the output of the southern and eastern countries would be directed either towards outside markets (inter alia European in the case of **reference alternative scenario A-1** with strong north-south co-operation), or towards regional self-sufficiency (case of the **A-2 alternative scenario with south-south regional integration**). Industrial growth in the countries south and east of the basin would be strong and well-balanced for the main branches (except perhaps for the capital goods industry which may present problems) and would include the export of manufactured goods towards the countries north of the basin, substantial in the case of strong north-south co-operation, or based more on regional complementarity in the case of predominant south-south co-operation. As with the previous scenarios (type T-3), strong industrial, agricultural, transport, etc. growth would entail high energy consumption, but with two main differences : greater attention (even a priority) would be given to energy saving and there would be a clear preference for some sources (very vigorous development of natural gas, clean fuel and expansion of renewable energies, especially at the end of the period). North-south or south-south relations, together with rising incomes and living standards would further tourism, whose development would be at its highest level (about 700 million tourists in all), with the vigorous growth of domestic tourism.

In addition to north-south or south-south international co-operation, promoting the exchange of experience and knowledge, the alternative scenarios are also characterized by a completely different approach to environmental problems : incorporation of protection costs in budgets, consideration of environmental factors in decision-making processes, less centralization but better co-ordination, involvement of local populations in decisions and management, etc. The forests, soil and water would no longer be considered as three different environments, subject of more or less independent action, but as **ecosystems forming a single resource**, protected and managed as such. Similarly, the coast would be the subject of **integrated planning**, linking the three levels of decision-making and development : local, regional and national.

Since agricultural intensification would be carried out while seeking the most efficient use of inputs, industrialization would resort to less polluting processes, energy use would be oriented to cleaner sources, tourism would be better distributed in time and space, urbanization would be based on a well-balanced network of small and medium-sized towns, employment would gain from the (encouraged) dynamism of small and medium-sized enterprises, **impacts** on the environment and resources would be **minimized** (although not entirely disappear, of course). Land-based pollution and the physical and biological degradation of the Mediterranean coast would also be minimized, even halted.

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The **trend** scenarios therefore proved to be **unstable**, either because of the **growing deterioration of socio-economic conditions in** a number of countries (exacerbating the geopolitical instability of the Mediterranean basin), or because of the **accelerated degradation of environments and resources**, leading to "natural" disasters, in fact largely aggravated by human action : floods, landslides, the irreversible loss of soil, desertification, etc.

Only the **alternative** scenarios seem able to reconcile economic growth **and** protection of the Mediterranean environment in the long term, even the very long term, i.e. ensure **"sustainable development"**. The key to these scenarios lies, rather than in growth rates, in greater **Mediterranean co-operation** and the **integrated management** of environments in the development process. The A-1 scenario, with strong north-south co-operation, would no doubt contribute to faster economic development in the countries south and east of the Mediterranean basin ; the A-2 scenario, with predominant south-south co-operation, could lead to a better balance. A **combination** of the two over a period of time would probably be the most **propitious**.

The Blue Plan horizons 2000 and 2025 may seem remote to experts in economic forecasting. In fact "economic time spans" are rather short compared to the "ecological time spans" of forests, soil or water, although a distinction should be made between the long time spans for genesis and/or rehabilitation of environments and the increasingly short time spans associated with degradation : by 2000 the soil lost and forests decimated could reach disastrous levels.

The conclusions of the scenarios must be somewhat nuanced depending on whether consideration is given to a country as a whole, or only its Mediterranean coastal region, or the sea itself. At the level of countries and coastal regions, the **most worrying medium-term threat** seems to be the **inability to check advancing soil erosion** ; soil protection requires that of the forest upstream. At the level of coastal regions and the sea, **priority** should be given to **protection of the coast**, defined as the narrow strip where land and sea meet, in which direct action can only be local and/or national, but where threats to the environment are the worst, even in the most favourable scenarios. Rather than the sea in general, the coastal strip is **where the future of the Mediterranean environment hangs** in the balance.

Finally, it seems that beyond 2000, **population growth** will change even the very dimension of problems for most countries south and east of the Mediterranean basin. Whatever the scenario, **production will** necessarily **have to be increased** through greater technification based on better scientific AND sociological knowledge, closely involving local populations in these efforts ; or **population growth will have to be decisively reduced** ; no doubt both will be needed.

In addition to raising the **awareness** of all Mediterranean people about the **issues of their environment**, the **challenge of the development/environment alternative scenarios** is not to establish a "new" economy but a **new rationality for decision-making.**

CHAPTER V.2

ACTING ON THE SECTORS AND ENVIRONMENT

The sectoral analyses sometimes raised major issues concerning the possible futures of economic activities. Reflection on environmental components stressed predictable trends, stemming from sectoral developments, and the risk of short- or medium-term degradation of the most essential environments - the soil, inland water, the forest and the coast, where effects accumulate. Those responsible now have to draw conclusions and take the necessary decisions to foster a desirable form of development, or to counteract a specific adverse trend. This chapter groups together some possible suggestions for action. Most of them will not seem too original to the specialist, but they have been targeted either on various specific relationships between economic sectors and the environment, or even more on the protection of the most endangered Mediterranean environments. These suggestions are directed above all at the national, even local level, as those for Mediterranean co-operation are presented in the following chapter.

URBANIZATION

Whatever kind of development is pursued, urbanization will continue at a rapid pace in the Mediterranean basin, reaching rates in the region of 70-80 % around 2025, already the case in some countries north of the basin. Requirements in terms of equipment, services and infrastructure stemming from this growth probably present the biggest challenge to officials and managers. Environmental protection in the Meidterranean coastal strip will depend more on the way urbanization is handled than on any other activity.

The **quality of life** in Mediterranean towns and agglomerations will depend largely, in the next 40 years, on physical planning policies and whether they are carried out with determination or on the contrary neglected. Main efforts should focus on :

- **water** supplies, sanitation, combating the wastage of a scarce resource which competes with other uses (agriculture, industry). Savings could be effected by recycling water and making a distinction between uses ;
- the **elimination of toxic waste** and its possible re-use. There should not be the least temptation to export urban waste, as done, for instance, by some cities in the United States ;
- the **creation of green spaces,** essential in Mediterranean towns which already have less (on average four times less) than north European towns. Green spaces must be supplemented by the maintenance or creation of pedestrian precincts (medinas, roads closed to traffic, etc.) ;
- the **saving of energy** by developing **solar technologies** for domestic use and space heating, and by supervising the use of coal and fuel (as in Ankara) in towns already severely affected by air pollution ;
- the strengthening of efforts to **reduce automobile pollution** at the origin (clean cars, vehicles designed especially for urban traffic, etc.) as air pollution, already severe in some towns, may become unbearable with the growth of automobile traffic. Efforts made to restrict the source (new cars) must be quickly extended ;
- the **reduction of pressure** , sometimes considerable, on peri-urban **agricultural land** in countries where it is scarce and in most coastal regions. In this respect some successful experiments demonstrate that land control legislation and practice can provide lasting protection for agricultural areas near towns and avoid uncontrolled urbanization ;
- the maintenance or development of **types of housing adapted** to spatial constraints and the ecological and cultural conditions of the country.

AGRICULTURE

Rising population levels and living standards in the countries south and east of the Mediterranean basin will considerably increase agro-food needs, and only vigorous intensification will help to reduce food dependency, which has become more pronounced in recent years.

This **intensification** should not be carried out in a haphazard or **poorly controlled** way, but on the contrary should be well-targeted and properly guided, by co-ordinating the technological **mastery of industrial inputs** (mechanization, fertilizers, pesticides, machinery, etc.) and by integrating the production of these inputs into the industrial and agricultural development process. This will contribute to reducing as much as possible the damaging effect of the large expected increase of these inputs. In the **north**, attempts should be made to **stabilize the amounts** of industrial inputs used in order to master better their application. In addition, **better knowledge** of the evolution of the pollutants (fertilizers and pesticides) in the environment would help to **combat** their **impact more effectively.**

The following measures should also help to improve **agricultural production** while paying more attention to the Mediterranean **environment** :

- **soil salinization** (one of the biggest threats to agricultural land) and waterlogging could be avoided to a large extent by **improving and maintaining** the **drainage networks** in existing irrigation districts and by taking care to install them correctly in new districts ;
- investments **in major irrigation dams** should always be followed by investment and necessary measures to **equip irrigation districts** appropriately, in close co-operation with local populations (duly trained and informed) ;
- the development and application of **biotechnologies** likely to increase or improve agricultural production (nitrogen fixation, crop protection, animal feed, etc.), a prime area for international **co-operation**, should be more strongly encouraged in the region ;
- the **conservation** of cultivated plant **varieties** and domestic animal breeds is **essential** for the development of future production in the Mediterranean region ;
- means of **tackling the very uneven production** from one year to another, caused by the vagaries of the Mediterranean climate, could be bolstered through **technical and institutional mechanisms** which would contribute to reduce pressure on soil and water ;
- finally, special attention should focus on the ways in which **agro-food industries** develop in Mediterranean coastal areas, as regards both site coverage and the risk of pollution and discharge into the sea.

FISHERIES AND AQUACULTURE

Fisheries and aquaculture are a **specific sector** which could **contribute more** to meeting food requirements in the Mediterranean basin. First of all, **statistical data should be co-ordinated and standardized,** as well as the various **systems for assessing stocks,** in order to increase the accuracy and reliability of results.

As regards fisheries, **concerted action** among states should be pursued, **and optimal use of the coastal** strip should be ensured, particularly as regards small-scale fisheries and the installation of articifial reefs and aquaculture facilities in the open sea.

Concerning **aquaculture** it would be useful :
- to identify and protect **potential aquaculture zones** in each country, notably lagoons ;
- to carry out necessary **experiments** to develop various products ;
- to give more systematic attention, from the viewpoint of aquaculture potential, to the **location of** marinas

INDUSTRY

The impact of **industrial growth** on the **Mediterranean environment** will therefore be considerable during the next forty years, especially in the countries south and east of the basin. **Trends or transformations** both in the north and in the south and east, which will gradually alter the industrial landscape, will be equally important. But this impact will change completely depending on the **policies followed or measures undertaken by states, industrialists or local authorities.**

Impact related to the **heavy pressure of new activities**, many of which would be concentrated on the coast, will largely depend on **land-use policies** decided upon and implemented at the national, regional, or local levels. The prior development of "**industrial zones**", duly drained and equiped with installations for the **evacuation or reprocessing of waste, or for water recycling**, should produce **savings** in resources, site coverage and water (bottlenecks in development).

The various Mediterranean countries, either alone or jointly (following the example of practice within the European Communities), could be **stricter about waste** ; but relevant regulations are insufficient, and everything will depend on the **quality of the inspectors** for industrial plants, and on their **capacity for dialogue** with those responsible for production in the **enterprise.**

As regards the existing industrial stock, identification and supervision of "**hazardous industries**" is a priority (that some Mediterranean countries have in fact already considered). State action should also focus, for example, on the **evacuation of toxic wastes** : an organized system for evacuation and treatment, which scarcely exists at present even in the most advanced countries, is essential in the Mediterranean countries.

Finally, the **role of the enterprise** is at least as **vital** as that of the state. Improvements as regards industrial pollution depends on the enterprise. Depollution installations are sometimes expensive (steel works), but the introduction of depollution techniques, and above all processes, can also be **profitable** (re-use of "waste or by-products", recycling etc.) ; in this respect the development of information exchanges on "**clean technologies**" would be very useful both internally and among countries. In any event **national and regional incentives** for the application of **existing industrial anti-pollution techniques** (which are not always used) should be improved and training stepped up in this area.

ENERGY

Future demand can be anticipated fairly accurately in the Mediterranean energy sector : resources are subject to heavy constraints related to the international context. The coastal countries do, however, have **some options open** to them ; **exchange of information and practices**, and the establishment of **suitable policies** geared as a priority to **energy conservation** and **environmental protection** would be useful.

Electricity and gas networks in Mediterranean countries of the European Community are already interconnected to a large extent. It would be appropriate to extend this kind of **interconnection** to the other Mediterranean countries. **Electricity development prospects** should be closely followed, with a view to the exchange of information and experience (inter alia for pollution control).

In the southern and eastern countries, the search for a **solution to the fuelwood problem** in rural areas (distribution of LPG, followed by decentralized rural electrification) is **urgent in** order to spare the often overexploited **forests.**

Even with a high rate of growth and penetration, the contribution of **solar** energy would not be significant in the Mediterranean countries in the short or medium term. In the **long term**, however, it should become more important. Through more systematic targeting, solar energy could already make a useful contribution, particularly for scattered dwellings and irrigation in the rural world.

Finally, trends towards a heating up of the climate and a possible rise in sea level should be closely followed by all the coastal countries, which should play an active role in international co-operation in this field.

TOURISM

Tourism is destined to be one of the major resources of the future for many Mediterranean countries.

In principle it would be possible to **receive four times more tourists** in the Mediterranean, (a level intimated by some scenarios), but countries, local authorities and those working in the tourist sector, who in addition are competing with each other almost everywhere in the basin, will not be able to handle this kind of growth without an effort to improve information, analysis and co-operation.

Each country, as far as it is concerned, should aim at **improving distribution** spatially (distribution of flows to avoid saturation) and especially **throughout the year** (partial staggering of holidays, short stays, winter tourism) to spread the **load**, increasingly concentrated on the narrow **coastal strip. Collaboration with local populations** at the decision-making level and more careful integration into the physical and cultural environment is essential to avoid the clear **risk of rejection.** The joint use of installations by the local population and by domestic and foreign tourists is one of the ways of achieving this objective.

The **rapid development of different kinds of tourism** must be closely followed by each country, as the trend towards **more active tourism** (sport, culture, conferences) has become more important. Finally, systematically raising the awareness of tourists as regards protection of the environment they have come to enjoy is essential in the countries as a whole. The **protection of some prestigious** and over-visited natural or cultural **sites** could be promoted by this awareness-heightening, but it may also require new solutions (recreational areas).

TRANSPORT

In the maritime area, **crude transport should drop**, while the transport of products refined by the producer countries should rise, which **changes** somewhat the **transport profile** in favour of **smaller ships with specialized cargoes** (some of which, more polluting or more toxic, would increase risks during **major accidents**). Renewal of the tanker fleet should take at least twenty years. Hence, in order to reduce discharges at sea by ships, the need to speed up the installation of land facilities with a view to **complying with the MARPOL 1973/78 stipulations** concerning the dumping of oil in the Mediterranean.

With respect to **other products transported by sea**, as industrialization proceeds in the countries south and east of the basin, and trade grows, there will be an **increase in the transport of chemical products**, either in bulk, in drums, or packed, and a parallel rise in the **risk of accidental pollution** (some of these products are highly **toxic**). An entirely new approach should be developed, by seeking in particular better safety conditions for this kind of transport.

Roll-on/roll-off cargo ships would be increasingly used on **intra-Mediterranean links** and their number would increase. **Care** should be taken to ensure that the loading of **merchandise hazardous for the marine environment** is authorized only on those **roll-on/roll-off vessels** which will meet the new, much **stricter international safety regulations** currently being drafted.

At the **national** level priority could be given to :
- the installation of **facilities in port complexes** to reduce maritime transport **nuisances** as far as possible ;
- *greater* *efforts* *to speed up the installation of* **deballasting facilities** (about 20 are needed).

As regards infrastructure for rapidly expanding road transport, considerations such as **incorporation into the landscape** or **protection** of potential agricultural areas should encourage the **careful choice of routes** and avoidance of inhabited areas (noise).

To be effective, **efforts to reduce emissions** at the source should be **vigorous and quick** because the **renewal** of the Mediterranean automobile stock, particularly in the south and east, is fairly slow (about fifteen years). Greater attention should focus on diesel vehicles and those with small cubic capacity (more numerous in the Mediterranean than in northern Europe), the supervision of used vehicles (also more numerous in the basin countries), and the harmonization of speed limits. The wider use of gas engines (LPG) would be an interesting contribution to the reduction of pollution. **Specific** regulations on automobile traffic set at the **national** level are essential in **congested agglomerations**. Collaboration on **trucks** would be useful.

Finally, the problem of **air corridors** and the **risk of congestion** over airports (stemming from the explosive growth of tourism) must be carefully examined by the **national** civil and military authorities : it also requires **Mediterranean collaboration**, especially because the **air network** will be decisive in the creation of a **new Mediterranean geography** and the process of bringing Mediterranean countries, regions and cities closer together.

THE FOREST

The Blue Plan scenarios highlighted the fundamental protective role of the forest, and also the fact that the problems presented by Mediterranean woodland cannot be solved, even if no unpleasant surprise occurs, without a considerable and prolonged effort on the part of the various countries concerned.

If the first positive results of this effort are to be obtained **before 2025**, with an **effect on adverse trends**, and if an **increase in irreversible situations** is to be avoided locally, this action will have to be taken immediately, as time is short and **negative trends are gaining ground.**

Forest research will have to be **better integrated** into planning processes (with an improvement, inter alia, of links between research and applications), with a view **to strengthening the role of the forest in rural development**. It is no less urgent - and no doubt more difficult - to **change attitudes radically** through information, extension services, or persuasion (political decision-makers, forest officials, coastal populations, the media, etc.).

Despite a time lag between the northern countries and those south and east of the basin, the very **existence of woodland in coastal regions** and areas with a **strong human concentration** is **threatened** by trampling, degradation, fire, pollution, and disease, and by abuse of manmade creations (artificial plantings, dune stabilization, green belts, urban parks, etc.) which are generally replacing areas which were once naturally wooded. One of the few effective and lasting **means of defending** areas to be preserved regardless would be to turn them into national **estates** managed by specialized bodies.

In the hinterlands of the countries south and east of the basin **management conditions** are far from optimal and need to be improved. The biomass balance of the forest could be improved by **reducing the removal of fuelwood** (improved efficiency of cooking and heating utensils, supply of substitute fuels, planting of fast-growing fuelwood trees near villages) and by **improving the fodder "system"** (fodder trees, improved grazing supplemented by artificial feed, etc.). **Jobs** could be created in this sector - even a civil service - linked to work beneficial to ecosystems, and local communities could be reimbursed for some of the direct or indirect benefits obtained from the forest in downstream areas, even far away. In these hinterlands, the **stakes in the forest are considerable**, for their future depends to a large extent on its evolution. Responsible authorities would gain in encouraging new forms of co-operation with local people to protect endemic forests from overgrazing. The setting up of **biosphere reserves** could further this action.

In the countries **north** *of the basin, lasting protection of the forest, beyond* **fire control**, *would be achieved* by way of the study of diseases and of the prospects for autochtonous species. Care must also be taken as to the way in which production, leisure and landscape protection functions will be incorporated.

Finally, forest protection can facilitate **conservation of the genetic heritage** of the particularly rich Mediterranean flora. In this vein, the planting of foreign species where **endemic** ones are **economically viable** should be avoided. In both the north and the south, action could focus on the establishment of protected areas for endemic species and of appropriately managed and **protected conservation areas**, (species banks, conservatories, etc.).

THE SOIL

Whatever the scenario the erosion of Mediterranean soil and **inability to check its processes** clearly seems to be one of the **most worrying threats**. Soil policy implies both rapid and **very long-term action**, along with the **mobilization of considerable resources.**

Experiences are very **different**. An initial **prerequisite** would be to prepare an **inventory** for all those concerned (problem of communication...) and **analyse the reasons for success or failure**, related either to the characteristics of the soil itself or to neglect of the socio-cultural aspects of the problem, tackled from a *purely technical viewpoint.*

Necessary agricultural intensification should take in account, from the outset, **control techniques for combating potential erosion** in the case of dry farming in the Mediterranean climate (cereal/alfalfa rotation patterns, replacing deep mechanical ploughing with surface ploughing), and the **risk of salinization** in the case of irrigated farming (with improvement and maintaining of **adequate drainage networks**). The **water retention capacity** of some **soils with a calcareous crust** could be improved by encouraging deep scarification and the introduction of species with deep roots to break up the soil below surface ploughing.

For **mountainous regions**, countries could give higher **priority** to **soil maintenance** by adopting **measures to combat overgrazing and deforestation.** On the slopes, they could foster the maintainenance or repair of the traditional **steps and terrasses** (stabilizing elements). Abandoned and eroded agricultural land on steep slopes could be gradually converted into **fuelwood forests.** In the northern hinterlands local authorities and forest officials could join forces to ensure suitable management of abandoned rural areas, including through **preventive afforestation and the timbering of agricultural wasteland.**

Water **resources** in many Mediterranean countries are naturally restricted by the climate. But for most of them this **constraint** could be overcome by **rational and skillful management.** Solutions for this kind of management are rather well-known and can simplify difficult choices between several competing uses. But **adaptations** will in any event be necessary sooner or later : the sooner they are introduced the less economic growth will occur to the detriment - partly irreversible - of the environment in both the north and the south and east (with naturally varying degrees of intensity). As in the case of soil or forest resources, rapid economic development, neglectful of the environment and resources, may seem less expensive, but only to the extent that these adaptations would be postponed (with increasing costs).

The **hierarchy** of water problems, **motivations** for conserving water in the environment, and the **choice of components** to be preserved will depend on the countries, whether their water is plentiful or scarce, or on their state of economic development. These choices would have to be based on :
- less global and more regional **analyses** and **prospective** studies, extending those of the Blue Plan and drawing from them as regards development prospects ;
- **processes of consensus** for adopting **qualitative and quantitative** objectives as regards the conservation levels for aquatic areas to be protected, and the regime and quality of water to be conserved, including for **coastal waters.**

Options chosen should fit into **water management and protection schemes incorporated into development plans.**

Effective achievements of objectives would imply :
- the setting up of mechanisms to internalize various external effects of water use in the economic decision-making process ;
- the establishment of integrated water management authorities (basin agencies or commissions), endowed with appropriate legal and financial resources and empowered both to guide and co-ordinate water management and conservation and to intervene as regards uses in general ;
- the development of information systems - assessment networks, regular census-taking operations, data banks - working as an "observatory of water resources and uses" for management authorities and the general public.

There is also a need for improving the **technical aspects** of water uses (especially for irrigation) by encouraging **water saving**, especially in countries where resources are scarce, and **developing the treatment and recycling of urban and industrial effluent for agricultural use.**

Finally, as pointed out for the forest and soil, social inertia adds to that of nature, and for results to be significant and lasting, efforts would have to be made, in this case also, to **change attitudes and behaviour.**

THE COAST

Particularly **vigorous policies** are required from states, regions, and local authorities in order to achieve effective protection and avoid destructive coastal concentration ; integrated planning, which could be based on the **scenario method** at the local level seems **essential** for short-term, or even more, long-term planning.

This kind of **integrated planning** requires the co-operation of specialists in very different disciplines related to both economics and ecology, as well as the land and the sea. Examples of this kind of **co-operation** are few and it is the task of **national or local authorities** to organize it. At the level of action and management, the situation is even more difficult because of the dispersion, overlapping or lack of administrative responsibility on the land and sea sections of the coastal strip in virtually all countries. **New administrative bodies** could be set up, as in the case of water resource management : physical planning agencies, coastal committees, etc.

Among the actions which seem to be the most urgent or necessary are :
- **exchange of experiences** (and possibly of projects) for the more effective use of the specific features of different coastal regions, and their complementary aspects ;
- the use of **modern computerized geographical information** techniques, especially geared to processing environmental data ;
- an **inventory** of the areas of the coastal strip **most threatened** by future development, and the preparation of **impact studies** for development zones, while identifying as from now areas to be protected at all cost and potential aquaculture zones ;
- **bringing under protection**, as quickly as possible in each country, a significant part of the land and **marine coastal strip** - about one third of its total length - through legislation, purchase (coastal conservatories), agreement with local populations or private owners etc. ;
- **efforts**, in the implementation of projects to be established on the coastal strip, to **reduce to a minimum impingement on the near-shore seabed** and to protect marine species in their larval and young stage by prohibiting certain kinds of fishing in some defined zones. ;
- establishment of a better linkage or co-ordination between coastal development and that of the **hinterland**, in order to achieve a certain degree of decongestion on the coast ;
- a deliberate option, when making choices, for flexibility in a number of installations, facilitating subsequent **adaptation to changing situations and prospective management.**

It should be recognized that **regulatory and legal action** alone is likely to be ineffective in the longer term to protect the coast and that it should be **accompanied** by deliberate intervention in **economic mechanisms** (price formation), notably in those of the **property market.** This implies setting up **agencies** able to define the development objectives of specific zones within the context of **regional and national** development scenarios, duly endowed with **means of implementation.**

THE SEA

The sea is the **common property and natural link** among all the Mediterranean coastal countries. Clearly threats are most serious on the **coastal strip** which falls under the **jurisdiction of each country.** However there is a **continuity between the coastal sea and the high seas. Pollution does not recognize the limits of territorial waters.** This is why the outcome of the various Blue Plan scenarios must be observed on the sea itself.

Clearly there is **no question here of adding to the guidelines for action concerning protection of the Mediterranean Sea** which, over the past twelve years, have been **formulated, discussed and decided** upon by the various organs of the **Mediterranean Action Plan.**

Following the Blue Plan work, it seems however that the studies, and the decisions that are drawn from them would benefit from being set squarely in the **more general context of the economic and social development** of the coastal countries and of the environmental policies they incorporated in their national plans. Protection of the sea starts with protection of the coast ; as ii has been repeatedly stressed, all environments are found on the coast and all human activities are carried out there. But environmental trends on the coast depend on environmental trends in the hinterland (forest, watersheds, etc.), and sectoral activities depend on the general economic level. Although it is true that land-based pollution is the biggest threat to the Mediterranean Sea, the complex application of the relevant protocol, the time spans involved for its effective implementation by all countries in all its aspects, suggest that **application should be closely correlated with the overall prospects for economic development and environment** in the coastal states, either at the level of the basin as a whole, or at the level of particular areas concerning one or several countries.

It is clear that the **state of sea pollution** will depend on the **effective application** of all the international conventions and protocols intended to avoid or reduce pollution, whether from land-based inputs, hydrocarbons transport, or the maritime transport of hazardous substances. International monitoring of maritime "corridors" is in particular essential to avoid clandestine degassing operations and ensure safety. However, **habits and practices** will clearly be formed at the level of the countries, together with the setting up of installations enabling the more or less effective application of international agreements. **Thus, the fate of the sea is determined on land in minds and wills.**

At the national level also many local or lesser measures can be taken, which will primarily affect the coastal environment, but which ultimately will affect the **state of the whole sea.** Control of any form of pollution which destroy the marine biomass and of any excessive aggression of the marine environment by the dumping of non-biodegradable substances or by the destruction of the seabed should form part of an **ethical attitude as regards the marine environment which still runs counter to age-old habits.**

CHAPTER V.3

FROM THE NATIONAL LEVEL TO THE MEDITERRANEAN LEVEL : SUGGESTIONS FOR CO-OPERATION

I. THE STRUGGLE FOR THE ENVIRONMENT WILL TAKE PLACE ABOVE ALL AT THE NATIONAL LEVEL

The **hypotheses** of the Blue Plan studies took into account, for the **"alternative" scenarios**, a consolidated policy of **environmental protection** and, especially, an improvement in its incorporation into development or physical planning policies.

However, the work also **highlighted** the fact that, even in the case of the "trend" scenarios, reference to policies followed over the years did not reflect reality in many respects, because the **effective application of government decisions** was **far removed** from the intentions expressed or laws passed.

In this respect the **biggest discrepancies** lie in the following areas :

a) **Control of urbanization** : the will to direct or curb urbanization through urban planning, land-use planning or guidelines on coastal development is sometimes thwarted or deflected by decentralization of the competent authorities. **Lack of supervision** and numerous "dispensations" have been observed as regards housing or tourism. Reality scarcely corresponds to the expressed intention to create protected areas or to shield some zones from urban encroachment. The **coast** in particular is increasingly subject to the **pressure of vested interests.** In 20 years nearly **2000 km of coastline** have been **sacrificed** in this way, although this was not the intention at the national level.

b) **Supervision of productive or transport activities** : monitoring of industrial plants and disciplines as regards maritime transport do **not comply** with the relevant requirements. **Planning** and strategies concerning **industrial waste** are clearly **inadequate**, and its destruction, storage or transport are often a hazard. There is also a discrepancy between stipulations and practice as regards the monitoring of **degassing operations on ships in transit.**

c) **Waste-water treatment plants** : The level of **land-based pollution** requires adequate measures. And yet, aside from the major rivers, there is little evidence of real progress. On the **coast**, waste water **depollution rates** are rarely available, but **do not exceed 15 %** on average. Many treatment plants are not in a suitable operating condition.

Nevertheless, despite the discrepancy between intentions expressed or programmes adopted and the reality of environmental practices, the Blue Plan studies show that decisions on the bulk of environmental protection will be made, or not, largely at the **level of the state.** Essential **legislation** and **standards** will have to be established at this level, as well as the **necessary mechanisms and institutions** with the financing and competence to apply them (based for example on the "polluter pays" principle). The heterogeneity of geographical, socio-economic or cultural situations leads in the same direction : only **states** can stipulate and implement a **suitable policy** within their borders.

The **intensification of efforts** currently under way (trend scenarios), and even more the **strengthening of environmental policy** (alternative scenarios), implies a **change of direction** and a more **goal-oriented action** focusing in particular on:

- the **strengthening of physical planning** and programmes and, if necessary, the formulation and publication of "**national and regional environmental protection plans**" with deadlines set for objectives ;
- the application of an **approach by "scenario"** for the establishment of **coastal "charters", including** the active participation of local institutions, socio-professional organizations and the population ;
- the study of **employment policies** for young people and the contribution that could be made in this respect by taking into account the **objectives of environmental protection** and the more effective **economic use of natural resources** ;
- the **training of environmental experts** able to ensure the link between scientific research, supervision or regulations, and the implementation of new development activities ;
- **raising the awareness** of elected representatives and the officials of local authorities and national agencies working in the area of development or physical planning as regards **environmental issues.**

Without greater **awareness** on the part of the **public** about the **interactions** between, on the one hand, the **environment and natural resources** and, on the other, individual and collective **activity,** it will be futile to expect a rapid and smooth evolution towards satisfactory forms of **sustainable development** in the Mediterranean basin as a whole. More systematic and consistent efforts would therefore have to be undertaken to :

- develop **general education** concerning the Mediterranean environment with the help of teaching materials focusing on the realities and problems of the region ;
- disseminate objective and serious **information** to the public about the possibilities and constraints of the local and regional environment in which they live, directed at various age groups and stressing the fact that one generation takes over from another ;
- encourage national and local **associations** for environmental protection and landscape conservation, **underscoring in particular** tangible action and evidence of results.

II. <u>BUT BROAD FIELDS ARE OPEN TO MEDITERRANEAN CO-OPERATION</u>

The **prospective** study on the Mediterranean basin could only be initiated with the **agreement** of all the coastal states concerned, anxious not to be overtaken by their fate and the passing years as regards **development and the environment,** and no doubt also the role of their region in the world. In turn, this last part of this report is devoted to this **co-operation between coastal countries,** starting with issues likely to emerge, or become more pronounced, in the near future. In accordance with the original intentions of the Blue Plan, some **suggestions for intra-Mediterranean action,** identified in the light of the scenarios and the accompanying studies, are therefore submitted to **decision-makers,** so they can assess their suitability for implementation. This could be based on multilateral or bilateral **co-operation,** on the establishment of **exchange networks,** on **joint projects** or on the development of **solidarity.**

A. THE PROGRESS OF KNOWLEDGE

Concerning **data and statistics,** it must be recognized that in the Mediterranean collecting and measuring mechanisms still provide a very **inadequate** basis for projections, analyses and **choices.** The statistics supplied by international organizations, which divide up this part of the world somewhat artificially into

Africa, Western Asia and Europe are limited. Entire areas **elude** analysis, or are documented by **unreliable data.** This is the case, to take just a few examples, of data on relationships between air and sea pollution, endangered species, the quality of surface water and groundwater, domestic and even international tourism by coastal region, etc.

The establishment of some **fifty series** of comparable socio-economic statistics and a number of **key indicators** on the **quality of the environment** would be useful. The places where **environmental data** are **gathered** and **processed** should be better identified and their efficiency and accessibility improved. **Networks** accessible to each coastal country could also be established based on specialized, but well-connected, **data banks.**

In addition, experience has shown how difficult it was for a number of countries to obtain data concerning the **Mediterranean regions** as such and the **coastline.** The harmonization of statistical data gathering according to administrative districts, or appropriate spatial divisions (e.g. by watershed) could be the subject of **collaboration among countries** and would be of **great help for future work.**

The development of **new techniques** could facilitate or partly modify the measuring, gathering and processing of data and their presentation (automatic cartography, for instance). **Remote sensing** will contribute significantly to renewing **monitoring techniques** for plant life, the soil, the climate, the coastal strip and urbanization. Intra-Mediterranean co-operation for **monitoring by "ecozones"** with the setting up of pluridisciplinary teams, would make it possible to develop links, still very inadequate, between the production of basic images and the users, on the basis, for example, of the joint interpretation of some **illustrative coastal sites***, especially where monitoring networks have already been established.

As regards **basic and applied research,** the countries could identify gaps which exist between scientific knowledge and decision-making or practical application. Thus **environmental meteorology,** the study of **complex, multi-purpose ecological systems,** the clinical study of **plant diseases,** the rehabilitation of degraded ecological systems, the recycling of water resources, the application to agriculture of genetic discoveries concerning conservation or selection, etc., could be useful to all Mediterranean people. Without an active policy for the **intra-Mediterranean dissemination of knowledge,** the gaps are likely to widen between countries in, for example, the application of **bio-technology** to agriculture. The Blue Plan would have liked to have been able to give **more consideration** to the question of **new technologies** and their future role in the search for patterns of development that are more mindful of the environment.

In this respect, the Blue Plan work also lacked a study of **social perception and behaviour,** especially trends in demands and needs. Some existing **social prospective studies** (use of leisure time, food consumption, environmental awareness, etc.) showed that the forecasting exercises needed a social prospective, closely linked to **culture.** The establishment of a **network,** notably in the **academic** context, enabling the exploitation throughout the Mediterranean of studies and research undertaken, could improve the situation.

B. CO-OPERATION ON MANAGEMENT AND THE ENVIRONMENT

Concerted action among Mediterranean states could, in this case, speed up the **strengthening of environmental policies** and especially their **incorporation** into **development policies.**

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* Portugal has carried out this work for the whole of its national territory with the assistance of the European Communities : the cost was approximately one million dollars.

Some forms of co-operation could be based on **existing structures** : this is the case, for instance, of the *General Fisheries Council of the Mediterranean, for fisheries, or of "Silva Mediterranea" for the forest*; other structures remain to be **established** in areas where exchanges are still at a very low level. In this respect, the formation, on a formal or informal basis, of exchange and co-operation networks is quicker and more effective than establishing new institutions.

The **Genoa Declaration** (1985) foreshadowed this kind of linkage for example by proposing the identification of **100 historic sites** of Mediterranean interest, which were adopted in 1987, or 50 **new protected natural sites** on the coast. Those responsible for them are expected to exchange experiences within the context of MAP. Similarly, managers of the "biosphere reserves" meet within the framework of Unesco's Man and the Biosphere (MAB) Programme. The MEDPOL programme, which links about one hundred research and analysis laboratories, and the Priority Actions Programme, which gathers together specialists on specific subjects, operate in the same way.

A better idea of requirements can be obtained by specifically reviewing the main **possible areas** of Mediterranean co-operation :

1. Co-operation on spatial management

<u>Coastal management</u> For reasons that were clearly stressed by the Blue Plan, **development** of the *Mediterranean* **coast** - *including the* **islands** - *calls for an exchange of experience on national policies* and development **practices** likely to **reduce pressure** on the coast, and encourage development of the hinterland.

Co-operation, particularly through comparative studies, could start with planning and development methods, conservation regulations, legal and financial protection mechanisms (coastal conservatories, for instance), **promotion** of awareness among tourists of environments to be protected, conservation of the near-shore seabed, the use of remote sensing, etc. **Meetings** between **officials** responsible for coastal regions would be very fruitful in this respect. The necessary information, exchange and training activities would be facilitated by the establishment of a "Mediterranean Coastal Observatory" focusing its attention on the changes taking place in the coastal strip.

The current inadequate rate of installation of **waste-treatment stations in** coastal regions implies that the objectives of the **Genoa** Declaration **may not be met.** Even though measures are the responsibility of each state, at least a **MAP questionnaire** could be drawn up at the Mediterranean level, enabling preparation of a public overview of the situation and prospects for the next five years. Plastic packaging distributed in coastal regions should be replaced by **biodegradable packaging.** Finally, an efficient co-operation network among **port authorities** could be useful for identifying problems and bottlenecks. The co-operation already under way between the European Community and the Mediterranean countries could help to complete port installations where they are needed for the application of the MARPOL Convention on degassing.

<u>Urban management</u> In 2025 more than 150 million people will be living in the towns of the Mediterranean regions (82 million in 1985). Collaboration among **specialists** could, in this case, focus mainly on the **creation of new towns, control of the use of peri-urban areas** where agricultural land is destabilized, economical **urban transport**, the protection and restoration of **historical centres**, the reduction of air pollution, the design of low-cost housing and public areas, small-scale urban systems in harmony with rural

areas, etc. **Urban management** as such (waste, sanitation, water, traffic, plantings, etc.) could rise to exchanges through direct "technical twinning" between Mediterranean towns.*

Water resources management The uncertainty and irregularity of water resources constitutes a **real bottleneck** for Mediterranean development, particularly for the southern and eastern countries.

Collaboration could focus on several aspects : resource management institutions, distribution of drinking water, sanitation techniques, water-saving irrigation techniques, re-use of waste water for agriculture, solar pumps, desalination of sea water, supply of water to small islands. The organization of **internships** and **regional training courses** for water resource management (domestic, agricultural and industrial uses, integrated planning and management) is a prime area for intra-Mediterranean co-operation.

Forest management Co-operation could be very beneficial in the following areas : upkeep and testing of stable, multipurpose **farm-forest cum grazing systems**, management and **protection of watersheds**, multipurpose forest management (including for hunting), the succession process of different kinds of vegetation, **diseases specific** to Mediterranean trees, precedures for timbering by stages, (choice of trees for retimbering), **combating of forest fires**, techniques and equipment for clearing undergrowth, exploitation of **by-products, alternatives to fuelwood**. Here again the organization of specialized regional internships and training courses could be encouraged.

Management of protected areas The **rich genetic heritage** of the Mediterranean region, as regards both wild species and cultivated or domestic varieties, is **seriously threatened**. The application of the Barcelona Convention protocol on "**specially protected areas**" and the work of the Salambo (Tunisia) Regional Activity Centre should help to develop the protection of **coastal and marine regions**. In co-operation with the International Union for the Conservation of Nature and Natural Resources (IUCN), it is essential to extend action to all the Mediterranean-climate **land ecosystems** in the region, particularly, through the expansion and improvement of the biosphere reserve network, the creation of biotope reserves and the adoption of a **regional conservation strategy**. The conservation of outstanding sites and Mediterranean landscapes should bolster this effort to conserve ecosystems, and could also be an area of co-operation. The participation of local populations in the management of protected areas is essential, and could also offer an opportunity for an exchange of experience.

Management of marine living resources Although they are not abundant, **Mediterranean living resources** could **contribute** to **reducing the food dependency** of some coastal countries if **exploitation** were carried out in a **rational** way so as to be **sustainable**. This kind of objective requires effective international co-operation, for which the General Fisheries Council of the Mediterranean provides a sound framework, but which should be **stepped up** and suitably co-ordinated with the action of other sectors such as transport or pollution control. Information about existing **fish stocks** (demersal and pelagic speies), their migration and reproduction cycle (especially in the less studied **eastern basin**) is essential for **optimizing** fisheries. A joint assessment of migrant species should also be encouraged. Above all, priority should be given to concerted action between countries exploiting the same resource, and the formulation, if necessary, of measures to limit fishing activity and ensure distribution of this resource, together with supervision of the effective application of measures. Legislation on use of the coastal strip through **artificial reefs** and, in general, national management and development plans for fisheries should be harmonized as far as possible.

* There are currently 360 twinnings, of which only 45 between North and South and ten South-South. Less than a dozen twinnings concern technical exchanges.

2. **Co-operation on appropriate technology**

The **establishment of new industries** in the south and east of the basin in particular will create an urgent need for information on precautions to be taken on installation, recycling, and depollution devices. It will be equally useful, however, to exchange the mechanisms and processes of " **clean technologies**" introduced into industrial processes, which make it possible - often with economic benefit - to reduce waste, save materials and energy, and re-use by-products. This could offer a broad area for exchange and co-operation between specialists from the north and south, in fields such as **energy, water, biotechnologies or waste**, which may possibly receive support from the European Community.

3. **Co-operation on major hazards**

Erosion of the genetic heritage The Mediterranean bovine, ovine and caprine **domestic races** amount to only 10 % of what they were a century ago ; **populations of shrub species** and plants that are part of the traditional diet are rapidly disappearing. The urgent establishment of **biological conservatories, gene banks, botanical gardens** and **biosphere reserves**, covering the land ecosystems of the Mediterranean region, will alone contribute to **conserving** ex situ and in situ the components of the wild or domestic **genetic heritage** of the region in order to maintain, for information, the domestic varieties and wild fellow-creatures essential for the genetic selection of varieties needed for agriculture and stock-farming in the future. A Mediterranean network of botanical conservatories and arboretums could be established. A **Mediterranean association for the protection of nature** could prove useful.

Natural hazards Natural **telluric hazards** have **always existed** in the Mediterranean, whether earthquakes, volcanic eruptions, or landslides. Moreover, the **irregularity of the climate** causes **floods** and recurring **disastrous droughts.** Solidarity is all the more effective in these spheres as it concerns neighbouring countries likely to be affected, in turn, by the same calamity. Studies on seismic hazards undertaken in the region under the auspices of UNDP, Unesco and PAP could be fruitfully extended to the Mediterranean basin as a whole. Work carried out on **drought** and **agroclimatology** is also an **important area for regional co-operation.**

Technological hazards Technological hazards are becoming increasingly serious in the Mediterranean basin with the development of industrialization, the manufacture and transport by land and sea of new chemical products, the increase in toxic waste, the production of nuclear energy, etc. Co-operation could focus on **prevention techniques and practices**, identification and marketing of new products (pesticides in particular), adoption of **suitable legislation**, measures to be taken in case of accidents, or transborder co-operation among local authorities. All coastal states could take advantage of the progress made by some industrialized countries, and of European collaboration, already under way. Broadening the fields of competence of the Malta Centre coincides with this recognition of **new risks** as regards **maritime accidents.**

Among the top priorities is **co-operation on industrial waste**, particularly toxic waste (destruction, transport, storage, reprocessing, etc.). The organization of regular contacts among industrialists, in co-operation with public authorities, would be a positive step.

C. FROM COLLABORATION TO MEDITERRANEAN SOLIDARITY

The work of the Blue Plan has often highlighted the **need for collaboration** much further upstream in a number of major sectors of economic activity, as a prerequisite for a true **Mediterranean solidarity.**

In this respect, it was observed that bilateral relations between states only marginally covers **environmental problems**. These issues should be given **more importance in bilateral** scientific, technical or commercial **agreements** between Mediterranean countries.

Relations between neighbouring countries have to be facilitated to achieve better **international balance** : maritime, and also air and road transport, electrical interconnections, communications, etc. A **network of exchanges** should **link up** the Mediterranean basin, where currently preference is given to relations along certain main lines, whose lesser ramifications tend to stagnate. The situation can be improved by ***strengthening short-distance relations***, *still too limited, particularly among southern countries.*

At the **regional or international level**, increasingly numerous forms of collaboration are pursued within organizations in which the Mediterranean States find themselves involved in **decision-making processes** that do not pay sufficient **attention to the Mediterranean identity**, especially the distinctive features of the Mediterranean environment. Very different kinds of international organizations, such as FAO, WHO, Unesco or world development organizations (World Bank, UNDP), are collaboration or decision-making levels in which the Mediterranean countries participate, but are a **minority** and never form a group. It would be appropriate for these bodies to **take the special nature of the Mediterranean into account** as far **upstream** as possible, on the basis of **prior consultations**, for instance in the MAP framework. The concerns of the Mediterranean countries would benefit from being better known before the adoption of environmental policies by these organizations. The same holds true for regional organizations, such as the European Community or the League of Arab States in which some countries of the region participate. Three major areas of economic activity: food and agriculture (resources and consumption), energy and tourism seem in this respect suited to a more advanced form of collaboration.

<u>**Food and food resources**</u> should be given special consideration. In forty years **self-sufficiency levels** in the Mediterranean regions have **fallen from 60 % to 40 % or even 30 %.** In order to **halt or reverse this trend,** a stronger kind of solidarity, which would avoid a rupture with its many repercussions, including on the environment, should be the subject of intra-Mediterranean collaboration and co-operation with other regions (of Europe in particular).

The drop in self-sufficiency in Mediterranean countries, which appears unavoidable in the short- and medium-term raises the **issue of food security** for these countries. Suitable **financial or commercial co-operation** would facilitate orderly specialization in production and would justify an **intensification** which, **properly managed,** would exert **less pressure** on the environment. More intense co-operation in **agronomic and agroecological research** would be useful (soil fertility, water use, creation of varieties and conservation of species, etc.). A priority research and development programme on **products subject to shortage** (cereals, oil seed, etc.) or to strong demand (fruit and vegetables) would be welcome. The same kind of approach is valid for **stock-farming.** Co-operation on **fisheries and aquaculture,** to the point of establishing regulations to be observed, is essential.

Energy is another sector where effective collaboration could start up rather quickly. The differences between oil consumer and producer countries will tend to dwindle with time, and **all countries** have experienced or will experience the **vigorous development of electricity**. Electrical energy is therefore a special area for the exchange of experience and know-how, particularly on **supply, on clean combustion techniques**, etc. The use of **natural gas**, already significant and a **link** between various Mediterranean countries, could **increase** considerably. Co-operation could focus on **exploitation** (deep drilling), **production** (small deposits) and **utilization techniques** (efficient industrial uses, chemicals such as methanol, combined electricity production, fuel gas, etc.

Knowledge acquired on **solar energy** and other **renewable sources of energy** could, in the end, create a true **technological bridge** between north and south and strengthen South-South co-operation, particularly on equipment for **water** (irrigation pumps), **dispersed dwellings**, production of baked clay materials, the drying of agricultural products, etc.).

Finally, for tourism, rapidly **developing in a somewhat haphazard way**, in which all Mediterranean countries **compete**, collaboration could first focus on **information** about **demand and occupancy rates** in the region (where the margin of error for figures exceeds 30 %). It could also concentrate on the **improved management** of intra-Mediterranean tourism, which currently accounts for 25 % of international tourism (**tariffs** and **air services**, and especially the **staggering of peak periods** through "time-planning"). It could involve the concerted appeal to tourism outside the Mediterranean. Finally, it it were recognized that foreign tourists are willing to contribute to **protection of the Mediterranean**, and that $5 per one-week stay would bring in more than $250 million, the establishment of a **voluntary contribution**, which could only be set up at the Mediterranean level, could have a **considerable impact**, especially if it were supplemented by a parallel contribution from the countries involved. Generally speaking tourists, who benefit greatly from the quality of life and the Mediterranean landscape, must be invited to make a **tangible contribution** to their protection.

D. A PROGRAMME FOR THE YOUNG GENERATIONS

The future of the Mediterranean may be seriously affected or modified by the implementation of **policies for the education, information and awareness-heightening of the young public - tomorrow's generations.** The young public in particular is not always aware of the time needed for a tree to grow, to manage a forest, or make the soil fertile and save it from desertification. It is **not always aware of the fragility of the world it has inherited.** This area could be the subject of fruitful exchange between coastal countries : handbooks for young people, teaching experiences in the field, and television programmes. It would be useful to take stock of public action undertaken and show that its effect may be decisive (for example, to increase waste-water treatment from 20 % to 30 % in ten years).

State policy and its implementation, together with policies of local authorities, are too little known and publicized. It would therefore be useful to **disseminate** information among Mediterranean people about **efforts undertaken** in countries other than their own. Stimulation among countries, cities and associations could mobilize some people or bolster the efforts of those who, in the sphere of the environment, occasionally feel isolated. The launching, in 1988, of the "**International Week for the Mediterranean**" is a step in this direction, but its scope is still too reduced.

Raising the awareness of young people about the fragility of the environment is one aspect : **entry into working life** is another. Joint efforts will therefore have to be made for **training in environmental professions**, and even more in the professions which must take into account basic concepts about the environment. In this respect, the training of town planners, engineers and technicians is one of the most fruitful means of North-South co-operation, one of the easiest to implement, and the one whose results will prove to be the most useful. This ookind of **co-operation for training**, already under way among Mediterranean countries in some areas, could be developed for all areas of environmental protection, resource management, or any other field identified above.

Sombre employment prospects also raise the increasingly difficult problem of the **incorporation of the young people into working life. Communal work schemes** mobilizing youth are being tried out in various places. Environmental protection can and must be given an important part in these initiatives, with the organization of exchanges and internships among countries, facilitating effective participation in tangible action.

It is not easy to grasp the **extent of the changes** which will take place in the Mediterranean basin during the **next forty years.** Perhaps it can be better understood if one considers that **60 % of the people who will be living in the Mediterranean in 2025 are not yet born.** These **325 million** or so Mediterranean people of the future will perhaps not have the same cultural and material references as the present generations, but their **basic needs** will not be very different from ours. It is the present generations whom they will hold accountable for the environment they find. It is for the Mediterranean people of today to take immediate action to **counter adverse trends and to prepare an acceptable future for themselves and their descendents.**

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