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**COASTAL AREA MANAGEMENT PROGRAMME
FOR THE ISLAND OF RHODES**

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INTRODUCTION

After more than fifteen years of experience, and acknowledging that the protection and enhancement of coastal areas and their ecosystems can be achieved only through development/environment integration, i.e. sustainable development process, the Mediterranean Action Plan of the United Nations Environment Programme decided to reorient the activities towards an environmentally sound integrated planning and management of the resources of the Mediterranean Coastal area.

Conceptionally, the MAP Coastal Areas Management Programme exercise (CAMP) was based on decisions of the sixth and seventh Ordinary Meetings of the Contracting Parties of the Barcelona Convention (1989 and 1991).

During the 1989 meeting, four Contracting Parties expressed their wish to undertake Coastal Areas Management programme in selected areas within their countries (Kastela Bay, Izmir Bay, Syrian Coast and the Island of Rhodes).

The Greek Government expressed its commitment to the philosophy of reorientation of MAP towards integrated planning and management of the Coastal areas and nominated the Island of Rhodes, as one of the first Coastal Areas Management Programme exercise (CAMP). An agreement relative to the Coastal Area Management Programme for the Island of Rhodes was signed in November 1990 between the Greek Government and the United Nations Environment Programme (UNEP). The objectives of the programme were to:

- protect and rationally utilize the coastal resources over a relatively long period of time. The task of such a programme was to determine and recommend the management measure with a view to resolving the existing environmental conflicts and setting up the optimum paths of the future dynamic development;
- propose a development concept of the coastal area, harmonized with the receiving capacity of the environment and to create conditions for the establishment of the system of integrated planning and management of resources in the area; and
- The immediate objective of the programme is to give, within the individual actions, solutions to environmental problems of the most urgent nature which could be implemented immediately.

The purpose of the present conference was to present to the Greek authorities the activities embodied in the project which have been completed or in an advanced stage of implementation with a view to stimulating thoughts and ideas in regard to the follow-up process.

The following five activities will be presented during the Conference:

- Development/Environment scenario;
- Integrated Planning Study, Environmental Impact Assessment (EIA) and Carrying Capacity Assessment for Tourism;
- Study on Implications of Expected Climatic Changes;
- Water Resources Master Plan;
- Geographical Information System (GIS).

This document contains, in a summary form, the presentation of the five activities.

a) DEVELOPMENT/ENVIRONMENT SCENARIOS

Short presentation of activities

The Study for the Development/Environment Scenarios for Rhodes is one of the fourteen activities envisaged under the Coastal Area Management Programme for the Island of Rhodes on the basis of the relative agreement between the Government of Greece and the United Nations Environment Programme/Mediterranean Action Plan (signed in October 1990).

The main objective of the Development/Environment is to explore the future potential impacts of human activities on the natural resources and the environment of Rhodes. Specifically the study was intended to:

- explore alternative strategies of regional development, urban growth and urban development in Rhodes;
- anticipate the probable impacts of urban development on the environment and the natural resources of the area;
- identify early probable conflicts of resource use and explore possible courses of action.

The systemic approach is employed in the Study of Development/Environment Scenarios for Rhodes, which assumes that the various environmental and human activity components and factors can be conceptually organized in distinct sets (sub-systems) which are interdependent forming a complex human activity-environment system.

The analysis of structure and dynamics of development in Rhodes suggested:

- faster population growth than the rest of the region and Greece as a result of the development of tourism in the last few decades;
- strong seasonal fluctuation in resident population due to tourism;
- a relatively lower level of educational attainment and skills of the labour force on the Island than the rest of Greece;
- both in terms of employment and income generation the primary sector is very weak, less than half than in Greece as a whole;
- tourism (hotels-restaurants-trade) accounts (in 1986) for one third of Gross Regional Income and almost one third of total employment in the Prefecture of the Dodecanese;
- in terms of tourism, the prefecture of Dodecanese accounts for almost 10% of tourist arrivals in Greece and for over 22% of overnight stays, which suggests the importance of Rhodes for the regional and national economy;

- tourism in Rhodes is by far dependent on foreigners (97.2% in 1987) and in terms of occupancy it is very high;
- by contrast to other destinations in Greece, tourism in Rhodes is growing. Overall there is a strong dependence of the Island on tourism, especially mass tourism;
- tourism has linkages to most of the other economic activities of the Island, notably extraction of materials, construction, artisanat, trade, transport and other services. All these activities depend on tourism;
- hotels account for 90% of total accommodation, half of which is in A or AA class establishments. A growing share of furnished apartments accommodation is also evident;
- both in terms of size and growth, population, employment, tourist accommodation facilities and urban development are concentrated in the northern part of the Island;
- recent trends suggest a concentration of tourist development and associated urban development along the eastern coastline.

In terms of the state of the environment :

- almost three quarters of the land is occupied by natural ecosystems (forests, shrublands) and only 5% is urbanized;
- the Island is characterized by typical Mediterranean ecosystems. Two species are particularly important : butterflies and cypress trees;
- forest fires have consumed a large part of local resources in the last few years;
- the abandonment of traditional rural management practices has also accounted for significant losses in resources and the emergence of higher natural risks;
- in terms of water resources Rhodes does not face any serious constraints. Most problems are highly localized and can be faced with better management practices;
- although the primary sector produces a small share of the local income it consumes almost half of the water resources;
- pollution risks are reduced due to the strong currents and open sea character of coastal waters;
- sea water quality (eutrophication and microbial load) is very good by both Greek and EEC standards and so far is not threatened by human activities.

The analysis of the political-administrative context suggests that certain local actors (i.e. hotel owners and tourist agents, local administrators and the prefecture) have a key role in the development of the Island.

In terms of development/environment interaction as tourism is intricately related to environmental quality, it is obvious that this relationship is an important factor for the Island's future.

A parallel and complementary approach was also undertaken. On the basis of the analysis of the Island's system dynamics, certain key factors were isolated which "control" the system outcome, in the sense that the system performance is sensitive to the outcome of these factors. In this respect such an analysis is complementary to the previous analysis as it focusses on the actual "bottlenecks" or "strategic problems" of development in Rhodes.

The two complementary approaches described above, the former primarily quantitative and the latter qualitative have systematically surveyed the prospects of development in Rhodes as it relates to environmental issues.

Tourism has two basic characteristics: it is a socio-economic phenomenon with wide spatial incidence and temporal variation and as an economic activity it is becoming more integrated and global in terms of organization and control. Therefore, much of the Island's prospects depend on broader patterns of change in regard to tourism.

Rhodes tourist industry will require a deep reconversion in order to adapt to the new tourist products demand and to a new social and economic environment in which people in holidays belong to older generations than in the past and are spreading their longer holidays over the years in shorter periods and over long week ends.

To face this new reality society and administrations will have to innovate and adapt to a much higher quality holiday service and to a more comprehensive mix of more classy cultural, sport and social entertainments.

Innovation in the tourist industry also requires innovation in accommodation, transport and above all in training, education and management.

In view of the uncertainties involved about the future and the complexities of relationships in the human activity/environment systems a scenario approach was followed. The elaboration of alternative scenarios for the Island was based on the findings about the structure and dynamics of the island system. Each scenario is a coherent system of hypotheses about future developments which can influence the development of Rhodes.

The elaboration of scenarios followed three converging axes of reflection:

- a. Top-down hypotheses. These were based on the original Blue Plan Scenarios for the Mediterranean Region, adjusted accordingly for the Eastern Mediterranean Basin conditions and following the tentative revisions of tourism growth projections, currently under consideration.

Additional adjustments were made to reflect the particular conditions in Greece in the context of the European Community. These outlined the Island's prospects in view of changes in the broader regional context.

On the basis of the analysis of the broader socio-economic and geopolitical contexts tourism in Rhodes is expected to hold an important role and grow even further, given the strong comparative advantages of the Island and its role in the regional and national economy.

- b. Bottom-up hypotheses. These were developed on the basis of certain key local factors as population growth, the structure of the economy, the availability of land and other resources. These reflect on the local constraints and potential for development.

No significant constraints on the basis of natural resources for future development are present assuming rational management of such resources.

- c. Normative hypotheses leading to policy scenarios. While the previous two types of hypotheses suggest what can be expected in terms of the broader regional and local contexts as problems or opportunities for development they offer a wide range of choices for action in response to such prospects.

On the basis of the three basic goals: economic efficiency, social equity and environmental conservation five illustrative configurations of goals and hypotheses- or scenarios- have been identified:

a. Efficiency scenario

The development of tourism is based on the construction of large units, based on the availability of investments, mainly from the external, to the Island, system. This situation results in increased dependence on the international tourism industry.

In terms of population growth a high number of tourists is expected, increase of the local population, due to labour immigration.

The structure of the economy is towards "monoculture", with all other sectors serving the exploitation of natural resources.

Agriculture will continue to decline, construction will grow in connection with tourism development, mining/quarrying likely to be regulated only in case of direct conflict with tourism industry, or by the laws of the market. Some expansion of handicrafts should be expected.

Short-term considerations dominate. The system obeys to its own dynamics, ruled by the laws of supply-demand.

The tour-operators determine choices and the image of the Island. The community adapts.

Centralization of administration will continue, regulation ensuring steady flow of investments, private initiatives dominate over public ones.

b. Equity scenario

The equity scenario puts emphasis on the maximization of opportunities offered for self-realization, basically through involvement in the tourism sector.

The construction of small units is likely to be the dominant pattern of development, usually lacking the quality of services provided in case of the efficiency scenario.

The number of tourists increases with a domination of low quality tourism.

Population is expected to increase at low rates with some immigration.

The maximization of local benefits from growth is the main concern and especially its distribution among members of the local community.

The continuation of other economic activities is likely only when there will be public pressures for their support.

The profile of agriculture will be defined by the policy followed and by the value system of the local people. The construction and the mining/quarrying branches will follow the demand in the tourism sector, encouraged by the demand for equity.

The upgrading of the services provided to the local community is of high importance, depending on the national fiscal constraints and of the requirements of the community itself.

"Laissez-faire" policy, trust in the maintenance of the attraction of Rhodes without proceeding in the adoption of any measures. Short-term considerations, dominant value: short-term profit. Hostility towards, quality, application of sophisticated management.

Centralization, regulation towards the protection of the local initiatives, reinforcement of the public sector;

c. Conservation scenario

The aim in this scenario is the preservation of the physical and built environment, through discouragement of further expansion of the tourist sector.

As a result the construction of new accommodation in the saturated zone is totally prohibited, while the upgrading of the existing tourist services can only be expected in case of stronger tendencies for investments.

Population is likely to grow at small rates, no significant immigration.

The conservation concept puts great emphasis on the development of the agriculture sector, always under the constraint of the protection of the natural ecosystem (i.e. environmentally friendly - but often labour intensive and costly- practices and products).

Special emphasis on avoiding all the problems which arise from abandonment, such as soil erosion, deterioration because of the invasion of other activities.

Appreciation of the costs of tourism in a more holistic manner.
Encouragement of selective type of tourism.

Strong regulation system, evaluation of environmental impacts of future projects, policies;

d. Efficiency-conservation scenario

This scenario reflects the strong dependence of tourism on the quality of the environment.

In this context it is conceivable that long-term considerations concerning the conservation and enhancement of the environment could prevail as necessary conditions for the development of tourism. Consideration is also expected on future innovations and structural changes in tourism industry (i.e. greater concern for environmental issues, demand for socio-cultural products, new perceptions towards leisure, demand for more activities).

In the tourist sector, the current situation, concerning the number of beds is likely to remain the same. Strong regulation for new construction, out of the saturated zone, and with high quality level could be envisaged. Emphasis on the construction of the necessary infrastructure, upgrading of the existing facilities and the development of new tourist products, friendly to the environment, with high added value.

The number of tourists could grow at small rates.

Better inter-sectoral linkages will be explored, but few opportunities for self-employment will be encouraged.

The contribution of the agriculture sector is likely to increase, characterised by intensiveness, utilisation of modern technology, production of specialised products, strong linkages with the tourist activity, care for the environment (appropriate cultivations).

In the industrial branch (handicrafts), emphasis towards quality is expected as well as the production of high value products through specialization, differentiation.

Rejection of a "laissez-faire" policy and of the short term considerations, encouragement of management, marketing.

Decentralization-centralization, regulation system/ emphasis on creating incentives in order to achieve the protection of the natural environment.

e. Sustainable development scenario

A balanced scenario in terms of emphasis of goals: efficiency-equity and conservation.

The human activity/environment system has undergone structural modifications, to increase it's complexity, its degree of diversification.

The local is highly differentiated with increased inter-branch linkages, through specialization.

A new view of social behaviour is required, its main characteristics being: equality, security, solidarity, participation, environmental awareness.

Long-term considerations in individual actions prevail over short term gains.

A sophisticated and rigorous regulatory system is necessary maximizing the opportunities for private initiatives.

Environmental impacts are highly localized and cannot be disassociated from the particularities of sites. Therefore, in order to compare scenarios in terms of their urbanization effects and environmental impacts it was necessary to focus on their spatial dimensions. Each one of the five scenarios can be associated to various spatial hypotheses. The combination of each one of the policy scenarios with a spatial hypothesis or strategy could lead to the formulation of an increased number of policy-spatial scenarios.

Four basic hypotheses concerning the potential spatial distributions were identified:

1. Uni-polar Concentrated strategy: the city of Rhodes remains the main pole of tourism development.

2. Bi-polar Concentrated strategy: development of a two-pole tourism system : city of Rhodes -Lindos.
3. Coastal development strategy: linear development along the coastline.
4. Multi-nodal strategy: a more balanced development with more than two, tourist poles.

From all possible combinations of policy scenarios with spatial strategies and on the basis of internal coherence and compatibility for each combination five sets have emerged as most illustrative for further analysis:

- Efficiency-concentrated strategy;
- Efficiency-coastal strategy;
- Conservation-concentrated strategy;
- Equity-coastal strategy;
- Efficiency-conservation-Multi-nodal strategy;
- Sustainable development-Multi-nodal strategy;

The analysis of environmental implications of these combined strategy schemes suggests that:

- the Efficiency-Concentrated strategy might lead to serious saturation problems and highly localized environmental degradation and requires land-use and environmental control regulations;
- the Efficiency-coastal strategy might lead to extensive environmental degradation problems and requires significant investments in infrastructure;
- the Conservation-Concentrated strategy has the least impacts on environmental resources but has serious implications as to the prospects of further growth in the local economy and requires the strictest control mechanisms on urban development;
- the Equity-Coastal strategy is by far the worst in terms of impacts on the environment and the least beneficial to the long-term viability of tourism;
- the Efficiency-Conservation-Multi-nodal strategy and the Sustainable Development-Multi-nodal strategy seem to lie in-between the other strategies in terms of environmental impacts. However, they differ substantially as to the requirements they impose on local society to face its future.

Each combination bears particular implications concerning the mobilization of capital and human resources, the use and management of environmental resources and the organizational and administrative capabilities of local society. The analysis of scenarios has assisted in the exploration of policy space as to the most appropriate strategy to be pursued, through the analysis of possible courses of events in terms of human activities, their impacts on environmental resources and the identification of preconditions for change.

It is obvious that the adoption of a strategy for the development of the Island is an outcome of a democratic planning process with the active participation of all actors involved at all levels. However, two important issues emerge as common to all options:

- a change in attitudes is necessary towards a long-term perspective on development/environment relations to sustain growth and prosperity in Rhodes;
- although tourism has a strong potential for further growth in Rhodes whether it will lead to a maximization of local benefits depends solely on the ability of local society to mobilize its own resources.

Notes:

1. The undertaking of the Study of Blue Plan Development/Environment Scenarios for Rhodes has been assigned to a joint team of experts from the Blue Plan/RAC at Sophia-Antipolis and from the Department of Environmental Studies of the University of the Aegean (Greece). The Study Team includes urban and regional planners, economists and specialists in terrestrial and marine ecosystem management, transport, energy, human ecology etc.

2. The spatial level of reference is mainly the Island of Rhodes and its immediate sphere of influence. Where necessary and for the purpose of clarifying the relevant issues special reference is made to sub-regional zones of activities or environmental problems. The study relies on existing quantitative data which are complemented with qualitative information from various available studies, reports and documents. Central and local resource persons have been also consulted.

b) INTEGRATED PLANNING STUDY, ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND CARRYING CAPACITY ASSESSMENT FOR TOURISM

Introduction

The Integrated Planning Study for the Island of Rhodes, being prepared within the CAMP project "The Island of Rhodes", has the nature of an "umbrella" document which, apart from research and planning proposals, will integrate the results of other activities performed within this project available in the moment of completing the final document of the Study.

The Study is the first and major step towards the launching of the process of integrated planning and management of coastal resources of the Island of Rhodes. The hitherto planning activities in the Island were mostly aimed at defining global aspects of development, often with sectorial orientation and a short planning period. So far, there were no significant environmental problems, but there are indications that they can be expected in future. In the planning documents prepared hitherto, environmental aspects of development did not have a prominent place. One of the principal objectives of the Study is the integration of those aspects into the earliest phases of the planning process, as well as to secure that all planning actions are verified through the assessment of their possible impacts on the environment and use of natural resources. That would make a good basis for the implementation of the concept of sustainable development of the Island.

The Study is a practical planning and management tool for: (a) quick identification of development and environmental issues; (b) definition of an outlook of the most feasible future development of the Island on the basis of the assessment of the capacity of the natural resources to sustain human interventions; (c) proposing spatial strategies of the development of the Island along with appropriate management actions; and (d) proposing measures for taking immediate actions. It has to be pointed out that most of the proposals will be made at the level of community associations or communities themselves. Although such a degree of disaggregation gives the study a practical value, it cannot be considered a plan, because for something like that MAP is neither in charge nor were adequate resources available. However, together with some other activities of this project, it offers an excellent basis for the implementation of such concrete action in the future.

Activities performed

For the preparation of the Study, a working group has been formed of the experts of the Ministry of the Environment, Physical Planning and Public Works, the Prefecture of the Dodecanese, and the Municipality of Rhodes, as well as a number of international experts engaged by PAP/RAC. The work started in June 1991, and since then, three missions of PAP experts visited Rhodes (each lasting 3 weeks) when basic elements of the Study preparation were defined. In the interim periods, the experts were preparing sectorial reports which are now used for the preparation of the final report of the Study. The first draft of the Study is expected to be ready by end January 1993 when it will be submitted to the relevant national and local authorities for revision.

The final report of the Study will consist of 5 parts, namely:

- (i) Introduction, in which the objectives, structure and methodological approach to the preparation of the Study will be presented;
- (ii) Development and environment: present situation and trends, in which the present development and environmental processes will be analyzed, and possible consequences pointed out should those processes continue at the same rate;
- (iii) Development and environment: options for the future, in which the basic spatial strategy of the development of the Island will be developed;
- (iv) Management action programme, which will present the list of actions to be performed in view of the implementation of the selected option of the spatial strategy of the Island;
- (v) Recommendations for immediate actions, presenting proposals of activities requiring urgent action, but which will not be opposed to the measures aimed at the implementation of the selected concept of sustainable development.

Major issues in hitherto development and state of the environment of the Island of Rhodes

Within the first phase of the study preparation, the work of the working team was oriented to the identification of the basic issues in the changing context of the development and environment of the Island. At that, only the available data were used, which were brought into the GIS database, which was then used for analytical procedures. Although some phenomena were analyzed sectorially in the first place (population, economy, spatial structure, natural systems, environmental management, etc.), a high degree of integration between them was achieved so that their mutual impacts and effects had been identified wherever possible. Also, for some issues, apart from the analysis of hitherto processes, trends were presented of a future development based on the present growth rates. The objective of this procedure was not to produce projections parallel to those produced within the preparation of development-environment scenarios (Blue Plan), but to point out, simply and at an early stage of the Study preparation, some problems that can be expected in future.

In a nutshell, the major issues that should be taken into consideration when planning the future development of the Island, can be grouped as follows:

- Over-dependence of the Island economy on tourism. Employment structure, urbanization processes, and investment policy are indicators of a long-term orientation of the Island to the development of tourism. Apart from the obvious benefits of such a development, some problems start appearing, such as: a general lack of local labour force and migration processes; concentration of the population in the northern triangle of the Island, and a relative

decrease of population in many settlements of the Island (especially in its southern part); dependence on investment decisions made outside the Island; rigidity of the Island economy with regard to the changed conditions at the market; declining hotel occupancy rates and declining income markets;

- Emerging processes of environmental degradation. Although the general environmental situation cannot be defined as unfavourable, there are traces of disturbance. It can be noted through increased sea and water pollution; overbuilding in the northern part of the coast and generally uncontrolled construction of tourist establishments, often without a building permit; and problems in historic settlements;
- Inappropriate use of natural resources. The unbalanced socio-economic development had strong effects on the practice of resource use, especially on the use of land and water resources. In some parts of the Island, land-use conflicts have already appeared as a result of the search for space for economic and other human activities (location of solid waste disposal sites, coastal land encroachment, threatening valuable ecosystems, etc.). The water resources have become an ever more limiting factor for the development. First, they are unevenly distributed over the island, and second, the increased demand due to the growth of tourist activities causes an accelerated rate of its use, as well as a number of associated environmental problems;
- Fragmented institutional structure of environmental management. Although the management role of the central Government is highly pronounced, a lack is noted of co-ordination between the various departments in charge of environmental management. Practically, the implementation of physical planning system on the Island is very weak, either because a well developed planning system is missing, or because there are no clearly defined procedures or instructions for regulation agencies which deal with environmental matters. The system of inspection and environmental law enforcement is loose.

Options for the future

In the second phase of the Study preparation, the working team generated a number of possible options of the future development of the Island. Two target years have been established: 2000 (for proposed management actions) and 2010 (for long-term planning actions). With regard to the action character of the Study projections further in the future than the target years would be sheer speculations. On the other hand, within this project, environment-development scenarios are being prepared with the main objective of researching into the possible development directions on a longer term.

In defining development options certain indicators were used (population, labour force, employment structure, tourism, environmental objectives, impacts on the use of resources, etc.) which were mutually interrelated. Furthermore, two major sets of objectives were established in order to assess alternative options: environmental quality objectives and income growth objectives. Therefore, three options were identified:

1. Continuation of the current development pattern (Economic Growth Option). This option adopts as its starting point the existing trend in the growth of beds until the year 2010. Projection of the number of tourist beds serves the purpose of tracing the impacts and repercussions associations with future development. The number of tourist beds is the key component because it determines the level of activity in the rest of the economy. The main conclusions to be drawn from this option are the combination of the pressure on the Island resources, the impossibility of the local labour supply to provide the labour force required by the number of beds, and marginal rise of the tourist receipts;
2. Alternative development option (Environmental Conservation). This option is based upon the sharp reversal of existing development trends, practical moratorium on new tourist accommodation, sharp reduction of incentives to tourism, and strict planning control and land-use standards. The expected consequences are increased protection of the environment but with slow down of economic growth, reduction of employment opportunities and some negative political reactions. New policies would need to be established for some other sectors of economy, like agriculture, which should replace tourism as the main full economic factor;
3. Alternative development option (Sustainable Development). To achieve this option it is necessary to combine a slower growth of tourist beds within a controlled growth strategy, designate "target development areas" and "conservation areas", enforce land-use/density standards, implement coastal zone management, achieve sustainable employment growth, diversify incentives to tourism, , diversify "tourist product" and achieve growth of tourist receipts. The implementation of this option will depend on an active environmental management programme and new tourism policy. But, above all, it requires a spatial strategy where allocation policy is such as to direct planned construction development to selected locations according to capacity criteria and environmental standards.

It is obvious that, assessing by environmental quality and income growth objectives, the option based on the sustainable development of the Island of Rhodes should be the preferred one. The Study then provides the respective spatial strategy of development. With respect to the policies to be adopted and implemented, the Island is divided in three distinctive areas. This differentiation is based on the existing development pattern, namely:

- saturated zone (the coastal zone from Kalavarda to Lindos);
- non-saturated zone (the coastal zone from Lindos to Prassonissi);
and
- hinterland zone (south-western part of the Island).

The study will elaborate on the set of general policy guidelines for each zone with respect to the principles of the protection of the environment and rational use of resources. Therefore, three types of policy guidelines are proposed: rehabilitation (in the saturated zone), controlled development (in the non-saturated zone), and conservation (in the hinterland zone). It has to be pointed out that those policies do not exclude each other, but rather complement each other in some zones, and are oriented to the achievement of a sustainable development of the Island as a whole.

Management actions

Bearing in mind the spatial differentiation of the Island, a number of sectorial actions will be proposed. Those proposals will cover a large number of development and environmental activities, divided in the following groups:

1. Land-use planning
 - settlement system
 - land-use
 - transportation
2. Environmental management
 - environmental administration
 - environmental education
 - economic instruments of environmental management
 - natural parks and natural reserves conservation and development programmes
 - general waste management programme
 - water management programme
 - noise prevention and air quality control
 - energy programme
 - fire hazard management
 - natural hazards and risk management
 - planning for climatic changes
 - environmental monitoring and research
3. Recommendations for immediate action
 - priorities for implementation
 - institutional implications
 - financial implications

Tools of integrated coastal zone management

Within its scope of activity, PAP has developed a number of tools and techniques of integrated coastal zone management, some of which have been implemented in the CAMP project "The Island of Rhodes". When selecting appropriate tools to be used, the main criteria were the needs of the local authorities, and the technical possibilities of using them in Rhodes. These tools and techniques have been used for the needs of the Study preparation, and will be used in the implementation of the proposals of the Study. The following tools have been applied:

- Geographical Information System (GIDS);
- Environmental Impact Assessment (EIA);
- Carrying Capacity Assessment for Tourism (CCA)

Since the programme of application of GIS is envisaged to be presented separately in this conference, only brief descriptions of EIAs and CCA will be given here.

- (1) Environmental Impact Assessment for the Waste Water Treatment Plant of the City of Rhodes.

EIA is one of tools used in the planning process which enables the decision-makers to take into account the possible environmental effects of the project in consideration. EIA is not just a document; it is also a procedure which enables all sectorial information on a project, environment and possible effects to be taken into account. EIA also contains proposal of measures to be taken in order to minimize and/or avoid negative environmental effects.

The prepared EIA for the waste water treatment plant of the city of Rhodes will be used in the process of making a decision on the construction of that plant. In the first place, the results of the assessment will be used for the design of the plant. Within the activity on EIA, the organization is envisaged of a training course for local experts. Also, computerized management is envisaged for the plant, based on the monitoring of selected parameters in the plant and its surroundings.

- (2) Carrying Capacity Assessment for Tourism in the Falliraki-Lindos Area

Carrying Capacity Assessment for tourism activities is particularly important at the present stage of tourism development in the Island of Rhodes. Namely, certain signs of crisis have been noted in the development based on the actual "tourist product" of the Island. Thus, the moment has arrived to reconsider that "product" and define new directions of tourism development. The concept of "carrying capacity" plays the dominant role in the implementation of that task. The carrying capacity of a tourist site can be defined as the maximum number of people who are able to visit the site simultaneously without creating disturbance in the physical, economic and socio-cultural environment, and without unacceptable decrease in the quality of the visitor's experience.

PAP has developed a methodology for the preparation of CCAs which was applied in the Island of Rhodes. Since the available resources were not sufficient to cover the entire Island, the Falliraki-Lindos area was chosen, as it is an area with considerable tourist capacities, yet with a possibility of further development. Harmonization of the present and future development of tourism in that area is important for the overall development of tourism in the Island, but it has to be done on a sustainable basis which can be set up only through an integrated procedure, such as this study.

c) **STUDY ON IMPLICATIONS OF EXPECTED CLIMATIC CHANGES**

The United Nations Environment Programme (UNEP) in its effort to analyse the potential implications of predicted climate change and to assist the governments in designing policies and measures which may avoid or mitigate the expected negative effects of this change, or to adapt to them, established in 1987 task teams on the implications of climate change for six regions (Mediterranean, Wider Caribbean, South Pacific, East Asian Seas, South Asian Seas, and South East Pacific regions).

During the work on the Mediterranean regional study, it was felt that while the general effects might be similar throughout the Mediterranean region, the response to these effects would have to be highly site-specific. Therefore in the framework of the Mediterranean Task Team six specific case studies were prepared (deltas of the rivers Ebro, Rhone, Po and Nile; Thermaikos Gulf and Ichkeul/Bizerte lakes) in 1989. Using the experience of these initial case studies, in 1990 the preparation of the "second generation" of site-specific case studies was initiated for the Island of Rhodes, Kastela Bay, the Syrian coast, the Maltese Islands and the Cres-Losinj Islands.

Executive Summary

The project on Rhodes is part of the greater integrated Planning Project of Rhodes Island, a pilot case for the Coastal Area Management Programme (CAMP). It is a result of a cooperative work of earth scientists of different disciplines that formed a Task Team that discussed the implications of future climatic changes on Rhodes Island. The project was carried out through the Mediterranean Action Plan of UNEP and the Greek Ministry of Environment. The objectives of the study were to identify and assess the eventual implications of the expected climatic changes on the various physical aspects of Rhodes; to determine the most vulnerable areas and ecosystems; and to suggest policies and measures necessary in order to avoid the negative effects of the climatic changes.

Basic Facts concerning Rhodes Island

Rhodes Island is situated at the SE corner of the Aegean Sea and is the capital of the Dodecanese Prefecture. It has an elongated shape with maximum length of 77 km, areal extent of 1400 km² and 191 km of coastline. It is a major tourist centre (about 850,000 tourist visitors in 1990) with a current population of 110,000 inhabitants.

The climate of Rhodes is typical Mediterranean with one cold and rainy period (November to March) and one warm and dry (April to October). The Island is however less warm in summer and less cold in winter than the other Aegean islands. Rainfall averages 714 mm/year, higher than in other islands, while the prevailing winds are mainly from the NE and, to a lesser extent, from the SW.

The Island is formed from a variety of rock types (limestones, conglomerates, sands, gravels) and is characterised by smooth relief bisected by a number of valleys running NW-SE. Two thirds of the coastal zone is quite wide

(500 to 2500 m) especially where soft rock outcrops (alluvial gravels and sands). Many beaches in the NW part of the Island experience high erosion rates while many landfalls and landslides occur in the nearshore zone. Tectonism is quite intense and along the northern shore uplift of 1 mm per year has been noted. The Island is affected by two different oceanographic regimes, one pelagic to the NW (Aegean) and one oceanic to the SE (Levantine). Strong currents pass through the Rhodes-Asia Minor Strait and long shore currents affect both the eastern and western coasts, which are also subject to severe wave attack in the rather rare event of strong Etesian and other winds.

The water requirements of Rhodes are about 30 Mm³/year, an amount which is constantly increasing due to the tourist demands. The total precipitation input on the Island amounts to more than 160Mm³/year. The main water sources are wells, springs and a dam, while the main aquifers lie in the alluvial deposits and the limestone karsts. Overpumping of the alluvial aquifer has resulted in its salinisation in many parts of the Island, making adequate water supply more difficult. The terrestrial ecosystems on the Island are forests and shrublands, that have been badly damaged by fires in recent years. A unique butterfly community resides at the so called "Petaludes Valley", where special temperature and humidity conditions seem to occur. Coastal and marine ecosystems are of oligotrophic character.

The economy of Rhodes is principally based on tourism, the services of which depends on a large number of hotels that have been built the Island's beaches. The other sectors of the economy are marginal compared to the tourist enterprise.

Operating Scenario and Major Impacts

The detailed climatic scenario due to the greenhouse effect for the eastern Mediterranean and for Rhodes in particular was constructed by the Climatic Research Unit of the East Anglia University. For the year 2030 the annual temperature increase is expected from 0.9°C to 1.4°C and by 2100 from 1.5°C to 3.3°C. Also an increase in the annual precipitation is expected. For the sea level change, a rise of about 20 to 30 cm is expected by 2050 and of about 60 cm to 1m by 2100.

The major impacts of the climatic changes on Rhodes insular environment are anticipated on the coastal zones, on the soil, on the aquifers, whereas the predominant socio-economical impacts will be on the infrastructure and the tourism.

The coastal zone of the Island is already affected by the wave and current action, especially at the northwestern part of it, and this erosion will be further intensified by the sea level rise (SLR). The impacts will not be noticeable in the initial 40 cm rise but will be much more intense in an 1m. rise. Also, due to further aridity of the soil and the torrential character of the rainfall, the present soil erosion will be further aggravated.

Regarding the water balance, the temperature rise will inevitably increase evapotranspiration and decrease total runoff and infiltration. The present water reservoir will be faster filled while the ground water will be diminishing due to less aquifer feeding, lowering aquifers level and ceasing springs. Also due to SLR, the sea water will further intrude the alluvial plains and the brackish front will further advance.

The anticipated temperature increase will lengthen the touristic period and this could be considered as a positive result. Also the local climatic scenario provides that Rhodes will continue to constitute a fresh spot in a warmer Eastern Mediterranean. At the same time the fire occurrence will increase, while the maquis ecosystem will be transferred to phyganic one.

On the infrastructure, most impacts are expected on the coastal zone structures. Fortunately most resort establishments are located at the backshore and future consequences of the SLR will be rather minor. However at the densely populated NW coast and northern tip of Rhodes, the impacts on the existing infrastructure, which is built near the shoreline, is expected to be very significant.

Suggested Actions and Recommendations

In order to meet the impacts a series of actions and recommendations are suggested in this report, that can be summarized as follows.

1. There is a need of a development of a coastal management zone that would provide specific land use zones and, where possible, set back space for the retreating coastal zone. The building standards have to be readjusted in terms of legislation, efficiency and implementation that f.ex. would provide no public compensation for erosion losses.

2. The water resources should be explored and exploited according to the present and future requirements. There is a need for additional water resources that could be derived from construction of new dams and drilling of more boreholes into karstic aquifers.

3. The burned and eroded sectors of Rhodes must be reforested and managed under scientific quittance and assistance.

4. There is a need to study the consequences of the lengthening of the touristic period on the further services that will be required and on the island's economy, character and population.

d) WATER RESOURCES MASTER PLAN

Introduction

"General Water Resources Master Plan" (WRMP) is one of the activities implemented by PAP within the MAP Coastal Area Management Programme (CAMP) "The Island of Rhodes". Among other activities carried out within that MAP CAMP project, PAP organized two expert missions relative to water resources problems. The objective of those missions was to get an insight into the characteristics of the water resources of the Island and into the problems of their management and exploitation.

The present state of the water resources is a limiting factor of a successful development. The capacity of water resources of the Island of Rhodes is estimated at 909m³/capita/year. Taking into account the number of tourists, this capacity drops to 757 m³/capita/year. In any case, those values fall below 1000 m³/capita/year, which is a threshold considered critical by various experts, and indicative of a chronic shortage of water. From the given data it results that ca. 35.2M m³/year of water can be mobilized from the presently exploitable sources, which gives an index of exploitation of 35%. An index of 20-25% exploitation indicates the need for urgent measures for resources development, as this factor begins to weigh upon the national economy. When it approaches 50% it reveals a strong pressure on the resources, which implies an assumption of the existing conflicts over the use of those resources and a necessity for planning and priority allocations.

From the above it can be concluded that the situation of water resources of the Island of Rhodes has become critical and difficult for management. It is especially so for the northern part of the Island which is most densely populated.

Departing from those facts, and upon the analysis of the mission report, it was concluded that the priority activity is the preparation of a water resources master plan for the Island of Rhodes.

Objectives, expected benefit, outputs

The long-term objective of this activity is the protection of the water resources of the Island of Rhodes, increased knowledge on the water resources management, and a rational management and use of the water resources.

This plan should provide an integrated presentation of all characteristics of the water resources, and will be used for defining optimal exploitation of the resources in accordance with the present and future demands.

The output of this project will be the General Water Resources Master Plan for the Island of Rhodes with accompanying studies on contents and elements of the water resources master plan.

In order to meet the proposed objectives, the following project tasks are envisaged:

I. ANALYSIS AND PRESENTATION OF THE PRESENT SITUATION

a. Characteristics of the available water resources

Hydro-climatological factors; regime and quality of surface water; hydrogeology, regime and quality of underground water; development of data bank; natural water balance.

b. Important natural factors

Soil erosion and torrents; ores; specially protected areas.

c. Socio-economic factors and development of water demand

Population settlements and industry-agriculture forestry and other economic branches.

II. SELECTION AND ANALYSIS OF SOLUTIONS TO WATER RESOURCES PROBLEMS

d. Water storage

Surface storage basins - underground reservoirs

e. Protection against water

regulation, protection against erosion and torrents, drainage sewer systems.

f. Water quality management

Water classification present state of pollution, protection measures.

g. Use of water

Water supply for settlements and industry, water supply for agriculture; water supply for tourism; other water uses;

h. Synthesis of water demands

i. Analysis and selection of water supply solutions

j. Pre-requisites of the implementation of the suggested water supply solution

Workplan of the project implementation

The Ministry of the Environment, Physical Planning and Public Works will act as co-ordinator and supervisor of the entire CAMP. This Ministry has appointed IGME, Athens, as the national co-ordinator of the implementation of this project.

PAP/RAC will provide experts to act as project consultants and co-ordinators of the programme. They will co-operate with the local experts in the development of the plans, and offer help in the examination and review of the works and studies.

In addition to the mentioned expert missions, PAP/RAC has so far prepared the document "General Contents and Elements of the Island of Rhodes Master Plan". The Project Document is in preparation, together with a detailed analysis and specification of all works to be done, required personnel, equipment and facilities, as well as the tentative schedule of the project implementation.

The project is planned to include several sub-projects to be implemented by various institutions and experts, according to their possibilities to contribute to the success of the entire project. Consequently, IGME will not implement the whole project. Local institutions and other ministries and organizations will implement one part of the project, whereas IGME will co-ordinate the entire work and be responsible for the implementation of the whole project.

All phases of the project implementation have not yet been clearly defined. Consequently, two main options of the project implementation are still possible:

1. Implementation according to the Contract Document, i.e. a complete and detailed water resources plan; or
2. Development of a study of the general water resources development plan, according to the currently available document and data.

The first option refers to the project which, according to calculations, should cost around US\$ 400,000 and last for several years, whereas the second option would be significantly less expensive, implemented in several months, but therefore less detailed and precise. However, the study proposed by the second option could be satisfactory and useful as the basis for the future development of a WRMP.

The decision on which solution will be implemented will depend exclusively on the available funds. It has to be pointed out that PAP/RAC has funds sufficient only for the implementation of the second option, i.e. the study.

e) **GEOGRAPHICAL INFORMATION SYSTEM (GIS)**

Introduction

The need for the environmental protection and conservation, and the increasing pressure of human activities on coastal areas lead inevitably to conflicts. There are many different and often opposing uses of coastal and marine environment which create serious conflicts. Comprehensive knowledge of the resources and uses of the coastal environment is required before any fair solution of these conflicts between environmental conservation and development is achieved. This information must be then placed in the hands of the planners and decision-makers so that they can address and satisfy the interests of the various users of the space. However, the effective use of large land related data volumes is dependant upon the existence of an efficient system that can transform such data into usable information.

Within the framework of PAP/RAC G geographic Information System (GIS) has been recognized as one of the basic tools that can satisfy the above mentioned requirements for advancing the process of integrated planning and management of coastal zones. The importance of GIS contribution is primarily seen in the possibility of a more precise and faster making of various, especially spatial analyses and simulations which used to be avoided as too labour intensive and time consuming. Accordingly, the training programme on GIS had been introduced throughout Mediterranean countries.

What is a GIS

The use of GISs has grown fast to become today commonplace in many businesses, universities and governments. They are now used for an amazingly wide range of applications. As a result there are many different definitions of what a GIS is and what it can or should do. One of them is the following:

" A system of hardware, software and procedures designed to support the capture, management, manipulation, analysis, modelling and display of spatially referenced data for solving complex planning and management problems."

Objectives of the training programme

According to the workplan, the training programme on GIS has the following main objectives:

- to implement the initial phase of training for the local GIS team to get awareness of and master the pcARC/INFO software;
- to create an appropriate GIS database capable of supplementing the lecture topics concerning important aspects of a GIS technology in general, as well as practical capabilities of the pcARC/INFO;

- to provide a basis for regional level GIS applications in supporting a part of planners' activities within the context of the Integrated Planning Study preparation.

Activities performed

Training of the local GIS team in Rhodes was performed at the PC level with software support of the pcARC/INFO package (software Redlands, USA). PAP/RAC, in co-operation with UNEP-GRID, Nairobi, and UNITAR, Geneva, provided the pcARC/INFO software to be used for educational (non-commercial) purposes, while the Municipality of Rhodes provided appropriate hardware and met other technical requirements.

The training programme on GIS was carried out in two phases. The first phase included the orientative training course for the organizers of GIS application in the Island of Rhodes. That two-week course was held in September 1990 in Split.

The second phase included a training course for the local GIS team in Rhodes with practical application of the pcARC/INFO software. That phase lasted 8 months and was carried out in three missions, each requiring the involvement of PAP consultants.

Outputs

The scope of the GIS database established for the Island of Rhodes was based on the perception of development and environmental problems, as well as on data availability and quality. It should be noted that a framework for the development of this database was defined in a close co-operation of PAP and the local planning and GIS teams.

As a part of the training activity, but targeting on the support to the preparation of the Integrated Planning Study, the basis for land suitability analysis for tourism development was set up. The objectives of the analysis was to assess the land suitability for future tourism development in the Island of Rhodes, as well as to show the size and layout of suitable sites.

Rather than executing this type of analysis manually, it was decided to take advantage of the capabilities of the pcARC/INFO software to perform relatively complex quantitative measurements of site suitability with ease.

Conclusions and recommendations

Upon the completion of the training programme, the following conclusions and recommendations can be formulated:

- the local GIS team is well trained and ready for future independent work;

- the applications developed within the MAP CAMP "The Island of Rhodes" GIS training programme proved to be practical and applicable decision support tool, and were successfully used in the preparation of the Integrated Planning Study;
- the contents and quality of the GIS databases developed as a part of the training programme made a satisfactory basis for various applications developed, as well as a simple resource inventory tool;
- multi-disciplinary backgrounds of the local GIS team members proved to be the best solution, having in mind the long-term objective of building multipurpose GIS for the Island of Rhodes, as well as the short-term goal of setting up desktop planning GIS to support the preparation of the Integrated Planning Study;
- as the next step in the development of the GIS database, it is proposed that the automated data layers be transferred back to the relevant institutions which made all necessary analogous data available to the local GIS team. This proposal also aims at the long-term objective of setting up a multipurpose GIS.