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## Programme on Man and the Biosphere (MAB)

### Regional meeting on integrated ecological research and conservation activities in the northern Mediterranean countries

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Final Report

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Previous reports in this series:

1. *International Co-ordinating Council of the Programme on Man and the Biosphere. First session. Paris, 9-19 November, 1971.*
2. *Expert panel on the rôle of systems analysis and modelling approaches in the Programme on Man and the Biosphere (MAB). Paris, 18-20 April, 1972.*
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16. *International working group on Project 1: Ecological effects of increasing human activities on tropical and subtropical forest ecosystems. Rio de Janeiro, 11-15 February, 1974.*
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18. *Regional meeting on integrated ecological research and training needs in the Sahelian region. Niamey, 9-15 March, 1974.*
19. *Expert panel on Project 2: Ecological effects of different land use and management practices on temperate and Mediterranean forest landscapes. Paris, 16-19 April, 1974.*
20. *Task force on pollution monitoring and research in the framework of the MAB Programme. Moscow, 23-26 April, 1974.*
21. *International working group on Project 5: Ecological effects of human activities on the value and resources of lakes, marshes, rivers, deltas, estuaries and coastal zones. Paris, 13-17 May, 1974.*
22. *Task force on criteria and guidelines for the choice and establishment of biosphere reserves. Paris, 20-24 May, 1974.*
23. *Regional meeting on integrated ecological research and training needs in the Andean region. La Paz, 10-15 June, 1974.*
24. *Expert consultations on Project 9: Ecological assessment of pest management and fertilizer use on terrestrial and aquatic ecosystems (Part on pesticides).*
25. *International working group on Project 3: Impact of human activities and land use practices on grazing lands: savanna and grassland (from temperate to arid areas). Hurley, 2-5 July, 1974.*
26. *Regional meeting on integrated ecological research and training needs in the South East Asian region. Kuala Lumpur, 19-22 August, 1974.*
27. *International Co-ordinating Council of the Programme on Man and the Biosphere. Third session. Washington, D.C., 17-29 September, 1974.*

28. *Regional meeting on integrated ecological research and training needs in Latin America, with emphasis on tropical and subtropical forest ecosystems. Mexico City, 30 September-5 October, 1974.*
29. *Expert panel on Project 4: Impact of human activities on the dynamics of arid and semi-arid zones' ecosystems, with particular attention to the effects of irrigation. Paris, 18-20 March, 1975.*
30. *Regional meeting on the establishment of co-operative programmes of interdisciplinary ecological research, training and rangeland management for arid and semi-arid zones of Northern Africa. Sfax, 3-12 April, 1975.*
31. *Task force on integrated ecological studies on human settlements, within the framework of Project 11. Paris, 2-6 June, 1975.*
32. *Task force on Project 14: Research on environmental pollution and its effects on the biosphere. Ottawa, 5-8 August, 1975.*
33. *Regional meeting on integrated ecological research and training needs in the humid tropics of West and Central Africa. Kinshasa, 29 August-5 September, 1975.*
34. *Regional meeting on integrated ecological research and training needs in the southern Asian mountain systems, particularly the Hindu Kush-Himalayas. Kathmandu, 26 September-2 October, 1975.*
35. *Regional meeting on integrated ecological research and training needs in tropical deciduous and semi-deciduous forest ecosystems of South Asia. Varanasi, 5-11 October, 1975.*

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## S Y N O P S I S

A Man and the Biosphere Programme sub-regional meeting of experts for the European Mediterranean area was held in Potenza, Italy, from 27 to 31 October, 1975, within the framework of MAB Projects 2 and 8. Organized by the MAB National Committee of Italy and the Unesco National Commission of Italy in collaboration with Unesco, the meeting was convened with the two-fold purpose of setting up a sub-regional network of pilot research projects to implement MAB Project 2 and establishing a network of biosphere reserves within the framework of MAB Project 8.

This meeting brought together delegates from seven countries of the sub-region (France, Greece, Italy, Portugal, Spain, Turkey, Yugoslavia) as well as representatives from FAO, Silva Mediterranea and the Centre International des Hautes Etudes Agronomiques Méditerranéennes (CIHEAM). A delegate from the MAB National Committee of Morocco also attended the meeting as an observer (see Annex 1 for list of participants).

The representatives of the MAB National Committees gave priority to the following research themes, without excluding, however, any other subjects of interest: the ecological consequences of forest fires and the ecological basis for protecting forests against fires; the impact of grazing on Mediterranean forest ecosystems; the influence of plantation forests on the environment; the impact of tourism on forest ecosystems; the effects of air pollutants on forest ecosystems and the influence of forest land on the air quality; ecological and socio-economic studies on drainage basins; ecological and socio-economic studies for the utilization and improvement of marginal land.

A certain number of specific field projects were proposed for each of these themes, and a more detailed description of the anticipated research is presented in Section 3 (by subject), in Annex 2 (by country) and in Annex 3 (synoptic table). The needs for international co-operation were also discussed (Section 5), and the necessity for a modern, well-planned methodological approach and more effective exchange of information was emphasized. A broader training programme, namely for field research manpower, without which some of the countries could not undertake the planned studies, was also considered to be of utmost importance.

Another purpose of the meeting was to establish a sub-regional network of biosphere reserves which are vital to the study of Mediterranean ecosystems, since these areas constitute reference points through which the changes and functioning of other ecosystems under human impact can be measured and evaluated. There is thus a complementarity between the proposed areas of research for MAB Project 2 and the biosphere reserves. Details of the latter are given in Section 4 and Annex 5; there is also a synoptic table of the proposed areas in Section 4.

## PREFACE

The main objectives of the sub-regional meeting of experts held under the Man and the Biosphere Programme (Projects 2 and 8) at Potenza (Italy) from 27 to 31 October, 1975, were to establish a regional network of ecological research pilot projects as part of MAB Project 2 and to set up a network of biosphere reserves in the European Mediterranean zone under MAB Project 8.

Hitherto, the Mediterranean aspects of Project 2 had been covered only by meetings at the national level. At its third session held in Washington from 17 to 29 September, 1974, the International Co-ordinating Council for the MAB Programme examined and accepted the substance of MAB Report Series Nos. 19 (MAB Project 2), 12 and 22 (MAB Project 8) and recommended that regional consultations should be held on the Mediterranean forest ecosystems.

Subsequent to this recommendation, the MAB Secretariat gladly accepted the invitation of the Italian Government to hold a sub-regional meeting at Potenza, from 27 to 31 October, 1975, in order to establish a network of integrated pilot projects (MAB Project 2) and biosphere reserves (MAB Project 8) in the European sub-region of the Mediterranean area.

The Potenza meeting was attended by about forty ecological research and nature conservation specialists from the following countries: France, Greece, Italy, Portugal, Spain, Turkey and Yugoslavia (see list of participants Annex 1). Attending as observers were representatives from Morocco, FAO and the Centre international des hautes études agronomiques méditerranéennes (CIHEAM). The Council of Europe and IUCN regretted that they were unable to attend the meeting.

The discussions were particularly conducive to reflection and mutual understanding, leading to scientific agreement at a high level with specific conclusions relating both to national activities and to international co-ordination and co-operation.

After a welcoming address by the President of the Basilicata-Lucania region, the participants elected Professor V. Giacomini as Chairman and Mr. O. Weber, Chairman of the MAB National Committee of Yugoslavia and Mr. P. Grison, Chairman of the MAB National Committee of France as Vice-Chairmen.

Under the work plan, the Vice-Chairmen were responsible for the two Commissions constituted in plenary, one concerned with questions of methodology and training and the other with listing research topics and their inclusion in a small number of pilot projects.

On 25 and 26 October, 1975, prior to the opening of the session, the MAB National Committee of Italy organized two excursions during which visits were made to: the forest region and the beech forests of Monte Pollino (2,248 m) on the edge of Calabria and now a National Park; the volcanic lakes of Monticchio surrounded by vegetation varying according to exposition and altitude; the remains of the Roman amphitheatre and baths at Venosa; the eyrie of Lagopesole which has, over the centuries, been occupied by inhabitants from all points of the compass.

The lessons to be learned from these ecological and archaeological discoveries were mentioned in the welcoming address given once again at the Town Hall by the President of the Region who spoke of what Basilicata had been in the most ancient times, namely a vast mantle of impenetrable forests and immense lacustrine basins.



## 1. THE MEDITERRANEAN ECOSYSTEMS IN THE NORTHERN MEDITERRANEAN BASIN

The typology of Mediterranean forest ecosystems cannot be understood and envisaged, without reference to the changes which have taken place during recent millenia and the incessant activities of man and civilizations in these regions.

To human assaults must be added the effects of a climate distinguished by long dry summers and irregular precipitation, particularly catastrophic for extremely fragile soils which then suffer sudden and often irreversible harm. Most of the agrarian systems around the village communities were developed on the basis of terraces directly associated with these conditions of relief, climate and soil. Terraces are a way of using steep slopes which could not otherwise be cultivated and, at the same time, of combating soil erosion, in climates where runoff is intense. The terrace is a regional phenomenon associated with climates where precipitation is violent, the plant cover precarious, and the population dense.

The present situation of the Mediterranean forests is alarming, and a solution must be found in coming decades if we do not wish to witness the more or less general destruction of this vegetable landscape which is unquestionably a vital factor in the ecological equilibrium of the Mediterranean region.

Despite their abundance, variety and biological individuality, Mediterranean forests have been the subject of only limited research, and knowledge of the structure and functioning of many ecosystems contained in them is still only in its infancy. The foresters themselves have too often applied to these forests the techniques for exploitation and conservation developed for mid-European forests; these practices are frequently ill-adapted to the Mediterranean zone.

Plant formations such as maquis and garrigues, considered "unproductive", are the result of this centuries-old deterioration brought about by fire and grazing. *Quercus* series are found to dominate here, particularly pubescent and/or holm oak formations brought about by centuries of over-exploitation (rotation over too short a period in simple coppices), the reconversion of which should form the basis of a new Mediterranean "silviculture".

In addition to the degraded oak forest in which are to be found arbutus, heather, myrtle and cistus, mention should also be made of the thermophyllous shrubland, with *Olea*, *Ceratonia* and *Pistacia*, which forms a landscape of some importance, for the most part in the warm variants of the semi-arid, sub-humid and even humid

levels on limestone substrata, found all round the Mediterranean basin. It is nevertheless abundant only in the south.

Side by side with the deciduous oak forests are the sclerophyllous forests composed mainly of a few species of evergreen *Quercus*, e.g. *Q. ilex* (including *Q. rotundifolia*), *Q. suber*, *Q. coccifera* (including *Q. calliprinos*). These trees nevertheless present very distinct areas of distribution and bioclimatic requirements.

Around the whole of the Mediterranean basin, particularly in semi-arid and sub-humid areas in the warm, temperate and cool variants and even in warm humid variants, coniferous forests are to be found, frequently very extensive although not much above an altitude of 600-700 metres in the Northern Mediterranean although they may grow up to an altitude of 2 000 metres in North Africa or Turkey. Two systematically close species are found in particular. These are the *Pinus halepensis*, widespread in the Western Mediterranean and the Greek mainland and which is giving way to *P. brutia* in Crete, in a few of the Aegean islands and especially in Anatolia and Syria. Oddly enough, *P. halepensis* reappears sporadically in the region of Adana, at a few points in Syria and Lebanon and again in fairly large forests in Israel and Jordan. Except in the area close to Adana, these two species seem to be completely mutually exclusive.

A few other conifers are found round the Mediterranean in addition to the two aforementioned species. These are primarily *P. pinaster* (in the *mesogeensis* type), *P. pinea* and a few Cupressaceae as well, e.g., *Cupressus sempervirens*, *Tetraclinis articulata* and various *Juniperus*, including *J. phoenicea*.

The vegetation changes as soon as one begins to rise somewhat in altitude or as one leaves the coast in the West, the South or the East. On the southern slopes of the Pyrenees, the Apennines and the Pindhos mountains, one only has to rise a few hundred metres to find the mixed Mediterranean forest in which deciduous trees and bushes of temperate latitudes are mixed with the xerophile evergreen species of the Mediterranean zone. If one goes up a little more, holm oaks are found mixed with conifers capable of resisting both the fairly severe winter temperatures as well as a climate which is dryer than that of the temperate zone.

The black pine is undoubtedly one of the most remarkable examples of paleogenic Mediterranean conifers; the break-up of its area of growth has given rise to innumerable morphological and ecological types, knowledge of which is still imperfect. This tree, or some of its sub-species, is found all round the Mediterranean basin, in the Eastern Alps and the Balkans and is of considerable interest.

The distribution of these trees by altitude varies according to the sub-species and particularly according to their geographical locality. In the Northern Mediterranean, they do well, between 500 and 1,500 metres and in the Southern Mediterranean, between 1,100 and 2,000 metres, with intermediate altitudes particularly in Corsica where the superb "laricio" forests grow between 800 and 1,800 metres.

The *Cedrus* forests are found more to the south and spread over the mountains of North Africa (*Cedrus atlantica*), the Taurus Mountains, Syria and Lebanon (*C. libani*) as well as the tops of the Troodos Mountains in Cyprus (*C. brevifolia*). In every case, however, the cedar forests are found on the Mediterranean mountain level.

Despite their fairly small area, the Mediterranean fir forests are one of the most outstanding formations in Mediterranean forestland, and going from west to east one finds *Abies marocana*, *A. pinsapo*, *A. nebrodensis*, *A. cephalonica*, *A. borisi-regis*, *A. equi-trojani*, *A. bornmulleriana* and *A. cilicica*.

There are no clearly individual features among the trees of the Oro-Mediterranean level except on the highest mountains, particularly the Atlas with *Juniperus thurifera*, the Taurus Mountains and the mountains of Lebanon with *J. excelsa*, and on the remains of the mountain level where *Cedrus*, *Abies* and *Pinus pallasiana* in particular grow in a sparse band of arborescent *Juniperus* spread over an altitude of 300 to 400 metres at heights of between 2,200-2,300 and 2,500-2,600 metres.

One of the principal characteristic features of Mediterranean forests is their varied flora and phytosociology, at least in comparison with other forests in temperate or cold regions. The Mediterranean forests are in fact made up of over forty major forest species and at least fifty sub-species whereas in Central and Northern Europe, these figures are no higher than twelve and twenty respectively.

As direct corollaries of this variety, we should, however, further mention the effects of the archaic nature of the flora and of the ecological characteristics peculiar to the Mediterranean climate (drought and cataclysmic precipitation with soil erosion), which perhaps are due above all to the intensity of the anthropozoogenic factors.

## 2. OBJECTIVES OF THE MAB PROGRAMME IN THE REGION

The basic question is how to counter the harmful effects of human activities which, by their variety and intensity, have accentuated the action of the climate itself, excessive in its irregularity, bringing about change and deterioration in the forest ecosystems. One must see how to rehabilitate the presence of human beings in this area which was and still is in many respects of special importance. One must see how to enable human communities, rapidly expanding both from within and by arrivals from elsewhere, to reinvest a capital of renewable natural resources which through thoughtful and wise management could be preserved if not increased. These are the main objectives of MAB activities in the Mediterranean region.

The many causes for the deforestation which has so changed the Mediterranean landscape, have varied as civilizations have developed. The early hunters and food-gatherers were no doubt the first to start fires, either intentionally or accidentally, but the damage caused remained on a fairly small scale. More serious destruction occurred as a result of itinerant crop growing by denshering and the first domestication of wild sheep, since shepherds no doubt began to burn mountain pasture-lands at the end of the summer in order to exploit the first autumn rains. As long as the human population remained small and very scattered, the original forest was able to reconstitute itself.

As the population and economic activity of the towns increased, the need for fuel augmented, and the area of deforestation extended further and further. To the use of wood for fuel was added its use for building houses and ships.

At this pace, the plant cover, and the forest especially, deteriorated. The soil as well was increasingly damaged by erosion as can be seen in Greece or South-East Spain where the thin layers of humus and alluvial soil in the drainage basins are irreversibly washed down to the sea, leaving an arid and sterile steppe where once the country was green and fertile. If the soil remains deep on some valley floors, it is then covered with unproductive vegetation and debris carried down from the denuded slopes by storms.

Although the areas in the north of the Mediterranean basin are still among the most deprived European regions, particularly because of rural over-population and a social and land organization based on the family unit, especially in Spain and Southern Italy, they have, since the end of the last century, shown signs of a clear change in agricultural practices which are leading to improvements in the standard

of living. This change has been the consequence of transport facilities which have made it possible to send fresh vegetables and sub-tropical fruit to the urban markets of Northern Europe.

Nevertheless, this practice could lead only to greater production in the low-lying irrigable land, increasing still further the disparity between the areas composed of highly productive agro-ecosystems and the more arid areas in the foothills and mountains. The latter become "marginal lands", increasingly deserted by men and consequently left to decline ecologically and to regress socially and economically.

This process is found in certain regions today as in Corsica, where the disequilibrium in population and technical development between the mountains and the eastern plain has become considerably more marked over the last ten years. At the same time, in the foothill areas, the traditional "hortus" has been replaced by a form of maquis sometimes reduced to a cistus plantation or to an asphodel-covered heathland depending on whether the area was used as a range-land by shepherds who owned only their flock and not the land itself.

A reforestation policy backed by *Silva Mediterranea* and based on the introduction of exotic species such as *Pinus radiata* and *Eucalyptus* has been tried by some countries on the initiative of Italy, a country which has both a solid phyto-ecological tradition and offers forestry training specializing in Mediterranean silviculture. Although Greece and Turkey have also turned their attention to these scientific and technical fields of research, the largest reforestation undertaking on marginal land has been carried out in Spain over the last twenty years, at a rate of 100,000 ha annually.

### 3. THE PRIORITIES FOR INTEGRATED RESEARCH IN THE REGION

The preceding considerations clearly indicate what the priority research activities should be, since there is a desire to conserve the soil and the plant cover, a forestry policy whose scientific bases need to be reoriented and a wish to restore the social and economic balance between the influences governing land use and distribution.

Mediterranean forest-land is not very productive. In France, 750,000 ha can, at best, produce only firewood. In the region of Provence and the Côte d'Azur (including Corsica), J. Pardé noted an annual production of only 500,000 m<sup>3</sup> of usable timber per year, which is scarcely 3 to 4% of national production and represents 0.8 m<sup>3</sup> per ha per year (the national average is around 2 m<sup>3</sup>).

The topic of Mediterranean forests must not be approached, however, from the point of view of timber production. Emphasis has always been rightly placed on the important protective rôle forests play (particularly against erosion from rain and torrents), which in itself completely justifies their conservation and expansion, particularly on marginal lands. Structural and functional changes will be the subject of research by ecophysiologists in order to better understand both the potentiality and suitability for reafforestation of marginal lands and their rôle in soil protection (see Sections 3.6 and 3.7).

The Mediterranean forest in this area of light, sunshine and sea coasts, is also necessary to the human environment. The forest which is vitally important for recreation and relaxation, must also be defended against those who enjoy it but in a careless way, but above all against developers and the harmful effects of tourism (see Sections 3.4 and 3.5).

Forest grazing is a subject of deep concern. Attachment to the pastoral life is an ingrained part of the Mediterranean outlook and its impact on the forest has been found to be harmful when the flocks are too large and wander. It should nevertheless be asked whether properly controlled forest grazing might not have certain advantages, among which would be the fire prevention (see Section 3.2).

With climatic difficulties added, classical forestry methods, adopted from techniques developed in Central Europe, are often ill-suited. A special Mediterranean forestry practice needs to be established, taking into account both the physical conditions and the social and economic circumstances of the region (see Section 3.3).

The problem of forest fires themselves is heightened by summer droughts and the growth of an easily inflammable plant cover. Fanned by local winds, forest fires in the Mediterranean region are frequent, violent and rarely accidental! They must sometimes be considered as a normal and regular function of forest life which should be included in forest management and development projects and, of course, in the aims of priority research as well (see Section 3.1).

### 3.1 The ecological consequences of forest fires and ecological bases for protecting forests against fire

Since ancient times, forest and plant fires have been one of the causes, if not the major cause, of the destruction of Mediterranean forest ecosystems. 81,000 ha of forest land were destroyed by fire in Italy in 1971 and 140,000 ha in Spain in 1974. French foresters recently estimated that present reafforestation areas could not last more than twenty years because of fire. The large area of maquis is a result of the land having been abandoned by the rural populations, with uncontrolled fires as one of the consequences. The delegates and observers attending the Potenza meeting were aware of the extreme gravity of this phenomenon and decided to pay particular attention to the problem of fires in the Mediterranean forest ecosystems, including the maquis and the garrigue.

Very few studies have been made on the ecological consequences of Mediterranean forest fires, and little is known concerning the exact short or long-term changes that occur in the biochemical and hydrological cycles or in the soil evolution. Although the effects are thought to be damaging, exact studies are needed on this subject.

The principal ecological bases for protecting forests from fires are the following:

- (1) Protecting the trees which can reproduce themselves and thereby reconstitute the forest in favourable areas. The trees of the Mediterranean region are naturally adapted to fires in the following ways: they regenerate themselves by sowing on mineral soil, e.g. *Pinus halepensis*, whose cones are opened by the heat of the fire; their stocks throw off vigorous shoots, e.g. *Quercus coccifera*; they resist passively, e.g. *Q. suber*, whose thick bark has become protective against fire; they form naturally low-combustible stands, e.g. *Castanea sativa*, *Quercus ilex*.
- (2) Protecting forests to enable soil reconstitution. It is not known to what extent over-grazing, too-frequent harvests and poor land management have caused irreparable damage to the Mediterranean soil. Reafforestation hopefully will help to conserve and to reconstitute the soil. Research will no doubt indicate how humans can accelerate this process.

- (3) Protecting forests containing ecological nesting grounds for vanishing species of flora, fauna and insects. Heterogenetic groups must be preserved.

In view of the research already carried out in France and the establishment there of a "Pilot perimeter for the protection of Mediterranean forest-land against fire" in the Maures, it was proposed that this protection perimeter be adopted as a pilot project supplemented by co-projects in various other Mediterranean countries. It should be added here that MAB Project 2 should be linked with MAB Project 3 - grazing lands - since the presence of animals in a forest and on the fire-breaks may prevent and reduce the risks of fire by clearing the lower level of vegetation.

### 3.1.1 Pilot project: Perimeter for the protection of Mediterranean forest-land against fire

The pilot perimeter was set up in 1966 in the Maures range of mountains in France. It extends over nearly 19,000 ha near the Mediterranean coast between Hyères and St. Raphaël and between sea-level and an altitude of 780 metres. The area within the perimeter has already suffered from frequent fires, 25% of the woodland having been burned, in fact, in the last 25 years. Rainfall (between 700 and 1,200 mm) occurs primarily in the autumn and winter. The summer drought lasts two to four months and is aggravated by the mistral which is frequent in summer.

The vegetation is composed of forest-land, maquis and garrigues. Afforested zones occupy more than half the perimeter. In this forest-land, we find for the most part *Quercus suber*, *Q. ilex* and *Castanea sativa* (the latter at high altitudes and on northern slopes). The cork oak and the holm oak are more abundant and, depending on the locality, grow in either pure or mixed stands. *Quercus pubescens* is found in the thalwegs. *Pinus pinaster* used to be very abundant but has been largely destroyed by the attacks of *Matsucoccus*. It is nevertheless still found above 500 metres and is regenerating in profusion in certain areas.

Many forests have deteriorated very badly as a result of fires which impoverish the soil and encourage parasite attacks. Generally speaking, fire is propagated chiefly in areas of maquis and garrigues.

The perimeter was designed in the light of field and laboratory experiments as a means of preventing or restricting the spread of fires in the Mediterranean area.



In the field, the facilities provided include watch towers, notices and signals, motorized patrols and aerial surveillance. In addition, the perimeter has been divided up by fire-breaks or fire screens 200 metres wide and incombustible, at least in part, e.g. cultivated fire screens (vines and olive trees), screens of trees (incombustible species), built-up screens (camping sites and second homes) and bare fire-breaks. A system of smaller fire-breaks sub-divides the perimeter, supplementing the main divisions. Roads and tracks, parking spaces and landing grounds have been provided in sufficient numbers in order to give access. Finally, a certain number of reservoirs have been established either by tapping streams or by building barrages in the hills.

The perimeter has furthermore been consistently studied under the biological equilibrium programme of the Délégation générale à la recherche scientifique et technique (DGRST). These studies covered ecological analysis of the *Matsucoccus* cycle, ways of combating this beetle and the possible regeneration the *Pinus pinaster* stands.

A variety of laboratory and field experiments have been carried out, among which are the following topics:

- (1) Fire sensitivity: assessment of sensitivity to fire, the inflammability and combustibility of the principal trees and shrubs of the Mediterranean region; annual and daily variation in the inflammability of these species; correlation between inflammability and ecological factors; preparation of fire-sensitivity maps according to the vegetation; chemical prevention.
- (2) The ecological effects of fire: the resistance of plant species; action on the structure and microflora of the soil; fire and soil erosion.
- (3) The social and economic effects of fire: assessment of the harm done to the human environment; direct and indirect effects; people's rôle in the starting of fires.

The pilot perimeter in the Maures has given excellent results since its establishment. Its effectiveness against fires will still have to be tested in coming years, but it already provides indicators for current research into forest fires and constitutes a management model. Another pilot zone has just been established in the department of Hérault. The forestry departments of the countries round the Mediterranean are aware of this venture and have included it in their fire-fighting programmes.

### 3.1.2 Co-projects

The specialists attending the Potenza meeting expressed great interest in the problem of fires and put forward programmes, some of which have been chosen as co-projects.

Greece. The problem of fire arises primarily in areas where the forests of *Pinus halepensis* and *P. brutia*, which are particularly inflammable, have been subject to long periods of drought. Greece hopes very much to co-operate with France and is ready to organize, in agreement with that country, a fire-prevention research project.

Italy. The programme being carried out in Tuscany by the Istituto Sperimentale di Silvicoltura in Arezzo might be selected as a co-project. It includes, among other things: fundamental research into the causes of fires and correlation between fires and meteorological phenomena; research into the interrelationship between vegetation and forest fires, e.g., inflammability and combustibility, the effects of fire on the vegetation and soil, and mapping of fire risks; methods of prevention, including forest management and the choice of species reducing the dangers of fires, the establishment of green fire screens and controlled forest grazing.

Finally, particular attention is being given to natural regeneration after fires and to the reconstitution of forest-land.

Portugal. Research is being conducted more particularly into the problem of fire in the *Pinus pinaster* forests. The social and economic aspects of this problem are being given special attention in an area of very fragmented private properties.

Spain. The Spanish Delegation proposed a project for the study of the ecological effects of forest fires on the reconstitution of the plant cover and for studying the action of fires on biotic and abiotic soil factors. This project is being carried out on the southern slopes of the Sierra Nevada on two experimental plots of 6 and 24 ha at altitudes of 1,100 and 2,200 metres, seriously affected by the fires of 1973 and 1974. The present forest vegetation consists primarily of *Pinus halepensis*, *P. pinaster*, *P. sylvestris* and many species introduced long ago, since the area has for long been a region for forestry studies.

Turkey. Because of the long summer drought, a particularly effective fire-fighting service already exists in Turkey, backed up by motorized units. Fires occur particularly in the Mediterranean and Aegean areas.

The Central Forest Research Institute in Ankara has set up a Fire Control Centre in Antalya which studies, among other things, the effects of fire on ecosystems, the duration of fires according to the various species, and the rôle of maquis in the starting and spreading of fires.

Turkey is ready to inform other Mediterranean countries of its research in this field and hopes to participate, either directly or indirectly, in the work being carried out in the Maures pilot perimeter.

### 3.2 The effect of grazing on Mediterranean forest ecosystems

Traditionally, the great pressure of cattle on Mediterranean forests led on the one hand to a detrimental ecological disequilibrium of the forest and, on the other hand, to conflicts between the people occupying the forest land, particularly between shepherds and foresters. The aim of the research in this domaine is to see what possibilities exist for grazing in forest areas and to seek a balance between forestry and animal husbandry from both the ecological and the economic points of view.

The main working hypotheses adopted are:

- (1) In the Mediterranean area at low and medium altitudes, the forest's main function is environmental protection (combat erosion, soil regeneration, bioclimatological action on the surrounding crops) and not timber production.
- (2) The forest best suited to protective functions in the Mediterranean area is one composed of different kinds of oak (association of holm oak, cork oak and pubescent oak).
- (3) The most effective maintenance of such a forest (clearing of brushwood) is done by animals who are able to clear as much as 50% of the annual growth, which also contributes to providing protection against fire.

#### 3.2.1 Pilot project

The research programme jointly drawn up by the Stazione Sperimentale del Sughero at Tempio Pausania and the Istituto de Allevamento Zootecnica e Casario in Sassari, in co-operation with research workers at the Institut national de la recherche agronomique (France), was adopted as a pilot project. The programme provides for comparative studies in five experimental zones situated in Sardinia in varying ecological conditions either on a crystalline or volcanic substratum at varying altitudes, or on limestone. One of the zones in semi-arid climatic conditions reproduces, with its pronounced xerophily, certain aspects of the North

African range-lands and therefore lends itself quite well to comparisons or extrapolations.

Research is already being conducted in the forest of Burgos (Istituto Zootecnico), and the vegetation map of Sardinia is being completed (Stazione del Sughero).

The general aim of the programme of observations and experiments is to study the functioning of a forest and animal husbandry system in a Mediterranean environment, describe the different factors present, determine the relationships existing between them, and finally define under what conditions this system could be used to achieve the best possible results (ecological equilibrium between forest and environment, maximum animal production).

This ecological and zootechnical study is not sufficient, however. A forest will not cover the whole surface of a territory and animal husbandry will not make permanent use of the forest. It is therefore vital to study how an association between forest-land and animal husbandry can be integrated into a general system of rural production and exploitation.

The relationships between flocks and the forests could therefore be studied from the following angles:

- (1) study of the physical action of the animal on the forest by individual observations made at several points, at various periods of the year, with different densities of animals belonging to different species and intra-specific genotypes, on forest plots at varying stages of evolution;
- (2) measurement of the instantaneous consumption by the animals through direct evaluation of the vegetation consumed and checks on the quantity of faeces, and by indirect measurement of changes in the animals' weight and, where appropriate, of their milk production;
- (3) attempt at a synoptic view by watching the behaviour of a flock using a forest in conditions compatible with its expansion and regeneration; measurements of the productivity of the flock living on the resources of the forest available to the animals will be supplemented by determining what resources (quality, quantity and period) they must find outside the forest;
- (4) study, within a specific regional framework, of forest-animal husbandry integration into a system of production, land distribution and farming units.

The social and economic development of rural communities depends both on how the land is adapted and how it is used, either by families or by co-operatives, and

co-operative exploitation can be established among land-owners, among cattle raisers or among both categories at once (GAEC type).

### 3.2.2 Co-projects

In corollation with the Sardinian pilot project, several co-projects are being studied.

France. The pilot project will have its counterpart in Corsica, in the mountain zones of the interior of the island where cattle raising is an essential activity. The Corsican sheep is closely related to the Sardinian and, like it, is used for milk production for Roquefort cheese.

The results of the work carried out in Sardinia on animals comparable to those in Corsica, further suggest that under the difficult cattle-raising conditions of the mountains, the local cow is more productive than that of an "improved" genotype (pedigree or cross-breed) and that the limitations on the raising of sheep for milk can be lessened by milking once a day without excessive loss of production occurring.

Given this situation, the need can easily be seen for consulting cattle breeders with a view to drawing up an inventory of available written and oral knowledge. The first stage of a research programme should thus be an attempt to study the animal population of Corsica. This study should include the wandering of flocks, associated with depopulation and the decline of agricultural activities; the almost exclusive dependence of animal husbandry on the available spontaneous vegetation (maquis, forest land, high grazing land); the simultaneous presence of several species (cows, sheep, goats and pigs) on the same territory and belonging to the same cattle breeder.

These studies correspond to the projects at present being carried out by the team from the Service d'expérimentation et d'information from INRA (SEI) and by the team from the Centre d'études phytosociologiques et écologiques (CEPE) in Montpellier.

Greece. In Greece, where research into the problems of grazing land was co-ordinated under the auspices of Silva Mediterranea, a project is already under way concerning grazing for goats in evergreen forests (*Quercus coccifera*).

Portugal. In Portugal, the problems raised by animals ranging in forest or woodland also occur, particularly in the higher areas, in an agro-sylvo-pastoral environment where grazing lands are found side by side with woodland.

Spain. Similar research has already begun in Spain (Badajoz) and is planned, taking account of differing local conditions, in Greece and Turkey.

Turkey. In Turkey, where five million country dwellers live in forest regions and obtain their resources from the extensive rearing of five and a half million animals, the Research Centre in Antalya, part of the Forestry Research Institute in Ankara, is working on the general problems of grazing lands and will carry out research in co-operation with specialists from other Mediterranean countries.

In mountain areas, cattle ranging in forest land, even in dense forests as in Corsica, can contribute to keeping the undergrowth and fire breaks in order under certain conditions of density and spacial distribution, depending on how the forest is arranged.

Transhumance, which is still prevalent in several Mediterranean countries, is another ecological and socio-economic characteristic of animal husbandry and rural life in the mountains. It reveals the complementary ties existing between the plains, which are frequently irrigated and intensively cultivated (the eastern plain in Corsica, the eastern areas of Sardinia, the North African plains), and the semi-arid mountains.

An overall approach to the agro-sylvo-pastoral balance in conjunction with social development should be made, as provided for in a current project in the forest zones in Northern Tunisia.

### 3.3 Influence of plantation forests on the environment

In recent decades, considerable reforestation work has been carried out in the Mediterranean region, both for soil protection and for timber production purposes. Vast artificial plantations of native or exotic species have thus been established, these often consisting of one species of tree only. These plantations occupy several million hectares throughout the region, the most extensive being in Spain, France, Portugal, Italy, Greece and Turkey.

The extent of these plantations raises problems relating to the evaluation of ecological balances, protection and management as well as problems of a social and economic nature. It has often been asserted, although not proved, that certain species grown exclusively have an unfavourable influence on the environment. It thus seems necessary to study the reciprocal relationships between artificial plantations,

the physical and biological environment and the social and economic structures of the regions concerned.

These problems have already been covered by one of the projects of Silva Mediterranea's Research Committee. An initial contribution to the study of the influence of Eucalyptus plantations on the soil has thus been published by IUFRO, based on the results of a joint Spanish, Italian and Moroccan programme.

The project provided for under MAB Project 2 must take up and widen this theme, paying attention to all the changes which have occurred in the physical, biotic and social environment as a result of the artificial plantations, i.e., it must study in different localities the influence of single-species plantations (whatever the species involved) and the influence of mixed plantations on: the local climate and the woodland microclimate; the soil (carbon cycle, nitrogen cycle and the mineral element cycle) and changes in its structure, microflora and microfauna; the water balance and the biogeodynamic cycle; local flora and fauna.

The research should also cover the productivity of the biological systems under consideration and, if possible, the total energy balance. It must lead to clarification of the correlations between bioclimatic factors, productivity and crop treatment.

A problem of prime importance is protection against attacks by harmful animal and vegetable agents which sometimes threaten the profitability or even the existence of the artificial plantations, and in any case, affect their equilibrium. This has been taken into account in an integral way in the Franco-Spanish biological research programme on the Mediterranean pine forests which provide for the systematic study of the various pests and their biology, the aim being to lay down principles for the prevention of attacks and to establish a foundation for integrated defence against them.

### 3.3.1 Pilot projects

Bearing in mind current or planned research, it was decided to entrust to Italy the task of preparing a pilot project on these problems as part of MAB Project 2.

Italy. At the present time, the following projects are under way in Italy: study of the total energy balance being conducted, as part of IBP, in a poplar plantation of 1,214 ha by the Centro di Sperimentazione Agricola e Forestale in Rome; study of the comparative influence on the soil of several exotic species in Chianti (Tuscany) conducted by the Istituto Sperimentale per la Selvicoltura in Arezzo.

This latter institute is also conducting ecology and productivity studies and treatment experiments on Eucalyptus plantations in Calabria and Sicily, on *Pseudotsuga douglasii* plantations in Tuscany and Calabria, plantations of Mediterranean pine in Calabria, and on *Pinus nigra* in Tuscany, Umbria and in the Abruzzi. The above-mentioned institutes wish to co-operate with research workers and institutes in other countries, and have the necessary infrastructure.

Several countries in the region have similar research projects either in process or being planned.

France. An integrated programme for the study of the *Pinus pinea* ecosystem was recently embarked on by the Département d'écologie du sol at the Centre national de la recherche scientifique in Montpellier, in co-operation with the Centre de recherches forestières and the Université d'Aix-Marseille. This species will be planted on a large scale in the South of France, either for its amenity value in tourist areas or for production purposes.

The following research is planned:

- (1) at stations in the coastal area: observations being carried out on micro-climatology, water dynamics, the nutritional cycle, biological activity in the soil and the influence of sheets of saline water;
- (2) at sub-regional level (from the Spanish to the Italian borders): relationships with edaphic conditions and rainfall temperature;
- (3) at regional level with international co-operation: problems of soil degradation in Italy; stabilization of dunes in Spain; nutritional physiology studies in Lebanon.

A similar programme, but relating more to forestry, is also being undertaken with regard to cedars (*Cedrus* sp.).

### 3.3.2 Co-projects

Greece. In Greece, ecological studies on the massive planting of various indigenous and exotic species are planned by the Forestry Research Institute in Athens and the Faculty of Forestry in Salonica as part of a vast reforestation programme. These studies will be parallel to the eco-genetic research already being developed by Silva Mediterranea.

Portugal. Comparative bio-ecological studies are planned on plantations of Eucalyptus *Quercus suber* and *Q. ilex* in Portugal.



Spain. Research into the treatment of plantations of indigenous species (*Pinus Binaski*, *P. pinea*, *P. laricio*, *P. sylvestris*) is being conducted in Spain by the National Institute for Nature Conservation (ICONA) in several places. This research includes ecological studies (soil, climate, vegetation) and control studies concerning productivity and the economy.

Spanish participation in the project could be extended to studies on *Eucalyptus* and *Pinus radiata* parallel to the research being carried out by Italy, and to a comparative evaluation of *P. sylvestris* and *Quercus pyrenaica* by the Institute for Agronomic Research (INIA) near Burgos.

Turkey. In view of the size of the plantations already made in Turkey, particularly those of *Pinus brutia*, it is planned to begin bio-ecological research and productivity studies. In addition to the work being carried out by the Forestry Research Institute in Ankara and the Faculty of Forestry in Istanbul, a substantial research programme on these themes is being prepared at the Institute for Poplars and Rapid-Growing Species in Izmit.

All the Mediterranean countries attending the Potenza meeting furthermore emphasized how much importance they attached to co-operation between their respective institutes in this field.

#### 3.4 The impact of tourism on Mediterranean forest ecosystems

The distinguishing feature of tourism since the Second World War is its fantastic expansion over almost all the coastline of the Mediterranean basin which has led to radical changes in the native population and in the natural environment. After a prolonged stage in which tourism developed in a chaotic and disorganized way, society is gradually becoming aware that overcrowding and over-exploitation of resources leads to a boomerang effect, and that deterioration of the natural environment is harmful to tourism, relying as it does on the qualities of that environment.

Striking a balance between tourism and the suitable development of natural environments is one of the most important problems for conservation today. It is vital to know how far ecosystems are able to support tourism and what tourist ventures will permit their balanced development. In other words, the tourist carrying capacity of each ecosystem has to be defined.

The second important problem is the social and economic impact of tourism on the people living along the coast and in neighbouring regions. With a concentration

of people along the coast at the expense of the depopulated hinterland, traditional agricultural activities are abandoned and the land returns to a fallow state.

Generally speaking, the tourist industry has established its facilities in, and brought its hordes of holiday-makers to hitherto preserved natural and human environments, with no prior study being made to predict the consequences. These problems have led Mediterranean countries to ask what the carrying capacity of the natural and human environment is and to direct research towards finding an alternative to tourist and industrial expansion, seeking to reconcile the needs of both these sectors with the potential of the natural environment.

#### 3.4.1 Pilot project: Programme for the protection of the human environment in the Yugoslav coastal area

Over the last ten years, Yugoslavia has seen its Adriatic coast become completely absorbed into the modern tourist economy. This process, which affects about ten per cent of the country, has led to overcrowding, to excessive demand on resources and to deterioration in the quality of the environment and landscape. The Yugoslav Government has been concerned with the growing disparity between the development of the coastal region and that of the hinterland and it has therefore prepared, with the assistance of UNDP, a programme for the protection of the human environment based on mapping the patterns of land use and natural resources.

This map highlights several essential aspects of the economic development (industrial and touristic) of the coastline, as follows:

- (1) expansion of tourist installations and villages outside the urban areas along the coasts in the most attractive positions;
- (2) concentration of people in this rapidly-developing area; over-population or urban and suburban regions;
- (3) decentralization of industrial and power plants and construction of new firms in the already over-loaded urban and suburban areas;
- (4) intensive and difficult-to-control construction of second homes which represent a further burden for this coastal area, with deterioration of the typical Mediterranean landscape, pollution from refuse, waste water, etc.;
- (5) simultaneously with the concentration of the population and the economy in a narrow coastal strip, opposite developments are taking place in the hinterland and on the largest islands, e.g., depopulation of the villages, and abandonment of traditional Mediterranean animal husbandry and agriculture (pyrethrum, olives, vines and orchards).

The excessive expansion of tourism has had a harmful effect on the forests of the coast and adjacent mountain region. This has become apparent in an increased danger of fire, unco-ordinated woodland clearance, the establishment of tourist complexes and private homes all over the countryside and the opening of quarries which destroy the native vegetation and hence the aesthetic value of the environment.

The introduction of species of continental origin and the reafforestation of large areas with species such as the Aleppo pine is often carried out with no thought given to the complexity of the ecosystem, without any prior studies and simply as the need arises. Thus the needs of tourism with regard to the Aleppo pine imply the elimination of all native vegetation in those areas where it is planted, either to prevent the risk of fire or to create areas for various kinds of camping. This hampers or makes impossible the surface regeneration of the soil and encourages surface erosion on the slopes.

Forest research, aware that the forests of the coast and the karst region are a basic factor for the stability of the ecosystems of the Mediterranean area, has set itself the task of intensifying current studies and supplementing its programmes in the following fields: fires as a consequence of tourism; protection of the aesthetic value of the landscape (based on the perception of this value by local people and visitors); the rationalization of horticulture; reassessment of the use-value of the forests in the karst region; research and the siting of gene banks; study and evaluation of the process of the natural regeneration of forests by establishing a wide network of permanent observation sites to study all forest associations and all stages of vegetation; establishment of a map showing the possibilities for using stations for the natural and artificial regeneration of forest-land.

The coastal development programme includes direct action, reafforestation, etc., in order to restrict and balance the effects of tourism on the natural environment:

- (1) the establishment of vast forest buffer zones between the urban, industrial and tourist areas providing protection for the natural environment, daily living and work;
- (2) establishment of a wide range of protected forest zones (anti-erosion measures, wind breaks, protection of the hydrographic network and the water reserves of agricultural areas, etc.) and also reafforestation work in zones which have suffered deterioration;
- (3) delimitation and separation of forest and grazing areas on karst (grazing areas reserved for limited numbers of cattle). A large

proportion of the former karst grazing land falls into the category of naturally regenerating forests which must be provided with favourable conditions by the elimination of grazing.

In restricting itself for the time being to a relatively narrow coastal strip, tourism has accentuated certain problems connected with the migration of rural populations to the towns and with environmental impact, thus making the Yugoslav coastline an ideal study area for the other countries of the Northern Mediterranean basin which are nearly all confronted with identical phenomena.

### 3.4.2 Co-projects

Although none of the other delegations submitted such a well-organized project as that of the Yugoslav Delegation, it was nevertheless apparent that they were concerned with the impact of tourism on coastal and forest environments.

Effect on forest ecosystems. The frequency and size of fires in areas suffering from considerable tourist pressure (forests near towns) has led Spain to embark on a study programme into both the "natural" causes of fires (types of forest stands, deterioration of forests as a result of insect attacks, etc.) and forest management policy for tourism and recreation.

As part of the integrated research programme planned in Spain, an evaluation of the effects of tourism on the natural environment is intended. This study could concentrate on such aspects as: the behaviour of the tourist in a natural environment and his landscape preferences; the interaction between grazing land and areas intensively used for recreation since they both have a common denominator of resistance to trampling and adaptation to eutrophization.

Nature conservation and tourism. The creation of natural reserves and biosphere reserves makes it possible to limit the effects of tourism in areas which are either fragile or of outstanding interest, and to educate the public. It is this possibility which has led several countries to establish reserves, particularly along the coasts, where tourism would be either excluded or practised in a supervised way with the aim of educating the public about nature.

Outside these protected zones, it will be possible to stabilize the effects of tourism, only by determining the carrying capacity of the environment (Portuguese study) and educating the public, as the Portuguese Delegation emphasized.

The Centre national français d'étude et de recherche du paysage (CNERP) has been made responsible for a study of the effects of social and economic development on the Mediterranean landscape, particularly the effects of the expansion of tourism. This study is being carried out in co-operation with Tunisia (Djerba study area) and is to be expanded by including Yugoslavia whose pilot project, described above, perfectly matches CNERP's field of interest.

### 3.5 The effects of air pollutants on forest ecosystems and forest influences on the quality of air

Both home and industry release into the air a considerable quantity of gaseous chemical compounds, substances which harm the environment and which are occasionally toxic. Some of these products have effects, localized to a greater or lesser extent, on the biological systems close to the sources of emission.

The frequent siting of industries in rural areas or in the suburbs of large towns around the Mediterranean is causing considerable damage to the surrounding forest ecosystems. It is thus important to find a remedy. Research already undertaken must be continued and new research projects covering the action of pollutants on the main types of Mediterranean forests must be initiated.

A few studies have already been carried out, particularly in the temperate forest regions of Central Europe and North America. Information concerning the effects of atmospheric pollutants on Mediterranean forests is, however, still incomplete because the conditions of the environment and, in particular, the trees affected, are different and frequently much more varied.

The research proposed has the following aims:

- (1) broaden knowledge about the nature and extent of the effects on Mediterranean forests of the various pollutants, particularly sulphur dioxide and other gaseous sulphur compounds;
- (2) identify either new or little-known forest trees which could be introduced into the Mediterranean area and which are particularly resistant to atmospheric pollution caused by gaseous sulphur compounds;
- (3) identify the plant species in the region which are particularly vulnerable, especially lichens, and which can serve as biological indicators of the pollution level in the air;
- (4) prepare restoration measures in conjunction with ecological planning as part of regional planning, in order to reduce the intensity of the damage done to the forests in the region and to improve the health and welfare of the people living there.

### 3.5.1 Pilot project

Spain has proposed to conduct a pilot study on the basis of observations and research carried out in a mountain area facing east and west and forming part of the Sierra del Cadi (Alt Bergada region, Barcelona) and its southern ramifications where there are fertile valleys with a high population density. In the centre of this area is the thermal power station at Figols which produces electricity by burning a lignite containing a certain quantity of sulphur.

The area potentially exposed to the action of the pollutant emitted by the power station is about 50,000 ha constituting the most northerly zone of the Llobregat basin.

The climatic characteristics are as follows: annual precipitation 950 mm spread over 72 days of rain and 30 days of snow, with a maximum temperature of 32 °C and a minimum temperature of -14 °C.

The plant cover includes forests in which *Pinus sylvestris* is the main species. *P. laricio* is found in the lower zones and *P. uncinata* in the highest areas. *Fagus sylvatica* is also found there mixed with *Pinus sylvestris* and *Abies*, especially in the North-West of the area. The low stratum is mainly composed of *Buxus sempervirens*.

The first visible sign was the decline of a certain number of *Pinus sylvestris* and *P. laricio*. The possibility of action by biotic agents, pathogenic fungi or insects was ruled out, whereas it was possible to establish a relationship with the emissions of sulphur dioxide.

Research carried out in this zone has so far covered the following aspects: determination by the National Institute for Nature Conservation (ICONA) of the zone in which damage is observable, and preliminary estimates of its intensity; analysis of pine needles with a check on sulphites and sulphates and comparison with other analyses carried out on pine trees in unpolluted areas.

ICONA and the National Institute for Agronomic Research (INIA) have planned to co-operate in this research. It has also been planned to seek the co-operation of the Department of Plant Physiology at the University of Barcelona in order to study the effects of SO<sub>2</sub> on vegetable metabolism (biosynthesis of pigments and other organic substances, the effects on enzyme systems, etc.).

The staff and equipment available for this research is considered to be adequate for the time being. Some of the ICONA technical staff in the region will be available for inventorying and experiments in the field together with some of the research staff and equipment from the National Department for Environmental Analysis (INIA). Existing equipment will be supplemented by the acquisition of apparatus to collect and measure the quantity of  $SO_2$  as well as an automatic analyser for this compound. The existing meteorological network will have to be supplemented and the use envisaged of remote sensing techniques as employed in other regions for evaluating other kinds of pollution.

It is planned to spread the various stages of the programme over four years. The programme will include technical controls as well as eco-physical and silvicultural studies.

With regard to monitoring, the following work is planned in particular: the collection of ecological data; a qualitative and quantitative monitoring of emissions of pollutants in the neighbourhood of the sources (in co-operation with staff of the power station); setting up an  $SO_2$  sampling network over the area to be studied; the setting up of experimental plots at varying distances from the source of pollution; study of the influence of climatic factors and the wind régime by establishing a meteorological network.

Where the eco-physiological or silvicultural studies are concerned, the following work will be carried out: a check on the loss of timber production; a study of damage to assimilation systems in the three main plant species; monitoring of the sulphites and sulphates in the air systems; study of damage to stomas and study of the effects of  $SO_2$ , particularly on reproduction organs, pollen and seeds.

Finally, steps will be taken to improve forest sanitation by: fertilization; the selection and increased number of resistant phenotypes; selection of forest trees able to be introduced into the Mediterranean region and showing a resistance to atmospheric pollution by gaseous sulphur compounds; study of the dispersal of atmospheric pollutants and their absorption by the leaf biomass acting as a filter; study of the effects of forests on the health and welfare of man.

### 3.5.2 Co-projects

Turkey: Murgul study area. The copper works at Murgul cause serious damage to forests, grazing land and cultivated areas, especially within a five kilometer radius.

The pollution action of many toxic gases, particularly  $\text{SO}_2$ , has already been studied. The villages in the area are considerably affected and are asking for compensation, which also raises social and economic problems.

The Turkish Ministry of Forests is supporting the research carried out in the region by participating in a series of study projects into the effects of atmospheric pollution on Mediterranean forests.

Yugoslavia: Solin basin. The influence of forests on the purity of air and the influence of pollution on forests was studied during 1974 in the Solin basin near Split, which is polluted by a cement factory and a plastics factory.

Analysis of data concerning sediments has been completed, as well as the necessary measurements with regard to the cultivated forests of *Pinus halepensis*, such as structural relationships, the development and increase in their trunks as well as their composition, soil analyses, phytoecological analyses, etc. All the data relating to the cultivation of the pines has been analysed and indexed. This research will be continued and directed towards the biological and ecological stability of the ecosystems, measures to stabilize forests suffering from deterioration and exploited forests (natural regeneration, growth), the protection of the environment, the influence of air pollution on forests and vice versa, etc.

It would be necessary, as part of MAB Project 2, to organize contacts and exchanges of research workers with other research institutes and centres in Europe engaged on similar studies.

### 3.6 Ecological, socio-economic studies on drainage basins

There are few interdisciplinary research topics in the environmental sciences which arouse so much controversy as the choice of the best development policies for drainage basins, since the use of water is increasingly a source of rivalry between agriculture, industry and human needs. This problem is all the more acute in the Mediterranean region where irregular rainfall, serious erosion and the destruction of soils threaten the productivity of these basins.

The torrential nature of the rivers is one of the characteristic phenomena of the region. Studies have shown that the transport of solid matter per square kilometer is at a maximum in basins where the mean annual rainfall is around 300 mm. It is less in more humid regions since the plant cover is denser. In dryer regions, the plant cover is sparser but rainfall is rarer.



Human action on the environment in these regions, as elsewhere, principally affects vegetation and the soil, and modifies the climatic balances. The interception of precipitation is reduced or even annihilated and the morphogenetic potential is greatly increased. All traditional rural civilizations have had to find solutions to these problems in order to survive. Increased population pressure without adequate technical progress reduces the efficiency of agricultural practices and almost always sets a process of deterioration in motion. Greater erosion by rainfall increases runoff which leads to the scouring of the ground and the removal of the soil.

Deterioration often becomes irreversible and causes the formation of ravines all over the clay or marl regions as can be seen in North Africa, Spain or Turkey.

This problem of soil erosion is one of the priority fields for research which concerns most Mediterranean countries. Yugoslavia, Turkey and Spain, in particular, submitted projects for the study of erosion and floods and steps to combat them.

The second major direction for research concerns the study of various basin management practices such as removal of maquis in order to plant productive forests, the effects of changes in the plant cover, etc.

The third research objective concerns analysis of the ecological effects of grazing on drainage basins.

### 3.6.1 Pilot projects

Greece. Since 1962, preliminary studies on forest hydrology have been in progress as part of Silva Mediterranea. The co-ordination of this work has been entrusted to Greece which, since 1972, has established a research programme covering a number of the following different issues.

- (1) problems of soil erosion considered from the point of view of methods of soil preparation with a view to transforming the maquis into pine plantations and the effects of these activities on water quality;
- (2) the influences of changes in the plant cover on water production;
- (3) other impacts on the soil such as the human impact, grazing, the use of fertilizers, herbicides, etc., which influence existing ecosystems.

Eleven experimental drainage basins have already been selected and equipped; work is currently proceeding on three others. The equipment of each basin enables

detailed climatic data and also data on water production and sediments to be collected. Furthermore, these basins exemplify different geological and ecological conditions (*Abies*, forests on schists, degraded forests of *Quercus* sp. and of evergreen on schists dense forests of evergreens and of *Fagus* sp. on metamorphic rock formations).

Three drainage basins having a total surface of some 440 ha are situated in Western Greece at an altitude of between 350 and 650 m on schists with a predominance of degraded forests of *Quercus* and of overgrazed evergreens.

Four basins are situated in Central Greece at an altitude of between 980 and 1,410 m on schists, the dominant species being *Abies*. Their surface area is about 342 ha.

Four other basins are situated in Eastern Greece between sea level and an altitude of 1,410 m on metamorphic rocks. Three of them are covered by evergreens, the fourth by forests of *Fagus* sp. Their total area is about 342 ha.

Spain. The area chosen for study is the Almanzora river basin in the province of Almeria. Its total surface is 2,112.41 km<sup>2</sup>. The altitudes vary from 300 m in the lower flood plain to 2,168 m at the summit of the Sierra de Filabres. The land relief is very irregular with slopes often at higher than 50%.

Rainfall varies from 650 mm in the higher zones of the basin to 285 mm in the lower (e.g. Albox or Purchena). There can be dry periods of four months in the mountain areas and of six months in the lowlands.

The soil is formed in the upper zone from mica schists, graphite, quartzite and some isolated amphibolites in the eastern section, whereas gneiss and marble are dominant in the west. The bedrock generally is Triassic with traces of Cambrian in the west. In the Sierras of Estancias, Madronal and Del Saliente, Triassic rock is dominant with limestone and dolomite soils.

Cultivated land covers 1,000 km<sup>2</sup> of the basin (including agriculture and forests) with grazing and uncultivated land occupying the remainder. ICONA has begun hydrologic-forestry works in this river basin. In the upper zone, more than 25,000 ha have been planted. The experimental basin is for the study of the effects on the water regime of forest plantations, changes in land use patterns and conservation projects.

The first studies will include research on water erosion in order to collect data which can be used for "the universal equation of erosion prediction" and thereby establish rational land use in the agro-hydrological management of the basin. The aim of these studies is to measure the following parameters: magnitude of erosion; susceptibility to erosion of common soil types; level of soil protection of the various types of vegetation; protection factor according to the various means of soil utilization, e.g. cultivation in strips, terrassing; infiltration capacity of the soils; surface runoff.

The second aspect of the research will deal with vegetation and the stages of the hydrological cycle in order to establish in the various types of plant cover the action of the elements which determine the hydrological system, e.g. rainfall, infiltration, evapotranspiration and runoff. In this study, research will also be made on the plant cover's interception of precipitation, as well as its influence on the formation of dew, frost, etc.

This research programme will be carried out under the auspices of ICONA in co-operation with the School of Forestry Engineering of the National Institute for Agronomic Research (INIA) and the Institute of Hydrology through various working groups.

### 3.6.2 Co-projects

Turkey. Management of the abundant hydrological resources of Turkey raises serious problems. The rivers (four of which flow into the Black Sea and seven into the Mediterranean, whereas the Tigris and the Euphrates, which have their source in the mountains of Anatolia, irrigate the south-eastern part of the country and Mesopotamia) carry more than 80,000 million m<sup>3</sup> out of an annual total of some 500,000 million produced by precipitation but the country is at present able to use only one-tenth of these resources.

Violent erosion is responsible annually for a loss of 500 million tonnes of soil causing serious degradation and destruction of forests and grazing land. Moreover, the population increase, industrial development and intensive agriculture call for increasing quantities of water.

The General Directorate of Hydrological Production is responsible for the improvement of the drainage basins and is assisted in this task by the Directorate on erosion and plantation matters, attached to the Ministry of Forests. The latter

is responsible for the management and improvement of forests on the high plateaux and in mountain regions. A large number of engineers and scientists are taking part in this work.

It is proposed that the zone of Lake Burdur and the region of Isparta which are already being studied by the Faculty of Forestry of the University of Istanbul be selected as pilot study zones for Turkey within the framework of the MAB Programme. The Research and Development Centre of the General Directorate of Hydrological Production and the Bureau of National Planning will provide the necessary assistance. This project might be integrated with studies being conducted in Yugoslavia.

Yugoslavia. The problem of erosion has been the subject of searching study. Some of the results obtained were submitted to the Yugoslav conference on karst problems which was held in 1969. The problem of erosion is mainly studied in the drainage basins of the major hydro-electric works situated in the coastal region and in the Neretva basin in the largest agricultural zone on the Adriatic coast.

A number of institutes are taking part in research on erosion, in particular those of Sarajevo, Mostar, Split and Zagreb.

Yugoslavia plans to co-operate in this field with Greece and Turkey. Contacts have already been established with Greece and a number of activities have already been started in collaboration with that country.

### 3.7 Ecological and socio-economic studies on the utilization and improvement of marginal land

Marginal land occupies vast areas in the north of the Mediterranean region. Not being subject to the swift and regular rhythm of agriculture, nor to the much slower rhythm of forestry, they have only a small directly usable plant production used mainly for extensive grazing. This is the *salvus* of the Romans, which was sometimes produced by the abandonment of cultivated areas which were periodically taken over once more by natural vegetation and, on the other hand, was sometimes carved out of the forest of which the area still retains scattered vestiges in its ligneous vegetation but which is mainly given over to herds of bovines and far more frequently to flocks of sheep and goats.

The action of the climate, the erosion of the soil due to fires or drastic felling, and grazing have over the centuries made the vegetation of these landmarks

highly monotonous, giving currency to the belief that they are homogeneous and, in our own times, arousing the unscrupulous rapacity of developers with their eye on available space.

In fact, any objective study reveals the extreme variety of these marginal lands, a variety created or exacerbated by the various stages of degradation, whereas forest ecosystems reaching their climax often assimilate the edaphic variety and mask it under forest cover. This biological mosaic has been overlaid and shaped for centuries by the diversity in the social behaviour of Mediterranean peoples.

This is therefore an exceptionally interesting field for action which deserves to be given priority under a number of MAB projects, particularly Project 2. But its scope and complexity call for a vigorous application of the approach of MAB and, above all, necessitate a high degree of multi-disciplinary integration, with an intensified effort to adopt new methods for data search, compilation and processing. Lastly, more than in other regions, a knowledge not only of recent history but of events over the centuries is necessary if the problems raised are to be fully grasped.

As a preliminary measure, it is necessary to agree on terminology and on definitions, and thus on the language itself which endeavours to grasp the diversity of these environments and landscapes. A highly confused typology involves a mixture of local names which are the subject of varying interpretations, extrapolations or generalizations by botanists, geographers and scientists in general. Terms such as maquis, garrigue, phrygana, tomillar, matorral and many others which denote phenomena ranging from denuded soil to pro-forest situations still require more precise definition. Even attempts to make a dynamic local synthesis on the series of deterioration or reconstruction suffer from these ambiguities. In many cases, to obviate these difficulties, terminologies of other continents are used, thereby increasing the confusion.

It is therefore necessary to make an effort at clarification in an attempt to recognize parallels, equivalences and oppositions in existing terms which cannot conveniently be abandoned, at least in the majority of cases. It will also be necessary, in framing definitions, to establish sufficiently clear limits to make the terms widely usable.

Biologists are often induced to propose distinctions and classifications of a very detailed kind which are no doubt essential in fundamental research. However, inter-disciplinary research applied to problems raised by very different human

populations requires a broad measure of communicability and comprehensibility. The use of an objective nomenclature may, moreover, serve as a background for tabulation and classification.

### 3.7.1 The two major approaches to research

This preliminary need for clarity having been established, two major approaches to research may be developed under MAB Project 2: a line which is mainly traditional but which is a necessary basis and which may be termed descriptive or structural and another more modern approach, which is typically functional. It is not easy to distinguish clearly between these two lines of research which represent two equally essential aspects of ecological research in particular with regard to the problems of marginal land. It can be seen, however, that in actual fact teams of researchers and research organizations have made their own choice and show fairly marked preferences. Liaison and easier communications should be established between the two interest groups in order to work in the inter-disciplinary spirit of MAB.

Such collaboration between the two trends is made even more essential in that any political choice on the utilization of these marginal lands can be a judicious one only if it can be based on records which are coherent and as full as possible. It is thus the task of the researchers who are consulted to make not only a detailed analysis but one which provides an understanding of the present situation and probable future trends.

Structural research. Structural study aims primarily at a description of types of physical, biological and human environment which is valid and serves practical ends. This entails a vast amount of research backed by abundant, although very heterogeneous, literature, as contributions come from very different and highly compartmentalized sources - climatological, geological, geomorphological, botanical, zoological, forest, geographical, socio-economic, etc.

One fundamental need is for a description of types of soil and vegetation, arranged in dynamic series. Many institutions and working groups are engaged on this topic but there is an unfortunate lack of liaison between them. Moreover, it cannot at present be claimed that the state of knowledge on the relationships between soil and vegetation is on the same level throughout the vast area of marginal lands. In particular, there is often complete disregard of the rôle of micro-organisms in such relationships.

In addition, the complexity of these problems is vastly increased by the activity, going back several thousand years, of human populations which have exercised and continue to exercise a particularly marked influence in the Mediterranean region. The task is therefore one of studying structures and dynamics - not only physical and biological but also human - which vastly broadens the problems. Thus, a study of historical data and also of the degree and nature of present pressures on soil utilization are essential.

In addition to research on human activity, there must also be a more co-ordinated development of climatological and biogeographical studies, and an effort must be made to distinguish between factors which depend on humans and those which depend on the climate and on other physical phenomena with regard to the origin and spread of marginal land. The endeavour to apportion responsibilities for the process of degradation of the Mediterranean land environment should be an abiding concern.

The practical aim of these studies should be to identify and evaluate the potentialities of such environments in order to provide a basis for making a rational choice with regard to utilization or objectives; this might be termed ecological development. The points which warrant particular attention in the context of Project 2 are therefore the processes of soil erosion, the requirements for constructive conservation oriented (wherever possible) to the re-constitution of forest cover, and the problem of actual and potential productivity with a view to the other possible uses.

In conclusion, it seems that the major problems in relation to this first aspect of research are the following:

- (1) the need for multidisciplinary co-ordination of structural research which should be achieved at certain focal points throughout the entire range of physical, biological and human sciences;
- (2) a deepening and broadening of knowledge on soil-vegetation relationships which should be extended to cover the microbiological level;
- (3) improving knowledge of the climate and of its impact on marginal land.

Functional research. The second approach to research, which we have termed functional, is designed to take into consideration the primarily physiological, bio-chemical and energetic processes which constitute, to use a now current expression, the circulation of regulatory information in the structure of ecosystems. This is a very broad and complex field of research and one which is strikingly topical and of fundamental relevance. It is a field in which ecology and physiology are combined and provide a basis for a deeper examination of quantitative and causal factors.

It must be acknowledged that attention is focused mainly on the first line of research which we have termed structural. As it provides a more immediate response to practical requirements, young researchers are naturally motivated in favour of a training which gives scope for intervention and action in relation to specific problems which ultimately entail consideration of socio-economic and political aspects of the environment.

As a result, research on functional aspects is all too often neglected even though it is of fundamental ecological relevance. Even a brief list of the most striking points would provide convincing proof of the need to stimulate on-going research and to develop new types of co-ordinated research throughout the critical field of the marginal lands. This would also provide a way and an opportunity to demonstrate that this functional line of approach is also capable of achieving a high degree of practical relevance. We shall confine ourselves here to a number of considerations which are likely to be of interest either from the point of view of basic science or from that of application.

In the first place, mention must be made of the problems of water dynamics and water balances which, in the degraded and semi-arid lands bordering the Mediterranean, are an aspect of absolutely crucial and sometimes almost dramatic importance.

Closely linked problems are those of nutritional balances, seen in terms of cycles of organic matter and of mineral elements, and this also implies a more detailed knowledge of biological action occurring in the soil. Nitrogen fixation should also be a matter of more than merely physiological interest and should become a subject of far more extensive eco-physiological research in view of the importance and urgency of the problems of enriching poor and exhausted soils.

The eco-physiological study of photosynthesis always occupies a central place particularly in relation to the fundamental problems of productivity and the processes of primary productivity.

The various adaptation strategies exemplified by biological forms, the facts of competition, of biological association with all its subtleties and the rhythm of the seasons are other examples of problems of great interest from the point of view of fundamental science and also in terms of their practical implications in which connexion close liaison should be maintained with structural research.



These examples and many others which might also be mentioned give an idea of the scope and complexity of functional research, which still remains too far behind more traditional forms of research. In the light of the situation, a number of observations can be made which raise further highly relevant problems concerning methodology and training.

It is therefore a matter for regret that there are still enormous gaps almost everywhere with regard to eco-physiology applied to ecosystems or sub-ecosystems of great scientific and human interest such as those of the marginal lands. The necessary methodologies, which in many cases are fairly sophisticated although less accessible, should be made more widely known through exchanges of persons and information. Progress, however, should be gradual and the need for complementary effectiveness should not be lost sight of in this activity. The two lines of research - structural and functional - should coexist in each individual country and in the same overall programme and should be kept reasonably in balance since each of them is as indispensable as the other.

Modern methods of work are particularly imperative in this field in which the number of variables and the volume of data go beyond traditional analysis (see Section 5.1 "Methodological considerations" on this subject).

### 3.7.2 Selection of pilot zones

Climatic diversity in conjunction with socio-economic diversity in the Mediterranean region makes the choice of pilot zones a difficult one. As the countries south of the Mediterranean afford very characteristic examples of climates of the arid type, the countries north of the Mediterranean should no doubt focus their attention more on damp climates in making their choice.

The work which has already been done in France in three research centres, one in Montpellier (CEPE L. Emberger of the CNRS), another in Marseille (Botanical Laboratory of the Saint Jérôme Faculty of Sciences), and the third at Avignon (Forestry Research Station of the INRA) with its field laboratory in Malaucène at the foot of Mount Ventoux has in part been carried out on a joint basis. The first mentioned centre comprises teams which are fully accustomed to the study of vegetation structures and others which specialize in eco-physiology and soil ecology; the second concentrates particularly on the phyto-sociological structure of vegetation in the entire range of areas bordering the Mediterranean; the third includes, in particular, ecologists who are specialists in problems of forest

entomology. Several teams of socio-economists have already worked with these researchers. The particularly detailed work on plant and animal ecology which has been conducted on Mt. Ventoux for the past ten years or so makes it reasonable to contemplate making it, in conjunction with its station at Malaucène, into a research centre for the area (see Annex 6). Similarly, an experimental tract of the CNRS, in the garrigue near Montpellier, is expected to play a complementary rôle. The necessary conditions have therefore been fulfilled as regards these qualified teams to achieve, in various forms, the required co-ordination.

### 3.7.3 Co-projects

In addition to this co-ordination project, plans should be made for focal centres of more or less extended sub-regional activity. Several delegations made proposals to this effect giving an account of work which had been done on marginal lands.

Greece. In Greece, the eco-physiological group of the Institute of General Botany of the University of Athens is currently specializing in studies on the structure, dynamics and metabolism of the phrygana and the maquis, on the adaptation mechanisms of Mediterranean species, and in studies which are also relevant to practical problems of reconstituting non-forest Mediterranean ecosystems.

Italy. The delegates of Italy pointed out that research of a structural nature on the garrigue-maquis series and on marginal lands of socio-economic importance has recently been launched and developed in the zone of La Tolfa (Latium) and in the Valley of the Agri (Basilicata).

Spain. Scientific support is proposed by the Instituto de Estudios Pirenaicos and Centro Pirenaico de Biología Experimental, both part of the Council of Scientific Research. For several years, these institutes, situated in Jaca, have conducted descriptive research projects involving geologists, biologists and specialists in the social sciences. The area under study covers some 500 km<sup>2</sup>, between the Pyrenees and the Central Elbe plain, is very degraded and has undergone a strong rural depopulation.

The studies have reached a functional research level and are conducted in the framework of the PBI. They are concerned mainly with the problems of primary productivity, the cycle of the mineral elements, and the dynamics and trophism of certain animal populations.

Although the principal concern of the pilot zone of the south-east, as outlined by the Spanish delegation, is to deal with problems of reafforestation, this zone also deserves mention here on account of the appreciable proportion of marginal lands which it embraces and in which there are acute problems of erosion in ecosystems made extremely precarious by over-grazing.

Yugoslavia. Lastly, in Yugoslavia, research on the ecosystems of Croatia undertaken by the Botany Institute of the University of Zagreb is focused on the vegetation of karst lands, in particular in the region of Gracac (very close to the Adriatic Coast).

#### 4. CONSERVATION PRIORITIES IN THE REGION

Although conservation problems are of vital importance, particularly in the Mediterranean region, there still does not seem to be sufficient awareness of them. In this connexion, the participants strongly emphasized the need, within the framework of MAB Project 8, to develop integrated and comparative research involving specialists from various branches. It will, however, be necessary in conducting such research to bear in mind the requirements of conservation, maintaining a balance between the social and natural sciences.

There is, indeed, a risk that the emphasis may be shifted either in favour of environmental protection, if nature is accorded greater prominence than human beings or, if the opposite is the case, towards regional development, which is not exactly the purpose of the MAB Programme. This balance must be observed as one of the criteria governing the choice of biosphere reserves, the rôle of which in moulding the attitudes of the public at large does not need to be emphasized.

What remains of natural and semi-natural ecosystems must at all costs be preserved through the creation of reserves, in particular biosphere reserves, in order to safeguard a heritage which is unique to the Mediterranean region. It is therefore necessary, with Unesco assistance, to take steps to draw up inventories of ecosystems, to describe their condition and to map them thematically. Such thematic maps should indicate the potential vegetation, thereby assisting in the establishment of protected areas within biosphere reserves with a view to establishing in them examples of natural ecosystems.

The function of such reserves in the field of research is not adequately clarified, and guidelines have still not been drawn up to enable the making of comparative studies with degraded and artificial ecosystems. However, the creation of a biosphere reserve should have the effect of stimulating scientific research and ensuring follow-up. It would be desirable to set up a group of acknowledged experts who could advise the Mediterranean countries and, with the help of established criteria, provide the necessary expert services.

##### 4.1 The proposed biosphere reserve network

The seven countries represented at Potenza indicated which reserves they would like to see included in the world network of biosphere reserves. These reserves (see Table 1), situated in the palearctic zone, a biogeographical province of the

Table 1. MAB Project 8: Network of biosphere reserves proposed for the European countries of the Mediterranean zone.

Country	Proposed Biosphere Reserve	Location	Approximate Size	Ecosystems
FRANCE	Camargue Vallée du Fango	Rhône delta Corsica	13,000 ha 3,400 ha	Wetlands; saline meadows; rich in migratory waterfowl evergreen <i>Quercus</i> sp.; various stages of maquis and forest
GREECE	Gorges of Samaria Mount Olympus Daphni	SW Crete NE Thessaly W of Athens	5,000 ha 4,000 ha 150 ha	High elevation (800-2,200 m) Mediterranean forest with <i>Cupressus sempervirens</i> , <i>Pinus brutia</i> , <i>Quercus</i> sp., <i>Pinus nigra</i> , <i>P. leucodermis</i> , <i>Abies</i> hybrids, <i>Fagus</i> , <i>Quercus</i> sp., Phrygana, evergreen sclerophyll, <i>Pinus halepensis</i>
ITALY	Circeo  Montedimezzo-Collemeluccio Pixinamanna - Is Cannoneris	Province of Latium, 90 km S of Rome 150 km E of Rome SW Sardinia	3,200 ha  420 ha 15,000 ha	Forest of evergreen and deciduous <i>Quercus</i> sp.; <i>Pinus</i> sp. coastal sand dune and wetland habitats  <i>Quercus</i> , <i>Fagus</i> , <i>Abies</i> forests  Some vestiges of <i>Quercus ilex</i> forest; otherwise degraded to state of maquis; fauna: <i>Cervus elephas</i> , local forms of <i>Felis sylvestrus</i> and <i>Sus scrofa</i>
PORTUGAL	Reserva de Castro Marim Reserva de Arrabida  Parque Nacional de Peneda-Geres	S Portugal 30 km SE of Lisboa NE Portugal	  60,000 ha	Wetlands and halophytic vegetation ("sapal"); abundant avifauna Mountainous region; coastal zone; forests of <i>Fagus</i> and <i>Quercus</i> ; maquis <i>Quercus robur</i> , <i>Q. pyrenaica</i> , <i>Q. suber</i> , <i>Pinus sylvestrus</i> , <i>Nardus stricta</i> meadows; fauna rich in reptiles and amphibians; populations of <i>Capreolus capreolus</i> and <i>Sus scrofa</i>
SPAIN	Ordesa-Vignemale	Pyrenees (Huesca province)	52,000 ha	<i>Abies pectinata</i> , <i>Pinus sylvestrus</i> , <i>Fagus sylvatica</i> ; alpine and sub-alpine meadows; rich fauna with chamois and <i>Capra pyrenaica</i>
TURKEY	Side Reserve	S. coast of Turkey (Pamphyllia)	100,000 ha	Mountain and lowland Mediterranean vegetation; <i>Cupressus sempervirens</i> forest; abundant avifauna
YUGOSLAVIA	Alps of Velebit National Park	145 km of Croatian coast	130,000 ha	"Sub-Mediterranean" ( <i>Quercus pubescens</i> - <i>Carpinus orientalis</i> ) on coast to <i>Fagus sylvatica</i> , <i>Ficea abies</i> and <i>Pinus mugo</i> in mountains; alpine meadows with <i>Sesleria juncifolia</i> ; rich fauna

Mediterranean Sclerophylla (to use the classification of Dasmann), cover the majority of forest ecosystems to the north of the Mediterranean basin from sea level up to the high altitude forests and even the alpine grasslands.

There is considerable variation in the standard of studies made in the proposed regions: sustained studies carried out by university laboratories; sporadic and piecemeal studies, etc. In general, there are few integrated studies involving, in particular, the social sciences. A number of reserves are equipped with field laboratories and others are planning to set up such laboratories in the near future.

The following brief survey of biosphere reserves indicates a number of shared characteristics: the sites selected are natural reserves created to protect rare species, remains of plant formations which have disappeared in other places or remarkable landscapes. It is therefore natural that the scientific research conducted in such reserves should focus in the main on vegetation, fauna or geology. However, in all or nearly all of them, human activities continue. Shepherds, foresters and even tourists use the areas designated as reserves and the question of excluding them does not arise except in the case of tourists who should be admitted only for the purpose of educational visits. Accordingly, it will be desirable to supplement biological research by studies on the human factor and its relations with the protected area both direct (exploitation of timber) or indirect (grazing).

#### 4.1.1 France

Camargue. The reserve which forms part of the Natural Regional Park of the Camargue covers some 13,000 ha in the Rhône delta in Southern France. It is mainly made up of ponds and sheets of water (8,600 ha), either salty or otherwise and of soils with a more or less strong salt concentration. The reserve has a characteristic halophilous vegetation in which plant associations of the Salicornion community are predominant. On its periphery, one finds groves of *Tamarix gallica*, and clusters including *Phillyrea angustifolia*. The vegetation of the dunes is entirely different and includes in particular a forest of *Juniperus phoenicea* which is unique in France. The reserve has long been known for its avifauna - migrants and nesting birds (egrets, flamingos, herons, ducks, etc.).

For fifty years, scientific studies have been systematically conducted on hydrological, geological, botanical and zoological aspects. Moreover, the reserve is now surrounded by regions which are farmed (particularly rice fields) and in which there is large scale industrial development (Fos). This makes it a pre-eminently

suitable site for the comparative study of the evolution of environments and of the effects of industrial zones on the natural environment.

Le Fango. Situated on the western slope of Corsica, the valley of Le Fango is one of the island's major natural regions and is little frequented except by shepherds. It forms part of the natural regional park of Corsica.

All types of maquis occur there at all altitudes and at practically all stages of degradation. However, the most striking feature is the forest of holm oaks which covers practically all the southern side of the Le Fango valley. The fauna is diversified and closely follows plant associations (mouflons and wild boars in the high mountains and low valleys). Traditionally this has always been a grazing region for transhumant flocks and a freely accessible region where the burning of vegetation is current practice.

A field laboratory installed in the forest has for the past three years provided accommodation for groups of researchers engaged in ecological studies on the maquis.

#### 4.1.2 Greece

Mount Olympus Reserve. The reserve, which was created in 1938, has a surface area of 4,000 ha and is situated on the eastern slope of Mount Olympus, a sacred spot in Greek mythology.

The main forest formations which occur there are of pine (*Pinus nigra* and *P. leucodermis*), fir (*Abies* hybrids), beech (*Fagus* sp.) and oak (*Quercus* sp.) as well as interesting annual and perennial species.

The spread of grazing, the river improvement works, the construction of roads and various other projects of a commercial nature have made constant inroads on this ancient national park which, in addition, suffered from the effects of the war and its aftermath.

Daphni: Site for the study of the phrygana. The Daphni Reserve, situated near Athens, embraces a characteristic example of various stages of degradation of a former forest environment with *Pinus halepensis* which, as a result of several thousand years of human activity, has become a phrygana.

The 150 ha site belongs to the Botanical Garden of the University of Athens which, for several years, has been engaged in research on the structure and dynamics of the phrygana; the physiology of seeds in various phrygana species; the structure of the leaves of sclerophyllous evergreens, etc.

Gorges of Samaria. The site of the Gorges of Samaria in the White Mountains in south-western Crete, hitherto protected by its inaccessibility, has been made a natural reserve in order to preserve this typical example of high altitude Mediterranean forests (*Pinus brutia*, *Cupressus sempervirens* and *Quercus* sp.) and of rare animal species such as the wild goat *Capra aegagrus cretensis*.

There is wide scope for study in this area, particularly studies comparing the preserved ecosystems of the reserve and those of the surrounding region which have been exploited agriculturally for thousands of years.

Moreover, it has been proposed that the biosphere reserve be extended to cover the whole of Crete which, on account of its geological history, its geographical situation, its climate, its endemic vegetation and fauna and the long period of human habitation, is a veritable natural laboratory.

#### 4.1.3 Italy

State Forest of Circeo. The forest reserve is part of the Circeo National Park, midway between Rome and Naples in the province of Latium. The forest is one of the last remaining vestiges of the great Pontine forest well known for its wooded, marshy landscape and also for its malaria, the struggle against which began as early as Roman times by means of drainage.

The recent introduction of eucalyptus and of *Pinus pinea* to control the water régime and to improve the soil have considerably modified the appearance and original composition of the vegetation. Only the 2,360 ha of the present state forest have been preserved almost in their original condition. A considerable part of the oak forest has been preserved and remains a fairly representative example of the conditions which prevailed in the former Pontine forest.

One quite special feature which is a fragmentary although striking reminder of the marshy landscape of Pontina is the "piscinae" which are flooded depressions of varying depth.



The variety of the stations and of the vegetation justifies the choice of this reserve as a biosphere reserve for it includes Mediterranean plain forests and humid zone forests.

Forests of Collemeluccio and of Montedimezzo. Two natural forest reserves were established in 1971 in the province of Isernia, in the Apennine range.

Collemeluccio consists of a forest of *Abies alba*, a survival or refuge of ancient formations of the central and southern Apennines. It is surrounded by an oak forest of *Quercus cerris* and by beech forests. During the two World Wars the forest was subjected to considerable damage which gave rise to serious pedological imbalances over a considerable area. The unusual fact that *Abies* and *Quercus cerris* are growing together, and the degraded state of the forest environment, offer interesting opportunities for the study of human activity, natural competition between species, the evolution of structures and productivity in the light of various ecological factors.

Montedimezzo, situated in the same region, is characterized by mature forests of *Quercus cerris* and *Fagus sylvatica*.

The creation of biosphere reserves in these two reserves is prompted by two causes: the existence in these two sites of forest problems characteristic of the southern mountains of the Italian peninsula; the presence of field stations which make it feasible to conduct scientific and technical research on a permanent basis.

Forests of Pixinamanna and of Is Cannoneris. The forest of Pixinamanna is situated in the south-western part of Sardinia on the territory of a future natural park in a hilly region the highest point of which (1,116 m) is the summit of Mount Is Varavius. The dense forest stretches over several tens of kilometres on a granite and volcanic soil but in general it has deteriorated and has become maquis as a result of thousands of years of human activity (grazing, fires, deforestation, etc.). The forest vegetation of the thermo-xerophyllous type is sub-divided in Italian literature on the subject into "macchia bassa", "macchia alta" and "macchia foresta".

#### 4.1.4 Portugal

Reserve of Castro Marim. The reserve, situated at the mouth of the Chanca in the extreme south of Portugal, near the Spanish frontier, covers a delta ecosystem which is a stopping place for numerous migrant birds. The saline and hydromorphic soil bears a halophilous plant formation known by the name of "Sapal". Studies made so far have focused on the soil, the vegetation and the avifauna.

Reserve of Arrabida. Situated in the district of Setubal to the south-east of Lisbon, the reserve protects a natural oak forest (*Quercus faginea*) and maquis formations. As a result of its accessibility and of the presence in summer of large numbers of tourists on the coast, the reserve is subject to considerable pressures. Studies are conducted there by the laboratories of the University of Lisbon.

National Park of Peneda Geres. The first Portuguese National Park was created in 1956, bordering the Spanish frontier in northern Portugal in a hilly region near the Serra Amarela. The natural forests of *Quercus robur*, *Q. pyrenaica*, *Q. suber* and *Pinus sylvestris* alternate with meadows of *Nardus stricta*.

Only the outer park is inhabited and equipped for visitors. Scientific studies have been carried out there with a view to creating the park and are still in progress (phytosociological, ecological, fauna and sociological studies).

#### 4.1.5 Spain

Ordesa-Vignemale. The proposed reserve consists partly of the National Park of Ordesa, established in 1918, facing the present National Park of the Pyrenees (France) and partly of the hunting reserve of Vignemale, established in 1966, in the central part of the Pyrenean mountain range. It covers a surface of 51,396 ha.

This zone is of interest in several respects: the existence of interesting flora (forests containing *Abies pectinata*, *Pinus sylvestris*, *Fagus sylvatica*; alpine pastures and alpine meadow). This flora is protected within the confines of the National Park whereas forestry operations are authorized in the reserve. Wild fauna, particularly avifauna, is rare. Certain human activities continue to be practised: grazing, forestry, regulated hunting (exclusively in the reserve). Moreover, the impact of tourism in the region of the park is considerable.

A great deal of scientific work has been conducted in this zone, including studies of flora, fauna and geology, and it would be desirable to make a compilation of these. Other research projects might be undertaken, either on isolated topics - study of the population of izaras, measures to protect the ibex - or interdisciplinary - forest-pasture relationships, forest-wild fauna relationships, impact of tourism, creation of genetic reserves.

#### 4.1.6 Turkey

Side reserve. The Side reserve which has been suggested as a biosphere reserve covers an area of 100,000 ha along the coast extending as far as the spurs of the Taurus Mountains in southern Turkey.

This reserve is of interest because of the wide variety of environments which it exemplifies, extending as it does from the coastal zone with its marine resources to the slopes of the Taurus mountains where there are ecosystems unique to the Mediterranean region. In addition, there are natural forests of *Cupressus sempervirens*, a rare Mediterranean vegetation and an interesting fauna. The reserve also contains numerous vestiges of past civilizations, Greek, Roman (Side).

This combination of factors makes Side an exceptional natural laboratory offering numerous scientific possibilities. The Turkish authorities would like to make the reserve a research and training centre of Mediterranean scope for the study and conservation of the natural environment.

#### 4.1.7 Yugoslavia

Velebit Alps. The future National Park of the Velebit Alps stretches for 145 km along the north coast of the Adriatic in a sparsely populated region which has not yet been subjected to the impact of tourism. It varies in width between 5 and 15 km, includes the first range of coastal mountains and offers examples ranging from the main vegetation stages of Croatia, sub-Mediterranean forests with *Quercus pubescens* and *Carpinus orientalis* to the northern forests with *Picea abies*. The region of the Park is an important genetic reservoir rich in neo-endemic plants. There is also a singularly varied fauna.

Three self-contained natural reserves, which are the responsibility of the Forestry Department, already exist within the confines of the Park as well as a botanical garden which has a collection of a large number of typical species of local flora.

The studies hitherto undertaken have focused in the main on the vegetation and on the mapping of the real and potential vegetation. Other studies have been carried out by the Institute for the Protection of Nature with a view to the creation of the national park: conservation of resources, improvement of natural characteristics, etc.

At the regional level, the Park of Velebit is an excellent example of the coastal zone of the province of Illyria, with characteristic vertical zoning of the vegetation.

#### 4.2 Other proposals for the preservation of genetic diversity

The biosphere reserves provide for the preservation of groups and also of systems which are subject to the effects of inter- and intra-specific competition. The preservation of a particular species which is of interest owing to its characteristics or its genetic potentialities may necessitate other forms of protection such as the preservation of seed in gene banks or the development of certain species by means of propagation in a specialized botanical garden. Such techniques are easier to apply with respect to plants than with respect to animal species.

Attempts have already been made by certain countries to preserve the genetic plant heritage. In the Mediterranean region a gene bank has been set up in the Island of Porquerolles (France) for the vanishing or threatened species of the region. The bank is under the authority of the Directorate of the National Park of Hyères. Studies are made there on methods of conservation and propagation, bearing in mind the necessity to alleviate the possible inconveniences of the method (genetic shift, hybridation, etc.). There are plans for the possible use of seeds in order to reintroduce certain species in their natural environment.

International co-operation is indispensable, because some of the seed will have been acquired through the *Index seminum*, published by the traditional botanical gardens. There are plans for seed gathering and exchange missions in order to conserve and even to develop other threatened or remarkable species. This gene bank will be made available for use by all countries, establishments and researchers who also will be able to provide or deposit specimens.

With regard to the preservation of animal genetic resources, the United Nations Environment Programme has drawn up a list of projects some of which concern the listing of breeds of sheep and cattle in danger of extinction and particularly those breeds of sheep which are vanishing in Mediterranean Europe.

The French and Italian delegations emphasized the importance they attach to the preservation of local breeds (which are often more productive in their own environment than "improved" genotypes), and they suggested a research programme on the adaptation and aptitudes of such breeds in relation to the local conditions in which they originated.

## 5. NEEDS WITH REGARD TO INTERNATIONAL CO-OPERATION

### 5.1 Methodological considerations

It was clear from the discussions both in working groups and in plenary meeting that considerable progress needed to be made with regard to methodology, particularly in the fields covered by MAB Projects 2 and 8. In particular, insufficient use was made of systems analysis, and modelling had not yet become the preferred means of ecological data handling. These are, however, methods which make it imperative for participating disciplines to co-ordinate their action and to achieve true integration.

As a result of these shortcomings, present activity at the level of the organization of research - and consequently training - has not achieved a rational and sufficiently effective form, and the required balance between human and biological sciences remains to be found.

In general terms, the following two major problems arise: (1) the study of methodology and of the co-operation and integration between scientists working on projects in the MAB programme; (2) the critical appraisal of methods and techniques as a means of obtaining data in the field which are useful to researchers in different disciplines.

As such problems are among the most important and also among the most difficult to resolve in a programme such as MAB, it would be more effective to discuss them on the basis of research which had been undertaken with a view to precise goals.

Accordingly, on the occasion of the forthcoming Mediterranean meeting in Montpellier, the MAB National Committee of France could hopefully submit a specific example of the systematic application and utilization of modelling, demonstrating how the Montpellier research team attached to the Ecothèque méditerranéenne and the Centre L. Emberger incorporates these research tools in the organization of their programmes.

The participants also hoped that this presentation would take different forms: on the one hand bringing out the general advantages of this type of method for the benefit of the meeting as a whole and, on the other hand, focussing on a discussion and a comparative study of methods used in the field but, in this case, for the benefit of a small group of experts with different training backgrounds and engaged in different disciplines. This latter part might take place in the Cevennes National Park, for Project 2, and in the Camargue, for Project 8.

It was proposed that, after the Montpellier meeting, another meeting be organized in 1977 at one of the field centres (see below) and should be concerned especially with questions of methodology and of techniques of data and information acquisition. It was even suggested that the National Committees might hold methodology sessions in the course of their meetings with the participation of researchers from other countries.

In addition, the following two rather special points were considered:

- (1) Systematic use of modern techniques, including those of remote sensing, should be used in tackling the integrated mapping of the area surrounding the Mediterranean in order to promote more effectively the restoration of the ecological balance which was the objective basis of territorial development. In research, and also in integrated mapping undertaken on a co-ordinated basis by the Mediterranean countries, it was essential to reach agreement on the standardization necessary to obtain comparable data which were capable of being synthesized. An agreement would therefore have to be drawn up by the MAB National Committees of the Mediterranean countries.
- (2) The participants expressed concern at the inadequate development of research on the functioning of ecosystems - research which required the formation of highly specialized teams of researchers.

In conclusion, the experts drew attention to the methodological inadequacies of research currently under way, which were already apparent at the preparatory phase of any research activity and have created a poor balance between the disciplines concerned or the omission of certain indispensable disciplines. Models were still used all too rarely. Even if more should not be expected of predictive consequences, it should at least be borne in mind that they represent the modern method of checking hypotheses made with regard to the functioning of ecosystems and even of checking whether the choice of data gave the best chance of pin-pointing the actual situation. It was also no doubt the best means of establishing, with reference to each problem, the objective weight of ecological data and of socio-economic data in particular in relation to each other.

It would also be important to know the list of centres for the promotion of methodology concerning MAB Projects 2 and 8. The Ecothèque méditerranéenne at Montpellier, which was initially geared primarily towards the problem of Project 3, is now in a position to provide useful support for Projects 2 and 8 as well. It was to be hoped that the inventory of these centres would give an idea in particular of what facilities they had for foreign researchers and of the financial resources which would enable the latter to work there. The Mediterranean countries should indicate precisely their requirements in this connexion.

## 5.2 Exchange of information

It is clear that the situation expressed above is largely the result of the inadequacy of information and sometimes even the total lack of information, with regard not only to research, its aims and methods but also with regard to the training which should stem therefrom.

The meeting laid the greatest stress on this shortcoming, to which the slow pace of progress and the other imperfections were largely attributable.

The next section, which deals with the training of personnel, surveys the various methods contemplated. It is clear that all training courses, seminars, symposia and meetings, whether formal or otherwise, should tackle not only the issue of training, which is discussed below, but should also ensure that information is circulated on the projects of the MAB Programme, on their state of advancement, on both successes and failures and on the lessons which should be learned from them. This was the only means whereby a MAB spirit could come into being capable of communicating the conviction which was essential if the ambitious and often difficult goals of the different projects were to be achieved.

## 5.3 Training of personnel

It was noted, at various levels, that a large number of training courses dealing with ecological problems and problems of the management of natural resources in the Mediterranean world, in the fields of research, techniques and the administration of territorial improvement are already in existence. A number of post-graduate courses organized with Unesco assistance and, in some cases, with the assistance of UNEP (see Annex 6) are of great value.

But in view of the large number of such courses, made necessary in particular by problems of language, it is difficult to be aware of both duplication of effort and of omissions. The wish was therefore voiced that an inventory of all existing courses relative to MAB Projects 2 and 8 within the Mediterranean framework be drawn up to enable a comparison of their goals and operation. When the inventory was completed, it would be possible to see whether the existing network was in keeping with requirements and how it might be improved. Nevertheless, it already seemed clear that too little emphasis was still placed on the human sciences in such training courses.

The inventory should not deal exclusively with general and permanent courses but should also comprise specialized and occasional courses in connexion with which much probably still remains to be done. Some such courses should be held in order to give participants trained in a group of disciplines information on the working methods and ways of thinking of other groups of disciplines. This ought to provide for better understanding between researchers, in particular those in the human sciences on the one hand, and in the biological sciences on the other, and should improve integration in team work.

The participants were appreciative of the flexibility offered, in particular, by the *à la carte* courses given by the Centre international des hautes études agronomiques méditerranéennes (CIHEAM), with its three institutes at Bari, Montpellier and Saragossa. Moreover, the experts noted with satisfaction the plans for the creation by this centre of a course on "Rural development relating to the environment" at the Saragossa Institute and of a course on "Management of Mediterranean forest ecosystems" as part of its programme which was still to be approved by its Governing Council (see Annex 7).

In any case, the participants very much hoped that Unesco and UNEP would be able to step up their financial assistance for fellowships to increase the number of participants, in particular from developing countries, and to promote practical instruction in the field.

Particular attention should be paid to the training of technicians. Although such training could in part be provided in the field under the guidance of researchers and with reference to specific problems, there nevertheless remained a gap in connexion with the training of technicians in highly specialized fields such as automatic data collection, programming and modelling.

Particular interest was shown in the field centres. In view of the difficulties of reaching an understanding of the technical problem and the difficulties of involving scientists from different disciplines in MAB research and training programmes, the experts considered that it was essential to utilize the field centres already in existence in the principal Mediterranean regions, the purposes of which are indicated below.

These centres might provide field training courses at the post-graduate level and also further training courses for young research personnel. The main objectives would be the gathering of data and information in the field, the methodological



problems raised by the utilization of such data, and integration techniques. Group discussions, in particular bringing together specialists in the natural and human sciences, would focus on problems of co-operation raised by the drawing up and execution of MAB training and research programmes.

The meeting took note with interest of the proposal that the Potenza Centre be used for the above-mentioned purposes. Ventoux, with its station at Malaucène (see Annex 6), might also play a similar rôle.

The pilot zones, already defined in the foregoing chapters, provide a means of localizing the specialized studies for the organization of which each country assumed responsibility. These zones should make it possible to benefit from acquired and accumulated experience and to provide the best possible training for researchers and technicians from all the countries concerned. It would be desirable for Unesco to support this exchange of researchers and technicians.

## 6. RELATIONS WITH INTERNATIONAL ORGANIZATIONS AND PROGRAMMES

### 6.1 Food and Agriculture Organization of the United Nations (FAO)

Mediterranean landscape and forest genetic resources are both subjects in which the Forestry Department of FAO is greatly interested, and with which it has long been involved. Almost 65 years ago, in 1911, Robert Hickel launched the idea of Mediterranean forestry co-operation, and in 1922 a small group of foresters and naturalists from France, Italy, Spain and Yugoslavia met in Marseilles to set up a Mediterranean forestry league under the name of *Silva Mediterranea*. FAO's Sub-Commission on Mediterranean Forestry Problems held its first session in Rome in 1948, and one of the conclusions of the session reads as follows:

"The degraded condition of existing forests is due in large measure to unrestricted grazing, particularly by goats and sheep, which raises the whole problem of a fundamental change in the way of life of large sections of the population. Remedial measures can only be effected through intimate co-ordination of all governmental and communal authorities concerned with forestry, agriculture, grazing, water engineering, and social welfare. Continued planning is essential".

In 1956, at the fifth session of the Sub-Commission on Mediterranean Forestry Problems, it was proposed to give the name of the former Mediterranean forestry league, *Silva Mediterranea*, proposal which was accepted. On this occasion, FAO wishes to have Unesco collaborate with the sub-commission in the Mediterranean forest field.

Twenty years later, at the Potenza meeting, this wish has nearly become a reality with the creation of study projects and themes, both for MAB Project 2 and *Silva Mediterranea*, and the response to the need for international and interdisciplinary co-operation long felt by the Mediterranean forester.

Before turning to MAB Project 8, it might be worth mentioning certain activities carried out by, under-way, or being contemplated in FAO in fields which are germane to those covered by MAB Project 2, so that they are not neglected when decisions are taken as to what should be done, and by whom, in the future.

Such activities relate to sand-dune fixation, watershed management, a proposed inter-country programme for the mobilization of the forestry system in the development and management of marginal areas in the Near East Region, a proposed UNEP/FAO global programme for the detection and control of forest fires for the protection of the

human environment, and to a Seminar on Forest Fire Management to be organized jointly with IUFRO in the Mediterranean region of France in 1977.

As for MAB Project 8, it will suffice at this juncture to draw attention to the UNEP/FAO study "The Methodology of Conservation of Forest Genetic Resources", the report of the Third Session of the FAO Panel of Experts on Forest Gene Resources, and especially to "Forest Genetic Resources Information No. 4" (particularly pages 21, 24, 37 and 38 dealing specifically with activities in the Mediterranean region), all recently issued by FAO which describe in detail the accomplishments, the intentions, and the hopes of FAO's Forestry Department in this field for the next five years.

## 6.2 Council of Europe<sup>1</sup>

An International Colloquy on the specific problems of plant cover renewal in the Mediterranean area was held in Cagliari from 27 to 31 October, 1975, under the patronage of the Council of Europe at the kind invitation of the Italian Ministry of Agriculture and Forestry and the Autonomous Region of Sardinia. Some information on the colloquy is given below as its theme was closely related to the MAB meeting in Potenza. At this point the close co-operation between the Council of Europe and Unesco to ensure complementarity of activities should be mentioned.

The Cagliari Colloquy dealt with the following five major topics:

- (1) possibility of natural renewal of plant cover;
- (2) integrated ecological planning considered as the basis for environmental management;
- (3) natural forestry as an aspect of ecological management;
- (4) the possibility of forestry which is not strictly natural;
- (5) ecological and economic considerations relating to forestry policy.

Participants in the colloquy recommended among others:

- (1) that an international symposium should be held under the aegis of the Council of Europe on the relations between flora and fauna in the Mediterranean basin, and that Italy should be the organizing country;

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1. Statement submitted to the MAB Secretariat in written form for inclusion in this report.

- (2) that a special section for typical Mediterranean forest environments which were threatened with extinction should be included in the European network of bio-genetic reserves set up by the Council of Europe;
- (3) that the Council of Europe, in conjunction with Unesco (MAB Programme), IUCN and other international organizations, should organize a registration and supervision system to ensure that the above-mentioned network continued to function;
- (4) that the other countries of the Mediterranean basin should as quickly as possible designate reserves for this network, in particular by making available Mediterranean biotopes which were worthy of preservation, following the example of Italy, which has stated its readiness to designate other existing natural reserves.

The full text of the final conclusions of the colloquy may be obtained from the Council of Europe by asking for document 43.833-09.3.

### 6.3 International Union for the Conservation of Nature and Natural Resources (IUCN)

At the 12th General Assembly of IUCN held in Kinshasa, Zaire, September 1975, the Programme of IUCN for the next three years was defined. This programme involves a series of regional and sectoral activities focussing on the conservation of nature, species and biotic communities, but integrated with the development objectives of the nations concerned. A time schedule for the regional activities has been approved in which, during 1976, principal emphasis will be placed on the South Pacific and South East Asia, moving in 1977 to a planning phase for the Mediterranean region, followed by an action phase during 1978-1979. It can be expected, therefore, that IUCN will be placing a strong emphasis on conservation in the Mediterranean region during these coming years, and will of course integrate any of its activities with those being carried out under the MAB Programme.

In the meanwhile, however, two other programmes of IUCN have been underway which have a direct and immediate bearing on conservation in the Mediterranean. These are the marine conservation programme (including coastal areas) and the wetlands conservation programme. During 1975 a survey of existing and potential marine parks and reserves in the Mediterranean has been carried out by an IUCN consultant, Dr. Hédia Bracer. The results of this survey will be presented to an Expert Meeting on Marine Parks and Wetlands in the Mediterranean Area, to be held in Hammamet, Tunisia, in Autumn 1976 convened by UNEP. A similar survey of wetlands of the Mediterranean has been carried out by another IUCN consultant, Mr. Erik Carp, and these results will also be presented at the meeting and an action plan shall be the

outcome. The reports of those surveys will be made available to MAB, along with the other proceedings of the meeting.

Marine areas to be recommended for protection will in most instances have upland components, either on the continental mainlands or on islands. All of them are in the coastal zone, and not the open sea, and can be considered to fall within the concern of the MAB Project 8.

IUCN is prepared to assist governments in carrying forward their conservation programmes, either directly or by arranging for proposals to the appropriate inter-governmental agencies.

#### 6.4 Silva Mediterranea

Following the reorganization of the Commissions of FAO, the Committee of Forest Research has become an integral part of the present AFC/EFC/NECF Committee on Mediterranean Forest Questions - *Silva Mediterranea* - formed in 1970. The basic guidelines which underlie the activity which has been carried out were adopted in the light of ongoing research projects in the various countries and of the study themes listed in Annex 4. The recent Project 4 bis, entitled "International experiments on the origin of *Pinus halepensis* and *P. brutia*", should be added to these.

At the last session of *Silva Mediterranea*, held in Ankara in 1970, study topics suitable for inclusion in the programmes drawn up by Unesco were proposed to FAO. Attention was once again drawn to this at the Potenza meeting.

Indeed, decisions concerning activities to be undertaken as part of MAB Project 2 correspond fairly closely with the following research topics formulated by *Silva Mediterranea* and its research committees:

- (1) influence of Mediterranean plant formations on the water balance of drainage basins;
- (2) use of trees and forage shrubs for reforestation and range-land development programmes;
- (3) use of controlled fires as a means of protecting the Mediterranean forest;
- (4) impact of tourism on Mediterranean forest ecosystems;
- (5) use and limits of fast-growing broad-leaved trees and conifers in reforestation programmes in the Mediterranean region.

The integration of these projects in Project 2 would thus enable Silva Mediterranea to concentrate its limited resources on the other projects and topics, the definition of which is not included among the preoccupations of MAB.

It would, however, be desirable that the meetings of Silva Mediterranea should take place on the occasion of MAB Project 2 meetings, in order to enable these complementary activities to progress side by side in the general interest of all the Mediterranean countries concerned.

In order to facilitate participation at these meetings of the co-ordinators of research projects or topics of Silva Mediterranea, it was recommended that the MAB National Committees of the countries concerned should involve these co-ordinators as closely as possible in the activities of their respective committees dealing with such topics.

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## STATEMENTS BY COUNTRIES FROM THE REGION

## FRANCE

The Mediterranean Forest. The Mediterranean forest in its entirety is the subject of the research programme directed by Professor Quezel at the University of Aix-Marseille. The objective of the project is to provide sufficient knowledge of the Mediterranean region forest systems by first integrating phytosociological, dynamics, bioclimatic and pedological data, thereby enabling a precise analysis of forest and grazing-land productivity and of the functioning of the ecosystems. Strong emphasis is placed on the basic problems raised in the conservation and protection of the original forest resources chiefly in relationship to fires, grazing and human activities. This project should be carried out in close collaboration with the "Mediterranean grazing lands" section of MAB Project 3.

International co-operation with Italian, Moroccan, Algerian, Tunisian, Greek, Turkish, Syrian and Lebanese ecologists has already been established within the framework of this project. Once the project is underway, other scientists from the research laboratories of these countries as well as specialists in forestry techniques in biopedology, entomology and land use should be included.

The first part of the research programme, "Phytosociological, dynamics, bioclimatic and pedological data", is well in progress, particularly in the following areas of the Mediterranean basin:

- (1) in France, it is practically completed in Provence and in Corsica;
- (2) it has begun in Syria and Lebanon in accordance with the Lebanese CNRS and the University of Alep;
- (3) it has been initiated in Italy, Greece, and Turkey (missions, research worker exchange programmes) and has commenced in North Africa;
- (4) exchange schemes with research workers in Spain were started in the spring of 1975.

The first stage of research will be carried out in the following three pilot areas:

- (1) in North Africa, where a study of the cedar plantations of the Middle Atlas, the forestry groups of the Kabyle coastal zone of Kroumirie and the forests of the Tunisian dorsale is planned;
- (2) in Southern Italy, with a study of the forest plantations of the Pouilles of Lucania and Calabria;
- (3) in the Eastern Taurus, the Syrian and Lebanese coastal regions with specific studies of forests of *Pinus brutia*, *P. nigra pallasiana*, *Quercus* forests and cedar and fir plantations.

An equivalent programme is envisaged in Spain (see statement of the Spanish delegation). The implementation of the first stage of the research programme should require three to four years, with the understanding that new French and other research teams should be based in North Africa, Sardinia, Sicily, Greece and Turkey. The second stage will commence in 1976, and will have as its objective to study, in close co-operation with the researchers participating in the first phase, the problems of forest management and productivity, as well as the functioning of the ecosystems. The co-operation of forestry services and research centres is necessary, and has already been established in France, Spain, Italy, Greece, Tunisia, Morocco and Lebanon. The Algerian, Yugoslav and Turkish forestry departments could also participate in this project.

Independently of the above programme, but in conjunction with the University of Marseille, the General Delegation to the Scientific and Technical Research (DGRST) has taken the following concerted action in the Ventoux mountains bordering on the northern Mediterranean region in order to:

- (1) determine and evaluate the different types of environment which are representative of Mount Ventoux, including their climatological, pedological, botanical, zoological and forestry characteristics;
- (2) study certain aspects of these environments, e.g. climate-soil-plant-fauna interactions;
- (3) know the extent of the human impact, particularly at the forest level (deforestation of the previous centuries, massive afforestation during the past century).

This joint activity has created a very positive collaboration between researchers from diversified fields. It has likewise provided a synthesis of the data (a map of the environment) which can be utilized by regional planners.

Studies on *Quercus ilex*. Certain forest species, of limited interest in terms of productivity e.g. the holm oak (*Quercus ilex*), play an important part, however, in soil protection and the improvement of the human environment.

A regional study on *Q. ilex* is planned by the Laboratory of Botany of the University of Aix-Marseille and a department of the National Institute of Agronomic Research (INRA), in order to establish a quantitative relationship between the productivity of *Q. ilex* and the variability of local climatic factors; to analyze the variation of this relationship on the Mediterranean basin according to bioclimatic, pedological and phytosociological situations; to study the influence of forestry techniques, human and flock activities on the productivity of the forest ecosystem.

This programme could be carried out in different stages. It would firstly seek to obtain a deeper knowledge of the forests of

*Q. ilex* in France and in North Africa from a bioclimatic, pedological and phytosociological viewpoint and to define the methodology for acquiring parameters of productivity and collecting basic climatic data. Work could be undertaken in the following areas:

- (1) in calcareous France: in the Ventoux, in the Gapeau Valley and near Montpellier;
- (2) in siliceous France: in the Aigoual, the Maures and in Corsica in the Fango Valley;
- (3) in Morocco, in the Azrou-Ifrane area (humid/cold), the Beini-Mellal (sub-humid/cool), the Segrou region (sub-humid/cool) and at Chattba (semi-arid/cool);
- (4) in Algeria, at Chrea (semi-arid/cool), in the region of Tlemcen/Sidi Bel Abbes (semi-arid/cool - sub-humid/cool), in the Cheliah (semi-arid/cool);
- (5) in Tunisia, at Oum-Jdour (semi-arid/cool) and in the region of Kef and of Ain Draham (sub-humid/cool, sub-arid/cool).

The second, and more routine stage, would be to collect both the biological and physical data. It should be followed by a correlative analysis of these measurements to attain the above-defined objectives.

The third stage, through a comparative analysis of the bioclimatic sites, would be to apprehend the impact of the pedological factors as well as that which is evident of the hydrological and geothermic balance.

This programme would of course include the collaboration of the governments of the countries involved, namely: Algeria, Greece, Italy, Morocco, Spain and Tunisia.

Studies on natural fir plantations. In the French Mediterranean region other types of forests are imbalanced or nearly so. This is especially prevalent in the numerous fir plantations, either natural (*Pinus pinaster*, *P. halepensis*) or artificial (*P. nigra*), which have suffered from fires, ravagers (*Matsucoccus feytaudi*) and tourists. One means of combatting this situation is to determine how the use of certain species, either new or unknown, could be used in a beneficial manner, and, if so, to study and expand on this practice. *Cedrus* and *Pinus pinea* could be used as examples. These two species have only been introduced empirically in France, with little and fragmentary research. Studies on these two species should be combined in order to foresee their potential rôle in a stable, aesthetic forest which could withstand biotic pressures.

International co-operation exists already for the study of these species, namely between the Laboratory of Botany of the University of Aix-Marseille and the University of Beyrouth as well as between the Department of Forestry Research of the INRA and the forestry research centres of Italy (Florence and Arezzo), Spain, Tunisia and Morocco. Furthermore, Silva Mediterranea, together with certain working groups of the International Union of Forestry Research Institutes could develop research in this area. In France, three organizations are participating in a programme on the cedar and stonepine: the Institut National de la Recherche Agronomique (INRA), the Centre d'études phytosociologiques

et écologiques de Montpellier (CEPE) and the Laboratoire de botanique of the Université d'Aix-Marseille.

The following problems are being studied for *Cedrus*:

- (1) determine the exact possibilities of this species in the south of France;
- (2) find its most favourable provenances for this region;
- (3) study the means of combatting certain difficulties;
- (4) specify the conditions for its more or less strong resistance to forest fires and to eventual insect or fungus assaults;
- (5) propose a consequent proper silviculture, from the seed stage to that of the development of older stands.

The following problems are being studied for *Pinus pinea*:

- (1) further studies on its distribution in France, its ecological demands and its possibilities for extension in maintaining biological balances;
- (2) specify the best origins and understand its growth elements, namely at a young age;
- (3) study its resistance to insects, cryptogamic diseases and fires;
- (4) consequently propose possible new uses and a rational silviculture in France.

An oriented inventory of existing stands for the two species is in process, with a selection of the most homogeneous types, on different types of stations, and a geographical definition of the points where the joint studies will be carried out. A phytosociological and bio-climatological study is envisaged for the principal selected stands, on planted areas as well as natural plant surroundings. Emphasis will be placed, however, on the study of the genetic variability and the best means of plantation for the cedar. A parallel investigation will be made of the bio-ecology of the ravagers present in the French cedar plantations (particularly the *Epinotia cedricida* and *Cedrobium laportei*).

Mention should also be made of the *Pinus pinea*/soil studies being conducted in a representative station west of the Rhône by a team of the CEPE.

Protection of Mediterranean forest ecosystems: fires parasites and pathogenic fungus. In the French Mediterranean region, the forest is constantly menaced by fires which are, one could say, part of its ecology. However, the wide extent of this phenomenon (68% of the planted areas have been touched by fire in sixteen years) which causes the progressive deterioration of the forest cover, has led the French government to develop a Mediterranean forest fire protection programme with particular action directed in the Maures (see Section 3.2), Corsica and the Herault. This programme, the aim of which is to progressively decrease the surface destroyed by fires each year, is founded on the following three forms of application:

- (1) preventive actions, including education, informing the general public, forest-land maintenance and management, detection and alerts;
- (2) active land and air fire-control;
- (3) co-ordination and research (deterrent products, specialized material, meteorological and topoclimatological studies, flammability of species).

The reconstitution of the forest by natural regeneration or by the introduction of new ornamental or productive species is also included in this programme.

As concerns the ravagers of the Mediterranean forests, a bio-ecological programme of concerted international action, drawn up in Madrid in 1969, is being carried out in Spain in the Mora de Rubielos area near Teruel, whereas specific, in-depth research is being conducted in France at Mont Ventoux and in Corsica (Forest of Valdo Niellu). The studies should open perspectives on the methods for determining indications whereby definite prognostics of possible pullulation of a ravager insect, of any species, could be established. This objective is linked to economic issues as concerns both production losses and the maintaining of biological equilibria.

The ravager insect is to be considered as one of the components of the ecosystem and one of its most significant indicators; its impact cannot therefore be arbitrarily isolated from the forest framework in which it intervenes. As a result, other environmental factors susceptible of increasing an overall imbalance (edaphic and climatic environment, structure of the plant stands, system of utilization, etc.) can be considered, and a programme of integrated prevention can be developed.

A programme of this nature to combat the *Lymantria dispar* in the Mediterranean pine forests is in preparation. The principal scientific objectives are the following:

- (1) in priority, definition of a standardized methodology to evaluate the qualitative and quantitative criteria of the *L. dispar* gradations in various forest ecosystems (in more or less anthropised monospecific stands as in mixed stands);
- (2) study the components of the biocoenoses to distinguish the link between *L. dispar* and the other organisms of the forest environments (vertebrates, arthropodes and entomopathogenic micro-organisms), without omitting the secondary effects of phytosanitary interventions, means of forest development and the problems related to the environment;
- (3) investigation of the utilization of biological agents in controlling *L. dispar*.

Studies are also in process on the conditions for restoring the balance of a forest ecosystem disrupted by a new aggressor, *Matsucoccus feytaudi*, which attacks the *Pinus pinaster* causing branches of this species to fall off (around the age of twelve years).

The observations are made namely on the mortality, the morbidity and the survival of natural regeneration trees, on a network of

132 observations cells set up to reflect the environmental variations.

Fungus is of the largest groups causing diseases of the trees. Among these groups, *Endothia parasitica*, which causes cankers on the trunks of coppice chestnut trees in Northern Italy, has been particularly examined. Studies were made on the resistance mechanisms of the trees (spontaneous cicatrization of the cankers), strains of *Endothia* (degree of variable virulence) and the trial introduction of hypovirulent strains in chestnut plantations where they did not exist (chestnut plantations of the Maures).

#### Mediterranean forest ecosystems and grazing.

Mediterranean animal husbandry has the following three principal features, closely associated with the geographical partitioning of the countries of this basin (insular phenomena, often-arid dominant mountain massifs with narrow coastal plains):

- (1) an equilibrium between the forest and the grazing lands utilized by local breeds well adapted to the environment. The forms of animal husbandry differ according to the regions: sedentary (Italy), seasonal transhumance (South of France) or nomadism (Sardinia, North Africa);
- (2) large proportion of mountainous grazing areas with low productivity in comparison to the plain parameters with more limited surface areas but with strong potentials;
- (3) ancient human societies, in a state of deterioration, whose traditional economy is often composed of a separation between agricultural and animal husbandry activities.

Rural depopulation in the industrialized regions to the north of Europe as well as the development of tourism in all its forms have created, and then accentuated, an imbalance by the absence of the utilization or competition in the development of the soil and vegetation; this has led to a deterioration and haphazard valorization of the latter, e.g. disappearance of terraced cultivations, extension of maquis.

Finding land-use systems which would re-establish and maintain a biological balance in these regions, indeed an optimal utilization of the natural resources, falls within a new social and economic context in which several arguments can be made in favour of a development of zootechnical research in connexion with other disciplines and in particular with forestry research. The Mediterranean animal husbandry situation, in a fragile ecological context where the agricultural economy has declined following depopulation, offers possibilities of association between animals and forests, in certain areas, during particular stages of utilization of the latter or in fire breaks (maintained by animals). Moreover, the plus-value of animal husbandry can be useful during the capitalization stage of forestry development.

In view of the preceding ideas, an interdisciplinary programme combining French and Sardinian foresters and zootechnicians will be undertaken, based on the following observations:

- (1) in the low and middle-altitude Mediterranean region, the principal function of the forest is the protection of the environment - not wood production;

- (2) the most suitable forest for protection in the Mediterranean zone is the forest of *Quercus* sp. (*Q. ilex*, *Q. suber*, *Q. pubescens* association);
- (3) the best maintenance of this forest (against brushwood) is ensured by animals who can eliminate up to 50% of the annual growth.

From these observations, the link between animals and the forest can be studied under the following angles:

- (1) study of the physical action of animals on forests: pinpointed observations made in several places, at different periods of the year with different animal carrying capacities of varied species and genotypes, on forest land cells at different stages of their evolution. It would be of special interest to analyze the problem of competition between the species (or of complementarity, study of the intake biotope of species), as well as the behaviour of the animals of local stock in comparison with "improved" genotypes;
- (2) measurement of the animals' intake: a) direct measure: evaluation of the vegetation consumed, monitoring the quantity of faeces; b) indirect measure: changes in weight and milk production;
- (3) synthesis experiments: behaviour of a flock utilizing the forest in conditions compatible to its development and its regeneration; measure of the productivity of a flock living on the forest resources available for animals and specification (quality, quantity, period) of resources it must obtain outside of the forest;
- (4) study, in a selected regional framework, the integration of the forest-animal husbandry association in a system of production, land-distribution and development.

#### GREECE

In Greece, the patterns of land use and the dominant type of plant cover are the result of a long historical, social and economic process. However, in the near future, economic development due to the migration of the rural population towards the towns will create conditions conducive to the expansion of the forest, either naturally or through reforestation. All the same, it will be necessary to carry out ecological studies in areas where forests are to be replanted. These areas, classified as being partly covered by forest, make up 24.5% of the total area of the country.

The distribution of the principal forest species may serve as a useful basis on which to undertake an integrated research programme relating to MAB Projects 2 and 8. They are distributed as follows: deciduous *Quercus* sp. (29%), large-leaved evergreens (19.02%), *Pinus halepensis* (13.61%), *Abies* sp. (8.72%), *Pinus nigra* (5.45%), *P. brutia* (5.33%), *Castanea sativa* (0.90%). *Cupressus sempervirens*, which occupies only 6,000 ha, is not mentioned, but is of interest as a genuinely Mediterranean species. Other species cover a fairly limited area, but are of interest in that their southern

limit is in Greece: *Pinus sylvestris*, *P. leucodermis*, *P. peuce*, *P. excelsa* and *Betula verrucosa*.

Project 2. Various programmes being conducted by Forest Research Institutes in Greece come directly or indirectly under MAB Project 2.

It should, however, be stressed that only an integrated interdisciplinary research project, in a specific ecological zone, can provide the criteria required for the establishment of a rational plan for the management and use of forest resources. At the present time, several zones seem particularly suited for such studies. Since 1970, with the assistance of the FAO and the UNDP (Project GRE 20), a network of experimental catchments has been established for the purposes of hydrological research and studies on soil erosion, the influence of the transformation of the plant cover on the water, the use of fertilizers, herbicides, etc., which influence the ecosystem as a whole. These studies take particular account of the growing importance of the use of forest areas for various purposes. Eleven catchments located in ecological zones more or less representative of the Mediterranean area are already equipped to collect detailed data concerning the climate, water and sediment content. Three other experimental catchments are planned in the near future. The eleven catchment areas are distributed as follows:

- (1) a first group of four catchments (a total of 470 ha) already equipped and located in the centre of the country, between an altitude of 980 and 1,410 m, on shale, with *Abies* as the dominant species;
- (2) three catchments situated in the western part of Greece, between 350 and 650 m, on shale; total area: 440 ha; dominant vegetation: degraded forest of *Quercus* and evergreens subjected to overgrazing;
- (3) four experimental catchments (total area 342 ha) situated in the eastern part of the country, from sea level to 1,410 m, on metamorphic rock formations. Three of them are covered by dense evergreens, the fourth by a forest of *Fagus* sp.

The present distribution of experimental catchments does not include any forest of *Pinus halepensis* or *P. brutia*, species of great importance for all the Mediterranean countries. If no proposal for integrated pilot research is forthcoming from any other source, it should be pointed out that in Greece, to the north-west of Chalkidiki, there is a stand in which these two species are in contact, and a hybrid population is to be found. A study of this ecosystem would give us a thorough knowledge of the ecology of these two important species.

While, in Greece, forest ecosystems occupy around 15% of the total area of the country, non-forest Mediterranean ecosystems cover more than 30% of it, and a fair number of regions in southern Greece do not possess forest ecosystems. There are several reasons for considering that non-forest Mediterranean ecosystems (phrygana shrubland and all its transitional stages) should be included in MAB Project 2.

Firstly, the ecological effects of the various forms of land use on Mediterranean ecosystems in the course of four thousand years of human activity are seen in the degraded phrygana

or shrub formations which now cover a large area in the Mediterranean countries. Most of the towns and villages are surrounded by such ecosystems. Thus, a study should be made not only of forest ecosystems but also of all the urgent problems arising from the degraded Mediterranean biosphere.

Secondly, up to now, research workers and national and international bodies have focused their attention primarily on forest ecosystems, disregarding other ecosystems. Thus in Greece there are 500 research workers actively engaged in forest research, whereas there is virtually no research work being done on non-forest ecosystems.

Thirdly, the question may be raised as to whether forest ecosystems are truly Mediterranean ecosystems, since they do not possess any particular mechanisms for adapting to the Mediterranean climate. On the other hand, some types of non-forest ecosystems have acquired particular mechanisms for adapting to the Mediterranean environment: the anatomy and life-span of the leaves of evergreen sclerophylls, seasonal leaf dimorphism among typical species of phrygana for instance. The evolutionary processes which have resulted in this adaptation and of the molecular bases of the adaptation mechanisms characteristic of Mediterranean plants should be thoroughly investigated, and this will make it possible to cope with the problems arising in Mediterranean areas.

As no such investigation had been made, the Botany Institute of the University of Athens decided a few years ago to extend its research to the biology of the phrygana-shrub plant complex, and in particular to the following aspects:

- (1) structure and dynamics of a phrygana ecosystem on Mount Hymettus;
- (2) seed physiology and initial stages of development in various species of phrygana;
- (3) leaf structure of evergreen sclerophylls and species of phrygana;
- (4) chemical composition of carob seeds and chemical changes occurring in the course of seed maturation.

Studies will be subsequently undertaken in the following subjects:

- (1) structure and dynamics of different phrygana ecosystems in various geographical areas in Greece;
- (2) water requirements of species belonging to non-forest Mediterranean ecosystems and their carbon, nitrogen and phosphorus cycles;
- (3) physiology of adaptation mechanisms in a Mediterranean climate;
- (4) decomposition of nutrients and nutrient cycle;
- (5) elaboration of new practical methods for improving non-Mediterranean forest ecosystems.

Project 8. Two types of action may endanger species and their diversity, and carry the risk that the genes necessary for the adaptation of these species to a future natural or artificial transformation of the environment may be lost: (1) the destruction of stands of trees containing important genetic material and (2) intensive artificial selection for the purpose of improving forest species, the latter being at present of minor importance in Greece.

Forest species, especially low-altitude Mediterranean conifers (*Pinus halepensis* and *brutia*, *Cupressus sempervirens*), have for a long time been subjected to negative selection as a result of intensive land use and because they have been destroyed to provide new agricultural or grazing land. This is also true of *Abies cephalonica*, which is endemic in Greece and has ecological characteristics that are important for most of the Mediterranean countries. Consequently, priority should be given to the protection of the natural areas where these species are present.

With regard to *Pinus brutia* and *Cupressus sempervirens*, it will be recommended that the gorges of Samaria (Crete), already established as a natural reserve, be protected. This site is the only one in Greece where timber-getting has always been limited on account of the site's inaccessibility. It also contains several annual and perennial species endemic in the island. The very rare *Capra aegragus cretensis* is also found in the gorges - another reason for a biosphere reserve to be established there.

As regards *Abies cephalonica*, the Greek delegation proposes Mount Aenos, already a natural reserve, on the island of Cephallenia. Recent anatomical and morphological studies of this species, together with mesological tests, give grounds for doubt as to the representative character of this population.

The Mount Olympus reserve also appears worthy of inclusion in the network of biosphere reserves on account of its outstanding landscape and the wealth of forest varieties and annual and perennial species to be found there, but above all because this mountain was the dwelling-place of the gods of Greek mythology.

Lastly, consideration should be given to the inclusion of the natural reserve of Lake Prespa, close to the Greek-Albanian frontier. This lake is well known for the large number of migrating birds that alight there.

The seven natural reserves officially set up in Greece are as follows: the gorges of Samaria (4,850 ha), Aenos (2,841 ha), Parnis (3,400 ha), Parnassus (3,512 ha), Oete (7,210 ha), Mount Olympus (3,990 ha) and the Lake of Little Prespa.

Greek legislation relating to natural reserves provides for a nucleus of between 1,500 and 2,000 ha to be managed exclusively as a natural reserve, without any equipment, and a peripheral zone of between 2,000 and 4,000 ha, which may be used as a multi-purpose area.

#### ITALY

The MAB National Committee of Italy is still in the organising stage. It should be pointed out, however, that activities relating to the international MAB Programme have been developed by groups of specialists in collaboration with Unesco, other MAB National Committees or through other agreements.

Project 2. As concerns MAB Project 2, preliminary information can already be presented on the activities undertaken in Italy.

Comprehensive research work on both the natural and planted Mediterranean forest ecosystems is in progress, in co-operation with Silva Mediterranea. These projects were presented in detail at the planning meeting held in Paris with the representatives of the French, Italian and Spanish MAB Committees. The delegates of the MAB Committee of Spain showed a very strong interest in this research work.

In a strictly forestry domain, research has already been undertaken, or planned for the following subjects:

- (1) Protecting the forest against fires: studies on fires of arborescent species, their ignitibility and combustibility, management of the forest in order to reduce danger of fires, mixing the species, planted fire screens, etc. Some research studies have been conducted by the Institute of Forestry Research of Arezzo and by the Faculty of Agronomical and Forestry Sciences at Florence, in conjunction with French scientists of the CNRF.
- (2) Possibility of grazing in Mediterranean forests (see Italian pilot project, page 20).
- (3) Impact of tourism on the Mediterranean forests.
- (4) Influence of artificial plantations of exotic species on the environment and problems of their management. Research has been undertaken by the Centre of Experimentation of ENCC of Rome, and the Institute of Forestry Research at Arezzo.

In the study of the human impact on the ecosystems and in particular on vegetal landscapes, mapping of the vegetation and other types of thematic cartography would provide a research tool which could be utilized more than is done at present.

Vegetation cartography has improved considerably over the past few years and can be further perfected through newer methods such as aerial surveys by satellite. However, the cartography methods employed often seek a very rigid methodical representation of the typologies which have been established in an abstract manner with overly theoretical extrapolations. The maps should provide real information on the alterations of the ecosystems and, in general, of the vegetal landscapes. An attempt of this nature was made by Italian researchers to show the degradation of the vegetation in a Mediterranean mountainous area.

Project 8. Concerning MAB Project 8, the Italian research work is not yet co-ordinated with that of other MAB National Committees.

For several years, the Commission for the Protection of Nature of the National Board of Research, with the support of the Italian Botanical Society, has collected as much information as possible on the biotopes requiring protection. There have been several publications on this work which have been, and will be, highly useful for regional planning and land management.

Conservation of the forest genetic heritage has already begun through the Institute of Forest Research of Arezzo, with the co-operation of the Forest Service, for the protection of the following species: *Abies nebrodensis*, fir tree of Sicily of which there are twenty-one at the present time; provenances of *A. alba* from Molise and of the Aspromonte; provenances of *Pinus nigra calabria*, from Sila de Cosenza in Calabria and Etna in Sicily.

The forest stands concerned have been marked off and their classification as natural reserves or seed stands has been acquired. Systematic research work should now be done on these stands in order to define the strong scientific basis for their future treatment, thereby ensuring their conservation. Protection should likewise be envisaged for areas of *Quercus aegylops*, still present in the Pouilles, and for provenances of other species.

The National Council of Research has recently proposed a comprehensive group of finalized programmes, with a priority programme on the quality of the environment comprising an extensive study of the existence and conservation conditions of the biotopes of the country. The MAB National Committee of Italy may possibly use these initiatives by combining its efforts with those of the Commission of the Protection of Nature of the National Council of Research who will be responsible for a greater part of the research programme on the biotopes. There is permanent contact between MAB and this Commission.

It is important to point out that the present conception of the conservation of the ecosystems is separate from the protectionist view hitherto accepted.

It is not sufficient to more or less strictly reserve a natural site, or to be satisfied with preserving a few hectares. In reality, these natural land cells have almost always undergone direct or indirect human-made changes and deteriorations, and only a management plan of the reserves - and not only parks - which apply ecological principles would enable experiments to be made for the reconstruction and restoration of the degraded natural balances. Specialists of diversified disciplines should collaborate on this work in the large nature laboratories that these reserves constitute.

It would be worthwhile to establish a new ecological centre where scientists would learn team work, and where those who are just entering the field of ecological research could receive training. The Italian delegation is of the opinion that this latter point is essential to the success of the objectives of the natural reserves.

#### MOROCCO

The MAB National Committee of Morocco, created in 1973, is comprised of leading members from the country's education, research and administrative organizations, including the Institut Agronomique et Vétérinaire Hassan II of Rabat, the Water and Forestry Directorate, the Animal Husbandry Directorate, the Institut Scientifique Chérifien, the Université Mohammed V and the Ecole Nationale Forestière of Salé.

The MAB National Committee of Morocco's first task was to make an inventory of research and land-use activities effectuated. For the Maghreb countries, the Sfax meeting was very

rich in information and in the exchange of experiments. During this meeting, the National Committee of Morocco emphasized the importance of full participation of specialists in the human sciences; this point was supported by several of the participants at Potenza.

As concerns MAB Project 2, the following Moroccan activities should be mentioned:

- (1) the anti-erosion and soil conservation programme at Loukkos-Nekkor in the North of Morocco;
- (2) the forest-grazing project;
- (3) amelioration of the living conditions in the High-Atlas mountains;
- (4) silvo-pastoral improvements on cork-oak forest (*Quercus suber*) in Mamora;
- (5) finding causes of the deforestation of the Azrou Plateau in the Middle Atlas;
- (6) study of the fauna of the Mamora;
- (7) study, with a view to agro-sylvo-pastoral management, in the Tessaout, South Morocco;
- (8) geo-botanical and cartographic study of the Souss in the south-east of Morocco.

The major problems with which Morocco is faced are erosion and grazing. The forestry services are more and more in favour of a forest-grazing distribution which necessarily includes humans and domestic animals.

During the Sfax meeting, the importance of the forest-grazing problem and of the control of erosion had already been brought out.

As these two problems were discussed at the present meeting, they should be considered as a basis for international co-operation within the MAB Programme, thereby enabling Morocco to benefit from the information on the state of advancement and the results of the work carried out in the pilot projects and co-projects.

Furthermore, in view of the fact that training on all levels is vital in the implementation of MAB, or related programmes, the following actions should be promoted: circulation of the methods used to educate the general public on the problems involved; publication of "case studies", important for the "decision-making" level.

The actual possibilities could thereby be known for each country north of the Mediterranean having a pilot project or a co-project covering forest-grazing or the study of the functioning or management of catchment areas.

In this domain, UNEP has requested that a regional conference be organized in Morocco, with Unesco's participation, on the protection of catchments. Furthermore, it would be advisable to support Unesco's proposal to help in the training of experts in the systematic and mathematical analysis of "marginal lands".

Although these two areas of study were emphasized, other problems nevertheless arise in Morocco, such as: pollution, tourism and conservation. On the latter point, Morocco has been engaged in an experiment since the 1930's which, while it has not led to the anticipated results, has however provided a wealth of information which could be of value in the eventual creation of national parks and reserves.

A project has been prepared on this subject under the auspices of the FAO, which aims to establish a network of national parks and reserves.

These problems which are not priority at the present time, could become so in the near future; in which case Morocco would hope to benefit from the acquired experience and research work undertaken by the countries north of the Mediterranean.

#### PORTUGAL

Project 2. The Potenza meeting provided the Portuguese Delegation the opportunity to establish contact with the MAB Programme and to be informed of the actions already undertaken by the other countries. A MAB National Committee of Portugal would facilitate contacts between research workers of the different Mediterranean countries working within the MAB Programme.

At the present time, it is difficult to define the first projects which could be included in MAB Project 2, the different researchers being distributed into working groups who are attempting to solve the immediate problem of agrarian reform. Moreover, the structures of the larger research bodies, particularly in forestry and agronomical research, are in the process of being regrouped into two lines of research.

In the field of forestry, Portugal considers the following problems as being of primary interest:

- (1) forest fires and controlled fires; (last summer, the surface touched by fire was ten times above the average, and six times more than the largest area burned in the last hundred years);
- (2) a new approach to regional planning for certain rural communities (the "baladios") which have had strong pressures from the forest following technocratic and autocratic management practices in which the human needs were not taken into account.

Portugal wishes to draw from other countries' experiences for these problems. The delegation pointed out that the General Directorate of Forest Resources is interested in any programmes which would be helpful.

There are a series of problems in Portugal identical to those of the Mediterranean regions. Thus a strong background has already been acquired in the classical investigations of natural or planted forests, but it would be necessary, however, to conduct quantitative ecological studies through an analysis of the structure, functioning and dynamics of these ecosystems.

It is also important to define identical principles and a methodology in all the countries of the Mediterranean basin in order to reach comparable results.

The delegation indicated that a relatively thorough knowledge of the different areas of the country has been acquired. This zoning is based mainly on the climatic lines, natural or cultivated vegetation distribution and the different soil types. However, in a division of this type, a synthesis of the interactions of these diverse elements and the socio-economic data is missing. To illustrate the aforementioned point, tables representing the following areas of distribution were presented to summarize the forest situation in Portugal:



- (1) land occupied by forests: 2,763,000 ha total;
- (2) forest-land distribution according to species or groups of species;
- (3) forest-area distribution in two large regions and according to ownership régime;
- (4) same distribution but according to the classes of dimension of these areas.

Project 8. For the Portuguese delegation, conservation is basically a human problem. The present "conservationist" movement stems from three successively differentiating tendencies.

The first tendency, which can be termed "protection of nature", appeared during the second half of the 19th Century, following the destruction on the American continent of animal species which, because of their enormous quantities, were thought to be inexhaustible. From an ecological point of view, animals, plants or the community play an important rôle here, humans being a negative ecological element which had to be withstood in order to prevent extinction of the former.

The second - conservation of natural resources - was differentiated as a consequence of two relatively closely-spaced World Wars, which not only lightened the demographic pressure but placed priorities on very different domains. This phase, very strong since the second World War, is characterized on the ecological level by human beings' major position and their concern about the biotic environment.

Lastly, the third stage - conservation of the environment - is a result of the pollution of the biosphere as a consequence of the extraordinary demographic pressure of the present era. Once again, human beings play a main rôle in striving to safeguard their physical environment.

The present conservationist movement, under which the MAB Programme is situated, is a merging of all these aspects, and the integration so strongly sought finds its justification in this programme.

In Portugal, little research is directly oriented towards problems of conservation, even though this movement has a certain tradition there. The Portuguese League for the Protection of Nature, founded in 1948, has already accomplished a considerable amount of work, by making the principles of conservation known and by denouncing the assaults against nature. But this League does not have financial resources or manpower and cannot reach outside the scientific world.

As for biosphere reserves and the necessary studies pertaining to them, it is more realistic for Portugal to undertake this work in national parks and the reserves already in existence. It is envisaged to protect numerous other areas in the future, namely in regions of the north-east and south-west of the country presenting a large interest. It is especially hoped to establish bordering reserves in co-operation with Spain, a region where the lynx still abides: in such areas, it would be useful to create Iberian reserves. The National Park of Peneda-Gerês urgently requires a Spanish counterpart in order that the wild boar, deer and other populations, protected on the Portuguese side, not be destroyed on the Spanish side.

Other than the phyto-sociological research work which has been conducted for a long time by the Estacao Agronomica Nacional, ecological research applied to conservation could be undertaken by groups attached to the Universities of Lisbonne and of Porto, as well as by the General Directorate of Forest Resources. The Secretaria de Estado do Ambiente is in charge on the administrative level. Thus, several institutions are involved with environmental problems. A MAB National Committee of Portugal, at the Inter-ministerial Commission for the Environment (CNA) would be able to co-ordinate the comparative ecological research work in the existing parks and reserves.

## SPAIN

### 1. Project 2

Integrated research has a long tradition in Spain, especially work concerning plant-soil relationships (Albareda, Kubierna) which has led to studies of the ecosystems (Margalef, Montserrat, Gonzalez, Bernaldez, etc.) conducted by the Consejo Superior de Investigaciones Cientificas (CSIC) and at the Universities of Barcelona, Sevilla and Madrid.

At the present time, work which could be related to MAB Project 2 is being carried out in the following regions: Cataloña (north of the Llobregat) and in the Pyrenees (University of Barcelona, Centro Pirenaico de Biologia Experimental and the Instituto de Estudios Pirenaicos); Guadarrama (University of Madrid); western Andalusia (University of Sevilla).

Most of these regions can be integrated to MAB Project 2 activities.

The Mediterranean forest consists of fragile ecosystems which are constantly close to imbalance. Fires, grazing, insect assaults, and the expansion of tourism and urbanization are the major causes. In order to prevent or rectify the causes and effects of the imbalances, they must be thoroughly understood. An effort must be made, among others, to define a specifically Mediterranean forest policy.

These concerns have led the Spanish Government to create a certain number of observation areas in which research is carried out on the causes endangering the forest and its natural equilibrium.

#### Study on the structure, functioning, productivity and conservation of forest ecosystems and their

Level of deterioration: experimental station of Fuentes Blancas and the local forest of Cardenajimeno (Burgos). The study zone of 90.12 ha, approximately five kilometers east of Burgos, is situated in the left side of the Arlanzon river, and is one of the rare remains of a forest still in existence near a city. The average altitude is 900 m without strong relief variations. The soil corresponds to the alluvial Quaternary in the large Miocene area surrounding Burgos towards the west, and consists of conglomerates derived from all the formations crossed by the river.

The zone is composed almost totally of a *Quercus pyrenaica* forest with a few *Pinus sylvestris* stands planted within the past fifteen years. The oak forest occurs in mono-specific spots; very rare graminaceous prairie formations can be found. In the lower zones, rosaceae grow with other plant indicators of high soil humidity. Aside from the afore-mentioned

plants, the principal inventoried species are: *Erica arborea*, *Calluna vulgaris*, *Crataegus monogina*, *Prunus spinosa*, *Thymus mastichina*, *T. zigs*, *Lavandula pedunculata*, *Rubus* sp., *Asphodelus albus*, *Helleborus viridis* and diverse liliaceae and composites.

The fauna is relatively rich in species. Among the average-sized mammalia can be mentioned: *Vulpes vulpes*, *Mustela nivalis*, *Oryzotolagus cuniculus*, *Lepus capensis*.

Among the micro-mammalia the following species are found: *Apodemus sylvaticus*, *Elyomys quercineus*, *Mus musculus*, *Rattus rattus*, *Crocidure russula*, *Microtus arvalis*, *Erinaceus europaeus*, *Pitymys duoecimostatus*, *Talpa casca*, *Suncus etruscus*.

The sedentary avifauna is not very abundant, but numerous seasonal or migratory species are found. Among the most noticeable of the sedentary species are: *Buteo buteo*, *Milvus milvus*, *Athene noctua*, *Tito alba*.

However, the largest number of birds in this territory belong to the "Passeriforme" category.

Study of the "Dehesa" formation. The transitional zones between forest and grazing lands are represented by plant formations termed "dehesas", i.e. either very sparse forests or wooded grazing lands. They represent a form of soil use characteristic of the Mediterranean region, where a cover of trees (*Quercus* sp.) protects the soil against a strong insolation. Livestock finds a food supply in the ligneous plants (acorns, leaves, branches, etc.).

The economic evolution has modified the utilization of the "dehesas", mechanisation of ploughing having brought the destruction of the trees on otherwise poor soil. This creates the risk of destroying a stable form of land-use and a characteristic type of landscape.

At the Hurley meeting<sup>1</sup> (July, 1974), it was envisaged to undertake investigations on the protection of the "dehesas". The proposed pilot zone for this study is situated on the left side of the Tietar (province of Caceres) and covers 770 ha, of which 696 are "dehesa" and 74 irrigated land to be used for poplar plantations. The southern area is flat; the centre and the north slope slightly towards the north (less than 4%). The soil, deep, is sandy with a layer of humus of approximately 20 cm, without rocky surfaces.

The annual rainfall is about 800 mm spread over the winter and spring. From July to October it is practically non-existent. There is no snow and very few days with dew, approximately 15 for the entire year. The maximum temperature is 42 °C; the minimum is 3 °C.

*Quercus ilex* (75%), *Q. lusitanica* (20%), *Q. pyrenaica* (5%) and some *Q. suber* are found in this area. The average density is 110 trees/ha with extremes of 40 and 270 trees/ha. The area is presently used for grazing by sheep, goats and pigs, from October to March. A few years ago, a quarter of the surface was still cultivated in rotation cropping. At the present time, an irrigated zone has brought about intensive cultivation and the "dehesa" is used for grazing.

1. See MAB Report Series No. 25 "International Working Group for MAB Project 3". Hurley, United Kingdom, 2-5 July, 1974.

The study programme could be directed toward the following problems:

- (1) study of the stability of the "dehesa" ecosystem;
- (2) evaluation of the effect of the protection of trees on the soil and fodder crops;
- (3) determining the fodder value of the trees;
- (4) socio-economic study of the utilization of the "dehesas" and consequences of their destruction.

Ecological consequences of forest fires. The objectives of the programme proposed by the Spanish delegation are to evaluate the effects of forest fires on the biotic elements of the soil (vegetation, fauna), and on erosion as well as the subsequent study of the vegetal cover successions following a series of fires. These investigations would lead to a better knowledge of the various elements intervening in wood flammability and developing means of protection.

Baseline studies have already been conducted by the Spanish Forestry Administration. It should be pointed out, however, that fundamental research studies on the ecological consequences of fires have hitherto been limited even though the problem is very important.

The National Institute for Agronomic Research (INIA) in co-operation with the National Institute for the Conservation of Nature (ICONA) have commenced studies in the two pilot zones situated near the southern slope of the Sierra Nevada (Grenada). The research programme proposes to study in the two cells, of 6 and 25 ha respectively, the following phenomena linked to the forest fires between 1973 and 1974: humus content, nutritional elements; variations of acidity and of the decomposition of organic matter; effects of fire on the soil micro-fauna and micro-flora, on the mammalia and birds.

The second part of the programme will consist of collecting edaphic and biocenotic data in different cells, on burned forests situated in areas with varied climatic, edaphic and vegetation features, representative of different Mediterranean forest types.

Statistical processing of the acquired data should enable the following objectives to be reached in the future:

- (1) improve forest-fire prevention;
- (2) implantation of more highly fire-resistant massifs;
- (3) afforestation with species to be used for construction wood, reducing the highly-combustible biomass to a minimum;
- (4) broader research on the effects of fires on the stability and yield-capacity of the ecosystems.

Bio-ecological research on Mediterranean pine forests. According to forest entomologists, the constant and increasing changes of forest ecosystems due to forest land use practices, afforestation with both indigenous and exotic species, and land-distribution changes, have

radically modified the biocoenosis structure. Zoologists should therefore take measures similar to those adopted by foresters in order to maintain the risks of imbalance within the limits the forest can ecologically and economically support. A French-Spanish integrated study programme has been developed, in the study zone of Mora de Rubielos (Province of Teruel), under the OILB, in order to find ways to solve this problem. It is a mountainous region, situated in the southern part of the Sierra de Gudar, with a climate that is severe in the higher areas and partly Mediterranean elsewhere.

*Pinus laricio* is dominant in the lower and middle areas, where it mixes with *P. pinaster*. Small enclaves of *Juniperus rhurifera* and *Quercus ilex* bushes are also found. The highest area is covered with *Pinus sylvestris*, with, to the north-east of the zone, a few spots of *P. uncinata*, the most southern localizations of this species. The forests of the area are developed and individual types of trees of all ages are found. The *P. sylvestris* and *P. laricio* are of poor quality in this uniformly planted area.

This programme was developed in conjunction with the Spanish Department of Forest Protection under ICONA and the French Service of Forest Entomology and National Institute of Agronomic Research (INRA) together with the General Delegation of Scientific and Technical Research (DGRST). Its objectives are: establish detailed comparisons among the ecological "spectrum" of the biotopes being studied; establish applied demographic methodology for *Thaumetopoea pityocampa* gradations; determine local influences on the dynamic evolution of an animal species and intensity of damage done (degree of heterogeneity of the zone, monocultural plantations on large areas).

Studies on maintaining and periodically re-establishing biological equilibrium can only lead to concrete results by integrating investigations of the multiple interactions within an ecosystem on which this biological balance depends.

#### Effects of air pollution on forest ecosystems and the forest's influence on air quality.

This study, selected as a pilot project at the Potenza meeting, is being conducted in an experimental zone of the Sierra del Cadi, near Barcelona, which is polluted by emissions from a thermal station utilizing a sulphurous lignite (see Section 3.5).

The envisaged study programme will seek to determine the polluting substances, and the ensuing ecological imbalances.

#### Ecological and socio-ecological studies on the Almanzora catchment area (Almeria Province).

The total area of the selected zone is 2,112.41 km<sup>2</sup>. Altitudes vary from 300 m in the lower river plain to 2,166 m at the summit of the Sierra de Filabres.

Cultivated land, including agriculture and forests, extends over 1,000 km<sup>2</sup> of the basin. Grazing and uncultivated lands occupy the remainder of the basin. Hydrological-forestry work has been undertaken in the drainage basin by ICONA; in the highest area, more than 25,000 ha have been afforested.

The experimental basin will serve to study the effects on the water régime caused by forest plantations, land use changes and soil conserv-

ation work. The first studies will be made on erosion in order to obtain data to be used in the "universal equation of erosion prediction" which would enable rational patterns of land use in the agro-hydrological management of the catchment area.

The following parameters should be defined:

- (1) rainfall erosion index;
- (2) erosionability of common soil types;
- (3) plant index, i.e. degree of soil protection provided by various plant types;
- (4) protection factor according to patterns of land use;
- (5) soil infiltration capacity;
- (6) surface runoff.

This information should lead to a water inventory system which could be applied to similar water basins.

The methodology of these hydrological studies will be related to the schema drawn up in the Unesco publication "Representative and Experimental River Basins"<sup>1</sup>, and applied in the installation and instrumentation used to define the required parameters.

The MAB National Committee of Spain has also selected a project on the ecological and socio-ecological studies on the use and management of marginal lands in the Pyrenees region.

## 2. Project 8

For the conservation of natural resources, there are two types of reserves in Spain - other than the national parks - which could be included in MAB Project 8: they are the National Game Reserves and the Enclosed Game Parks.

The National Game Reserves, created by a law, are subject to a special cynegetic régime. They are established in regions presenting exceptional wildlife possibilities, in order to ensure the preservation of important animal-game populations. The Ministry of Agriculture, responsible for their administration and development, has delegated this work to the National Institute for the Conservation of Nature (ICONA).

Enclosed Game Parks are areas, either owned by the State or in which, through convention, the State has placed game. These reserves are also under the administration of ICONA. Particular interest is placed in the conservation and rational use of the cynegetic resources.

Spain has at the present time thirty-six national reserves (1,500,906 ha) and twelve enclosed parks (382 ha), or a total of 1,666,288 ha distributed throughout the entire country and where the most important cynegetic species are present. The latest inventories provided the following figures for the principal animal species in these two types of reserves: *Cervus elaphus*: 8,300; *Capreolus capreolus*: 7,000; *Dama dama*: 3,700; *Rupricapra rupricapra*: 16,400; *Capra pyrenaica*: 13,900; *Ovis musimon*: 2,800; *Amotragus Lervia*: 100; *Ursus arctos*: 80; *Tetrao urogallus*: 1,300.

1. See *Hydrology Studies and Reports Series No. 4.*

It should be pointed out, however, that most of the national reserves have not yet attained their optimal stock capacity, particularly the thirteen reserves created in 1973 where restocking is carried out with game from other reserves or cynegetic farms. Furthermore, these reserves or enclosed parks, in which only controlled and selective hunting of some species is practiced, constitute an ideal base for the development of other animal species (*Lynx pardina*, *Canis lupus*, *Felis sylvestris*, *Aquila heliaca*, *A. chrisaetos*, *Gyps fulvus*, *Aegypius monachus*, *Gypaetus barbatus*, *Neophron perenotus*).

As in the reserve areas, the enclosed parks are managed with the aim of ensuring both the development and rational use of the wildlife resources as well as of providing the public with a maximum amount of satisfaction on the social, recreation and economic levels. The management programme is based on the following objectives:

- (1) obtain a maximal compatibility between the wildlife, the natural environmental conditions and the human activities pursued in the reserve or enclosed park;
- (2) act on reserve's ecosystem to ensure an equilibrium in the animal populations and the necessary sanitary conditions for maximum qualitative output;
- (3) adopt the necessary measures for the conservation of non-cynegetic species under a special system of protection;
- (4) fulfill the reserve's cultural, educational and recreational objectives by enabling the general public to observe and study its wild animals;
- (5) provide the necessary roads and installations to facilitate hunting while at the same time taking into account the other activities pursued in the area.

Moreover, Spain intends to create a biosphere reserve in the Pyrenees region, encompassing part of the national park of Ordesa and part of the game reserve of Vignemale. This reserve is described in Annex 5.

## TURKEY

Project 2. In Turkey, as in the other Mediterranean countries, the forest has always been used for many purposes, on the one hand providing a source of income and, on the other, affording opportunities for hunting, grazing, recreation and rest. In addition to this, it has been instrumental in protecting the water balance of the soil. These various functions should be taken into consideration in management plans based on scientific and technological information as to the relations between man and the forest.

In recent years man has, whether voluntarily or not, destroyed the forest or used forest land for various other purposes. These changes have affected the ecological equilibrium of the environment and destroyed the ecosystems of these regions.

The frontier zones of the regional forestry directorates of Mugla, Antalya, Mersin and Adana are in the Mediterranean region, and cover

4,551,000 ha, including 1,684,000 ha of productive forest. The most common species are *Pinus*, *Cedrus*, *Abies* and *Juniperus*, some *Quercus*, followed by deciduous trees such as *Populus*, *Fagus* and *Alnus glutinosa*; 74% of these forests consist of tall trees, and only 26.6% of brushwood.

The inhabitants of the villages situated in this frontier zone and within a radius of 10 km necessarily have an impact on the forest. They mostly live on stock raising; some work in the forest, for the region, which is very mountainous, is unfavourable to agricultural work.

The drought which prevails during the summer months makes for forest fires, which are very frequent during that period. According to statistics, during the last five years there have been on average 320 fires a year, and an average area of 4,834 ha has been burned every year.

Recent investigations show that the fires are started either to extend arable land, grazing areas and village sites, through carelessness, or for other reasons. The number of forest fires clearly reflects the socio-economic pressures to which the frontier zones are subject.

Reforestation is carried out in the region on reclaimed land, often following forest fires. In the Mugla region 5,400 ha have already been planted with fast-growing species in an area of 12,000 ha set aside for afforestation. In the Adana region, 3,100 ha of the 6,300 ha planned have been replanted. For these afforestation plans, priority is given to *Pinus brutia* and *Eucalyptus*, which are fast-growing species. While *P. brutia* is a species perfectly suited to the region, the influence of the eucalyptus and other exotic varieties on the local vegetation has not been studied.

Furthermore, no studies have been made of the effect of fires on ecological conditions. Owing to the aridity of the climate during the vegetation period, unless appropriate measures are taken, the areas which have suffered from fire will be increasingly invaded by thicket.

The total destruction of the plant cover by fire affects the threefold relationship between soil, plant-life and water, and gives rise to phenomena of erosion, entailing a disturbance of the ecological equilibrium. The runoff water and the considerable volume of sediment carried by the rivers affect the fish in the rivers and the fauna in those areas which have been burned. Although familiar, these phenomena should be the subject of more thorough-going scientific studies.

To sum up, studies on the following subjects should be undertaken, in order to find effective counter-measures and remedy their effects on ecosystems: causes of forest fires; problems connected with ecological equilibria in areas which have been burned; socio-economic effects of fire on the environment.

It would be highly profitable for the countries of the Mediterranean forest zone to co-operate and co-ordinate their research efforts in these three fields.

Grazing should be based on balanced planning of the use of land intended for that purpose, whether in a forest or elsewhere, but in this region it has not been possible to plan the use of forest land, and this has inevitably resulted in overgrazing. It has been observed that in the area surrounding forests some grazing land has been ploughed and used for agricultural

purposes. Such activities are incompatible with natural land use and have given rise to considerable erosion and destroyed the ecological equilibrium of the region.

Forest grazing is particularly harmful in young plantations (the greatest damage being caused, apparently, by angora goats). However, the sole economic resource of the inhabitants of the villages located in the Mediterranean forest zones of Turkey is livestock. It has been calculated that in one day 5,288,000 animals graze in the forests of the districts studied, including more than four million goats and sheep.

The effects of grazing on the ecological equilibrium have not been scientifically studied in the region. They may be summarized as follows:

- (1) compression of the soil, which causes the destruction of micro-organisms in the soil and prevents seeds from germinating;
- (2) overgrazing, which leads to erosion;
- (3) limitation of the growth of young trees, which makes for the development of bush;
- (4) destruction of the threefold equilibrium between soil, plant-life and water in the catchment area.

In view of these effects, studies should be carried out on the compression of the soil and its effects on the micro-organisms in the soil. In addition, the point at which natural growth is inhibited as a result of soil compression should be determined; the type and age of forest stands suited for grazing should be defined; and, lastly, the amount of destruction of the various forest plant species caused by the different types of animals should be ascertained.

Project 8. In natural zones which have been protected against human action, the relative ecological stability provides permanent protection for plant and animal genetic material and creates conditions favourable to wildlife. It follows from this that the conservation of wildlife necessarily entails the protection of natural zones which provide animals with balanced living conditions. Any interference with these zones inevitably affects this balance. Thus, the destruction of the forest environment by fires or other phenomena has led to a rapid drop in the populations of *Cervus dama*, *Capra aegagrus*, *Capreolus capreolus*, *Felis pardus elisina*, *Cynus caracal*, *Hyena hyena*, *Ursus arctos*, and of birds such as *Francoelinus francoelinus*. Special measures have been taken to ensure the reproduction of these species, the decrease in whose numbers is also due to uncontrolled hunting.

The conservation of natural zones primarily involves the protection of vegetation, and the protection of various plant species from humans and animals would facilitate the safeguarding of the natural flora.

It is obvious that protective measures should take into account the socio-economic situation and the principles of the various forms of land use.

In the Mediterranean coastal region another factor affects the genetic material contained in natural areas and particularly forests, namely tourism, which, every year, brings

thousands of people to the coast during the long summer season.

To protect the ecosystems of these regions, the following national parks and recreation areas have been established or are to be established in the near future:

- (1) the national park of the Mugla 'Dilak Peninsula, one of the largest, covering an area of 11,000 ha, which can be visited by 10,000 people daily;
- (2) three marine reserves are planned in this same region: Bodrum Peninsula, the underwater reserve of Gökova and Karaağaç Bay;
- (3) in the region of Antalya the national park of Thermessus (7,000 ha) contains the remains of an ancient city and interesting wildlife. The natural scenery is so beautiful that it is an outstanding site. Another park - that of Olympus mountain range - is to be established in this region, covering 70,000 ha;
- (4) the "Bridged Canyon" national park affords protection for the only cypress forest (36,000 ha) in the world and for remains from the Roman period;
- (5) the Aslantas Karatepe national park (Adana) is situated in an archaeological area of great natural beauty and possesses interesting wildlife.

Despite the increasing volume of tourism in Turkey, particularly on the coastal strip, no serious study of the subject has yet been carried out.

The research mentioned in this report could hopefully be carried out by the different countries concerned, in centres which would collaborate closely with each other and exchange their findings. In addition, short courses could be organized for scientists from countries in which there are different patterns of land use. Unesco could bear the cost of these courses.

Turkey, for its part, intends to establish two research stations for the purposes of MAB Projects 2, 3 and 8 in the regions of Mugla and Antalya-Side and to define the themes which will be studied there on a pluridisciplinary basis.

#### YUGOSLAVIA

The MAB National Committee of Yugoslavia was set up three years ago on the initiative of the Council for Scientific Research and the Yugoslav National Commission for Unesco. On account of the administrative structure of the country - six states and two autonomous provinces - the Yugoslav Committee is made up of three representatives for each of the eight administrative divisions, one member of the Council of the Academy of Sciences and one member of the Association of Yugoslav Ecologists. In addition, sub-committees have been set up in each of the states and autonomous provinces. The MAB Committee's first task was to draw up a list of all projects in progress in Yugoslavia so as to co-ordinate them within the framework of the international MAB Programme. Only those projects given priority at national level were included in this list. At the present time, changes are being made in the conditions governing the financing of scientific research in Yugoslavia.

As a result, a new medium- and long-term scientific research plan is being established. As the majority of the public, institutions and industry consider the protection of the human environment to be of prime importance, it is likely that sufficient funds will be allocated to the MAB Programme and its related projects, the level of development of the country as a whole and the need to reconcile economic development with its impact on the environment being taken into account.

Yugoslavia is marked by very great internal differences. This is a result of historical conditions which have made the country a veritable patchwork of nationalities, religions, levels of social and economic development and cultures. A number of inequalities and discrepancies have had to be dealt with in order to rectify these disparities. The country has also a great diversity of natural resources, geomorphological, hydrographic and climatic conditions, vegetation, geology and forms of development.

The diversity of orographic and climatic conditions is reflected in the wide variety of types of forests. Along the coast and along the rivers which flow into the Adriatic and are influenced by the Mediterranean climate, many examples of Mediterranean flora are to be found, in particular different deciduous and coniferous varieties.

Project 2. Two research themes have been selected in connexion with Project 2. The first, which has the same name as the project itself, has been studied by the Institute for Forestry Research of the University of Zagreb, under the direction of Professor Đusan Klepac and with the collaboration of eight research workers. Particular attention has been paid to human activities connected with the economy of natural forest ecosystems. In addition to the study of beeches and firs in the continental zone, the cultivated stands of black pine and Aleppo pine have been analyzed in the eu-Mediterranean zone.

Furthermore, studies have been conducted in the Mirna Valley (Istria Peninsula) on the sub-Mediterranean forests of English oaks and hornbeams considered from the point of view of their aesthetic and recreational function and their rôle in protecting the environment.

In 1974, research was initiated on the influence of the forest on the purity of the air and that of atmospheric pollution on the forest in the Solin Basin near Split (see Solin co-project, page 32). All this research will be continued, and will deal especially with the biological and ecological stabilization of ecosystems, the introduction of measures designed to stabilize degraded and exploited forests, environmental protection and interactions between the forest and atmospheric pollution. It will be financed from the Republic's Fund for Scientific Research. Under a new research programme being carried out within the framework of the MAB Programme, a study is to be made of forests on karstic land, their maintenance and the planting of new forest areas.

The second theme - "Ecological, phytocenological and biocenological research on Croatian terrestrial ecosystems" - is being studied by the Institute of Botany of the University of Zagreb, where research work was for a long time directed by Professor Stjepan Horvatic, an eminent specialist in the littoral

vegetation of Yugoslavia, who died this year. His work is being continued by Professor L. Ilijanic, with the collaboration of several others, and is centred on the forest vegetation of certain mountainous continental regions. Studies on the vegetation of a few karstic zones have also been initiated (in the Gracac area, for instance). This research work will be continued with the aim of determining the ecological characteristics of this vegetation, which is indispensable to the maintenance of ecological equilibrium in this Karstic region.

Project 8. The twenty-three themes selected under MAB Project 8 are too numerous for even a brief summary to be given of them here. However, the research being carried out by the various institutions will give some idea of the work which is under way.

In S.R. of Croatia, the Institute of Botany of the University of Zagreb has assumed responsibility for seven research themes, including the preparation of a map of the vegetation of Croatia. So far, slightly less than one half of the map of Croatia has been completed for certain plant associations, and the first map of the vegetation of the region of Pula (Istria), on a scale of 1 to 100,000, is now in the press.

At the same time, the research workers are engaged in the preparation of an analytical flora of Yugoslavia which will include Croatia. This work will consist of five or six volumes. The first two parts of the first volume have appeared, and the third is in preparation, so that the first volume will be complete in 1976. Certain groups of smaller plants will also be covered, but only in respect of the S.R. of Croatia, so as to establish a complete list of the plant-life in that region. As part of the study of the flora of the S.R. of Croatia, the research workers are analyzing those taxons which are difficult to define, using in particular cytogenetic, serological and phytogeographical methods.

The initial problems presented by the introduction and acclimatization of higher plants, including Mediterranean and sub-Mediterranean plants, are being studied by botanists from various faculties of the University of Zagreb in the Botanical Garden of the Science Faculty. These studies will be extended to other species.

Other research is being carried out on the pathological anatomy of the vegetative and reproductive organs and on the viruses of tall plants in the mainland and coastal regions of Croatia.

The Institute of Biology has a wildlife research programme which covers the whole of Croatia, in particular the coastal strip: it deals with the study of bird-life on the Croatian littoral and the ecology and speciation of small mammals in the karstic regions. Similar studies are being carried out in the national parks and on the islands near to the coast.

For some ten years, studies have been carried out in the national reserve of the lakes of Plitvice, which is the largest in Croatia, for a project on the regional limnological characteristics, hydrological topology and cartography of the lakes of Plitvice, which is being conducted by the Institute. A new Institute has just been set up for the protection of these lakes, and will continue the work of the Institute of Biology.

Montenegro is particularly rich in spectacular landscapes and sites. Various steps have been taken to preserve them, including the establishment of national parks and committees for the protection of nature.

The three existing national parks come under the control of the Titograd Institute for the Protection of Nature.

The longest established - the Durmitor reserve - contains the highest mountain in Montenegro. Protection is thus afforded to highly interesting mountain flora and fauna, and to glacial lakes.

The mountain near Biograd and its lake are a national reserve which is protected because it contains remains of the Ice Age. These lakes are being studied by the Titograd Institute of Biology.

The Mount Lovcen reserve contains the mausoleum of the great Montenegrin poet and politician Njegos. This area is of interest from the biological and especially the botanical point of view.

Montenegro also possesses one of the most beautiful natural sites in Yugoslavia and Europe, the river Tara and its canyon. A special committee established in 1973 at Titograd to protect it has set up a Fund in order to assemble the resources required for the financing of scientific research on this site.

The S.R. of Macedonia contains three national parks, two of which are situated on the Greek-Albanian frontier, in the mountains of Pelister and Galicica. The third is the Mavrovo lake and dam reserve, which is more of a leisure centre than anything else. These parks are managed by the Directorate of National Parks in Skopje, which comes under the Institute for the Protection of Cultural Monuments of the S.R. of Macedonia.

Sporadic scientific work has been carried out by Macedonian and Yugoslav research workers in the mountains of Galicica and Pelister, especially on the local flora and fauna, but there is no continuous research programme.

Despite the variety of the themes studied, by no means all aspects of environmental protection are covered. Subjects such as the

effects of major engineering works, the protection of the karstic zone and certain sociological questions are to be studied in addition to this programme. A special meeting to arrange for this will be organized in January 1976. All the members of the Yugoslav Committee for the MAB Programme will attend and will endeavour to define the direction that future work should take, and to add new research themes.

An interesting step was taken by the Society of Yugoslav Biologists at a symposium organized in Ohrid (Macedonia). It was decided that a network of permanently protected areas should be established forthwith in all the biogeographical zones of Yugoslavia so that ecological research could be carried out in them.

This network would include legally protected areas - national parks, reserves and other areas - of particular importance for basic research and for the rational use and protection of the environment in which man lives. In addition, new areas to be protected should be designated, both on land and sea (Adriatic Coast). These activities could be carried out in the framework of the MAB Programme. A minimum initial programme will have to be defined during the first phase of research.

This first phase includes the organization of the network of permanently protected areas in each republic and province and the identification of the objectives to be attained by means of the research programmes that are planned.

The second phase consists in the implementation of the long-term programme, which will depend upon financial resources and the availability of staff in each republic or province. In this connexion, the training of staff and the acquisition of scientific equipment present a problem, which could be solved with Unesco's assistance.

Lastly, for several years Yugoslavia has been engaged in a vast project for the study of the human environment in the littoral region, where the problems covered by MAB Projects 2 and 8 are closely intertwined. This project is described in Section 4 of this report, as the Yugoslav pilot project.

## ANNEX 3

MAB PROJECT 2: PROPOSED NETWORK OF PILOT STUDIES AND  
CO-PROJECTS FOR THE MEDITERRANEAN FOREST REGIONS

Research themes	Pilot studies
<p>Ecological consequences of forest fires and ecological bases for the protection of forests against fire</p> <ul style="list-style-type: none"> <li>- inflammability and combustibility of the principal trees and shrubs</li> <li>- ecological effects of fire</li> <li>- socio-economic impact of fire</li> </ul>	<ol style="list-style-type: none"> <li>1. Pilot project: Les Maures, France: <i>Quercus ilex</i>, <i>Q. coccifera</i>, <i>Castania sativa</i>; brush (maquis), shrub (garrigue); area: 19,000 ha</li> <li>2. Co-projects: Greece: <i>Pinus halepensis</i>; <i>P. brutia</i> Tuscany, Italy: problems of forest regeneration and reconstitution Portugal: <i>P. pinaster</i> Sierra Nevada, Spain: <i>P. halepensis</i>; <i>P. pinaster</i>; <i>P. sylvestris</i> Turkey: Fire control centre in Antalya, effects of fires on ecosystems</li> </ol>
<p>Effects of grazing on Mediterranean forest ecosystems</p> <ul style="list-style-type: none"> <li>- fodder potential of the various plant formations</li> <li>- evaluation of the palatability and control of the nutritional properties of various plant formations</li> <li>- selection and improvement of local or introduced rural breeds</li> <li>- management systems and their sociological and land tenure aspects</li> </ul>	<ol style="list-style-type: none"> <li>1. Pilot projects: Corsica, France: a few experimental zones Sardinia, Italy: five experimental zones covering various ecological conditions</li> <li>2. Co-projects: Greece: goat grazing project in <i>Quercus coccifera</i> forests Badajoz, Spain Turkey: Antalya research centre</li> </ol>
<p>Influence of plantation forests on the environment</p> <ul style="list-style-type: none"> <li>- on the micro- and the meso-climate</li> <li>- on the soil (chemical, physical and micro-biological influences)</li> <li>- on the water balance and biogeochemical cycles</li> <li>- on the local flora and fauna</li> <li>- on the socio-economic situation</li> </ul>	<ol style="list-style-type: none"> <li>1. Pilot projects: France: <i>Pinus pinea</i> (thorough studies are to be undertaken in the south of France and in other Mediterranean countries) Italy: Poplar plantation forests (around Rome); comparison of the effects of the various exotic species on the soil (Chianti, Tuscany); Eucalyptus plantation forests (Calabria, Sicily); Douglas firs (Tuscany, Calabria); Mediterranean pines (Calabria); <i>P. nigra</i> (Tuscany, Umbria, Abruzzi)</li> <li>2. Co-projects: Greece: great interest in this project (Forestry Research Institute of Athens and Salonika) Portugal: comparison between plantation forests of Eucalyptus and cork-oaks and holm-oaks Spain: plantation forests of indigenous species, particularly Mediterranean pines (in Salamanca, by ICONA); <i>P. radiata</i>, Eucalyptus, <i>P. sylvestris</i>, <i>Quercus pyrenaica</i> (Burgos Institute of the INIA) Turkey: effects of plantation forests of <i>Pinus brutia</i>, <i>Populus</i> (Forestry Research Institute, Ankara)</li> </ol>



Research themes	Pilot studies
<p>Impact of tourism on Mediterranean forest ecosystems</p> <ul style="list-style-type: none"> <li>- demographic impact</li> <li>- carrying capacity</li> <li>- protection of the aesthetic and natural values of the landscape</li> <li>- problems of land use and landscape development</li> </ul>	<ol style="list-style-type: none"> <li>1. Pilot project: Yugoslavia: Adriatic coast</li> <li>2. Co-projects: Various countries have expressed their interest in co-operating on this project</li> </ol>
<p>Effects of air pollutants on forest ecosystems and forest influences on air quality</p> <ul style="list-style-type: none"> <li>- impact of various pollutants, particularly sulphur dioxide and other gaseous sulphur compounds</li> <li>- identification of forest species which are resistant to pollution</li> <li>- identification of pollution-resistant forest species</li> <li>- measures to restore the natural state and improve human health</li> </ul>	<ol style="list-style-type: none"> <li>1. Pilot project: Spain: Sierra del Cadi - Alta Bergada (Barcelona), 50,000 ha of <i>Pinus sylvestris</i>, <i>P. laricio</i>, <i>P. uncinata</i>, <i>Fagus sylvatica</i>, <i>P. excelsa</i>, <i>Buxus sempervirens</i></li> <li>2. Co-projects: Turkey: impact of copper works at Murgul on forest ecosystems Yugoslavia: impact of a cement works and a plastics factory in the Solin basin</li> </ol>
<p>Ecological and socio-economic studies on catchment areas</p> <ul style="list-style-type: none"> <li>- soil erosion problems</li> <li>- effects on the water régime of different management practices in catchment areas</li> <li>- effects of grazing and of fertilizer and pesticide use</li> </ul>	<ol style="list-style-type: none"> <li>1. Pilot projects: Greece: eleven catchment areas covering different geological and ecological situations Spain: pilot studies are planned in the Alanzora basin (province of Almeria)</li> <li>2. Co-projects: Turkey: two projects are planned, at Lake Budur and in the Isparta region Yugoslavia: investigation of erosion in the catchment areas of the River Neretva</li> </ol>
<p>Ecological and socio-economic studies for the use and development of marginal lands</p> <ul style="list-style-type: none"> <li>- structural research into a valid description of types of physical, biological and human environments, and their use in practice</li> <li>- functional research to gain knowledge of the physiological, biochemical and energy-producing processes</li> </ul>	<ol style="list-style-type: none"> <li>1. Co-ordination centres: France: Botanical Laboratory of the University of Marseille for structural research of a biological nature; Department of Soil Ecology of the CNRS at Montpellier for functional research</li> <li>2. Co-operating centres: Greece: ecophysiological group of the Botanical Institute of the University of Athens Italy: Botanical Institute of the University of Rome, study of the brush and shrub series and other marginal lands in "La Tolfa" area (Latium) and the Valley of the Agri (Basilicata) Spain: fundamental and descriptive research at the Institute of Pyrenees Studies and the Pyrenees Centre of Experimental Biology of the CSIC Yugoslavia: study on karstic vegetation (Gracac) at the Botanical Institute of the University of Zagreb</li> </ol>

RESEARCH THEMES AND PROJECTS OF THE SILVA MEDITERRANEA

1. Research projects under implementation

Project No. 3. Direct and indirect costs and benefits of forest shelterbelts and windbreaks in the Mediterranean area. Co-ordinator: G. Guyot (France)

Project No. 4. Selection of stands of Mediterranean conifers for the production of seed to be used for reforestation programmes. Co-ordinator: R. Morandini (Italy)

Project No. 5 bis. The economics of irrigation, cultivation and fertilization in poplar plantations. Co-ordinator: A. Semizoglu (Turkey)

Project No. 6. Eucalyptus provenance trials. Co-ordinator: J.F. Lacaze (France)

Project No. 7. Selection of eucalyptus plantations in the Mediterranean area for the protection of seed for reforestation programme. Co-ordinator: A. Franclet (France)

2. Research themes

Project No. 1. Study on the influence of Mediterranean plant formations on the water balance of catchment areas. Co-ordinator: E. Karamitos (Greece)

Project No. 2. The economics of the utilization of fodder trees and shrubs in reforestation and range management. Co-ordinator: L. Liacos (Greece)

Project No. 5. The economics of irrigation, cultivation and fertilization in eucalyptus plantations. Co-ordinator: G. Giulimondi (Italy)

Project No. 8. Establishment of arboreta for the selection of species suited to national reforestation requirements. Co-ordinator: E. Giordano (Italy)

Project No. 9. Study of the biology of esparto grass and its management. Co-ordinator: J. Ben Aissa (Tunisia)

## ANNEX 5

## DESCRIPTION OF PROPOSED BIOSPHERE RESERVES

## FRANCE

Two biosphere reserves are proposed by the French delegation. The first one, the Camargue reserve, already designated as such, represents a protected delta zone, subjected to various agricultural, industrial and touristic pressures. The second one, the Fango Valley (Corsica) represents a typical grazed climax forest environment which supports a fauna which is itself linked to particular plant associations.

Name	CAMARGUE RESERVE
Geographical location	Department of Bouches-du-Rhône - Rhône delta 43°26 - 43°34 N/4°29 - 4°36 E Nearest important town: Arles Commune: Saintes-Maries-de-la-Mer
Altitude	From sea level to 3 m
Area	13,117 hectares
Legal protection	Declared natural reserve by Decree; situated within the Regional National Park of Camargue. Operating budget: 600,000 F
Administration	Société nationale de protection de la nature et d'acclimatation de France
Physical features	Humid zone. Water: 8,600 ha, land: 4,617 ha, forest: 60 ha. Flora, vegetation and fauna: see "Le Courrier de la Nature", January-February 1975, No. 35 (special issue on the Camargue)
Vegetation	Shrubs of <i>Populus alba</i> , <i>Salix alba</i> , <i>Ulmus campestris</i> , <i>Quercus pubescens</i> , <i>Phillyrea angustifolia</i> , <i>Tamarix gallica</i> . Prairies and grass <i>Brachypodium phoenicoides</i> , <i>Doryenium jordan</i> ; rush beds: Sansouires; <i>Salicornia</i> sp.; aquatic vegetation: <i>Typha</i> sp., <i>Scirpus</i> sp., <i>Phragmites communis</i> ; dunes: <i>Ammophila arenaria</i> , <i>Anthemis maritima</i>
Fauna	Migratory birds: Flamingos, herons, laridae (gulls, sea-gulls, terns), mallards, ringed plovers, limicolae. Mammalia, foxes, wild boars, rabbits, hares. Fresh-water and sea fish
Modification by man	Peripheral agricultural and industrial development
Scientific research potential	Hydrological, geological, botanical, zoological studies conducted over last fifty years. Scientific support: Biological Station of the Tour du Valat and Camargue Ecological Centre of the CNRS. Receives 1,200 specialists each year, from all disciplines and nationalities, as visitors or researchers. Accommodations: Maison de Salins at Badon (ten beds) Hotels in Sambuc and Arles
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Name	VALLEE DU FANGO
Geographical location	Corsica, Department of Haute-Corse 42°35 - 42°40 N/6°39 - 6°48 E Nearest important town: Calvi Commune: Galeria
Altitude	From 10 to 1,000 m
Area	3,991 ha in a mountainous area of 30,000 hectares
Legal protection	Partly forest domain, within the perimeter of the natural regional park of Corsica; natural reserve project under consideration. Research contracts budget: 30,000 F
Administration	Protection of Nature, Parks and Reserves Department
Physical features	Forest environment (10,356 ha) and brush
Vegetation	Holm oaks

Modification by man	Very thinly populated, no tourism
Scientific research potential	Hydrological, pedological, geological, botanical, zoological studies Scientific support: Laboratory of Pirio, APEEM, created in 1974 International research: proposed programme Accommodations: Maison forestière at Pirio with 5 beds and camping Hotels at Galeria (10 km)

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GREECE

Name	MOUNT OLYMPUS RESERVE
Geographical location	Eastern slope of Mount Olympus, in the north-eastern part of Thessaly, 40°9 N/22°5 E, about twenty km from the town of Katerini
Altitude	Between 400 and 2,914 m (summit of Mount Olympus)
Area	4,000 ha
Legal protection	Reserve established by Decree in 1938
Administration	Ministry of agriculture
Vegetation	Typical stands of <i>Pinus nigra</i> , <i>P. leucodermis</i> , hybrids of <i>Abies</i> , <i>Fagus</i> sp. and <i>Quercus</i> sp. Numerous annual and perennial species
Fauna	Numerous species
Other distinctive features	In ancient Greece, the dwelling-place of the twelve gods of Greek mythology

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Name	GORGES OF SAMARIA
Geographical location	South-western part of Crete, in the White Mountains, 35°12 N/23°59 E, 45 km to the south of the town of Khania
Altitude	From sea level to 2,113 m
Area	4,840 ha (forests: 3,114 ha; grazing land: 926 ha; marginal areas: 791 ha)
Legal protection	Natural reserve
Administration	Ministry of agriculture
Physical features	The gorges, which run from north to south, extend in an almost straight line six kilometres long through the mountains and rock formations. The region was selected for its natural beauty and its abundance of endemic animal and plant species
Vegetation	High-altitude Mediterranean forest: stands of <i>Pinus brutia</i> , <i>Cupressus sempervirens</i> and <i>Quercus</i> sp. Numerous endemic species
Fauna	<i>Capra aegragus cretensis</i>
Modification by man	Well-protected region on account of its inaccessibility
Scientific research potential	The region affords outstanding opportunities for a comparative study of the differences between ecosystems situated within the reserve and those outside it, which have been subject to human influence for several thousand years

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Name	DAPHNI
Geographical location	15 km west of Athens
Altitude	100 - 300 m
Area	150 ha
Legal protection	Strictly protected reserve. A few small areas open to the public
Administration	University of Athens: I. and A. Diomedes Botanical Garden
Vegetation	Zone exemplifying the degradation of ecosystems: forest of <i>Pinus halepensis</i> , evergreen sclerophylls, phrygana

Scientific research potential Good opportunities for studying water, water power, etc. Thorough studies of the soil and flora of this site. Physiological and ecological studies on the phrygana are in progress

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### ITALY

Name CIRCEO

Geographical location Province of Latium, 90 km south of Rome in the National Park of Circeo, near the Tyrrhenian coast  
Commune: Sabaudia

Altitude Sea level

Area 3,268 ha

Legal protection Forest reserve with integral reserves

Administration State domanial forest

Physical features Flat land with some traces of marshy sites because of relatively impermeable soil. Average annual temperature 15.5 °C. Annual rainfall 937 mm

Vegetation Varied vegetation according to soil structure, degree of humidity and human activities. Principal types of forests: localized stands of *Quercus ilex*; mixed stands of *Q. suber*, *Q. pedunculata* and *Q. farnetto*; dominant stands of deciduous oaks, *Fraxinus*, *Carpinus*, etc.; marsh forests of *Fraxinus*, *Carpinus* and *Quercus pedunculata*; remains of *Eucalyptus* sp. and *Pinus pinea* plantations

Fauna Mammalia (*Sus scropha*, *Vulpes vulpes*, *Meles meles*, *Mustela Putorius*, *M. nivalis*, *Hystrix cristata*, etc.). Interesting birds include *Picus viridis* and an isolated colony of *Dendrocopos major*

Modification by man Site has undergone drainings since the Roman period to combat malaria, which has lowered the ground water

Scientific research potential Pedological studies, wildlife studies, reconstitution and evolution of the environment after drainings

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Name COLLEMELUCCIO AND MONTEDIMEZZO FORESTS

Geographical location Apennine Chain, east of the Abruzzi National Park, 150 km east of Rome

Altitude 800 to 1,065 m

Area Collemeluccio: 187 ha; Montedimezzo: 242 ha

Legal protection Managed natural reserves, created in 1971

Administration Azienda di Stato per le Foreste Demeniali (Ministry of Agriculture)

Physical features Mountainous zone. Site exemplifies forestry problems of the mountains of southern Italy. Average temperature: 12 °C; minimum: 11 °C, maximum: 22 °C. Annual rainfall: 900 mm, concentrated over 90 days

Vegetation Ancient forest formations and degraded forests  
Collemeluccio: *Abies alba*, *Quercus cerris* and *Fagus sylvatica*. Poor management during the last two World Wars has seriously damaged part of this site which is overgrown with herbaceous vegetation, preventing forest regeneration. Interesting possibilities for ecological studies  
Montedimezzo: next to the Collemeluccio forest, with tall forest stands of *Quercus cerris* and *Fagus sylvatica* some of which are very impressive in their dimensions

Modification by man Poor forest development

Scientific research potential These sites were selected by the MAB Committee of Italy because they offer logistical support to scientific research. Studies of the fir tree in progress. Facilities available

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Name	PIXINAMANNA-IS CANNONERIS FORESTS
Geographical location	Province of Cagliari (Sardinia) Commune: Pula (approx. 8°55' N/39° E), within a future national park to be created by the Sardinian government in the south-eastern part of Cagliari
Altitude	40 - 864 m
Area	15,000 ha
Administration	Mainly by the Sardinian Region
Physical features	Mountainous and hilly site with granite and volcanic soil, representative of large areas of the central Mediterranean region. Average annual temperature: 17-18 °C (maximum: 31-35 °C; minimum: 5-6 °C). Annual rainfall: 970 mm over 80 days
Vegetation	A large part of the site has deteriorated to the scrub stage with a few remains of forest. Thermo-xerophile vegetation (Pixinamanna forest) of <i>Olea oleaster</i> , <i>Pistacia lentiscus</i> , <i>Phillyrea latifolia</i> , etc., at low altitudes. In higher areas, vegetation of <i>Quercus ilex</i> , <i>Phillyrea latifolia</i> , <i>Arbutus unedo</i> . The scrub vegetation is very complex with thorny species exemplified by <i>Genista ephedroides</i> . <i>Nerium oleander</i> groupings are dominant in the valley floors
Fauna	<i>Cervus elaphus</i> , <i>Sus meridionalis</i> , <i>Felis lubica sardoa</i>
Modification by man	Human influences - grazing, fires, deforestation - date back to the Roman period. The area is presently nearly uninhabited
Scientific research potential	Possibilities for ecological and plant cover restoration studies

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PORTUGAL

Name	CASTRO MARIM RESERVE
Geographical location	Southern Portugal, district of Faro (Algarve), at the mouth of the Chanca River
Altitude	Sea level
Legal protection	Reserve
Physical features	Hydromorphic saline soil region
Vegetation	Halophilic "sagal" vegetation
Fauna	Abundant bird-life. Shell-fish
Scientific research potential	Studies have been made on the soil, vegetation and fauna (fish, reptiles)

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Name	NATIONAL PARK OF PENEDA-GERES
Geographical location	Northern Portugal, district of Braga, Viana do Castelo et Vila Real
Altitude	350 - 1,550 m
Area	60,000 ha
Legal protection	National Park
Administration	General Directorate of Forest Resources
Physical features	Mountainous region with forest ecosystems and humid zones
Vegetation	<i>Quercus robur</i> , <i>Q. pyrenaica</i> , <i>Q. suber</i> , <i>Pinus sylvestris</i> . Grasslands of <i>Nardus stricta</i>
Fauna	Very rich in reptiles and amphibia, <i>Capreolus capreolus</i> , <i>Sus scrofa</i> , etc.

Modification by man	Impact of tourism in the park meadows. Very accessible
Scientific research potential	Soil, phytosociological, wildlife, sociological and ecological studies have already been carried out. Facilities available
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Name	ARRABIDA RESERVE
Geographical location	Mount Arrabida, district of Setubal, 30 km south-east of Lisbonne
Legal protection	Reserve
Administration	General Directorate of Forest Resources
Physical features	Mountainous region, littoral forests and maquis
Vegetation	Natural forest of <i>Quercus fagineae</i> and maquis. Easy access
Fauna	Various species. Little known
Modification by man	Strong tourist pressure along the coast in the summer
Other features	Arrabida Convent
Scientific research potential	Laboratory and accommodations in Lisbonne

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SPAIN

Name	ORDESA-VIGNEMALE RESERVE
Geographical location	Spanish Pyrenees, within the National Park of Ordesa and the National Game Reserve of Vignemale (42°34' - 40°51' N/0°02' - 0°28' E)
Altitude	890 - 3,355 m
Area	51,396 ha (2,166 ha in the Ordesa Park, the remainder in the Vignemale Game Reserve)
Legal protection	National Park and National Game Reserve
Administration	Institute for the Conservation of Nature (ICONA)
Physical features	Situated in one of the highest regions of the Spanish Pyrenees
Vegetation	Forests of <i>Abies pectinata</i> , <i>Pinus sylvestris</i> and <i>Fagus sylvatica</i> with vast alpine and sub-alpine meadows
Fauna	Abundant and relatively intact (isard and bouquetin, <i>Capra pyrenaica pyrenaica</i> )
Modification by man	Strong tourist impact, especially in Ordesa National Park
Scientific research potential	Studies to be made in this region: - comparison of intact ecosystems and adjacent developed ecosystems - study of means of safeguarding the bouquetin and isard - socio-economic study of the mountainous populations There are many possibilities for co-operation between France and Spain in this area, since the Pyrenees National Park, with the more humid Pyrenean ecosystems, borders the Ordesa-Vignemale

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TURKEY

Name	SIDE RESERVE
Geographical location	Province of Pamphylia in the southern part of Turkey (approx. 36°8' N/31-32° E). Bordering the coast, extending up to the Taurus mountains. Nearest town: Antalya, 80 km, seaport, airport
Area	100,000 ha
Legal protection	Declared to be a protected zone by special decree of the Ministry of Tourism, which draws up the research programme and appoints the Committee for the Protection of Side. The budget is the responsibility of this Ministry. A special budget is planned for the future

Administration	Ministry of Tourism; Committee for the Protection of Side
Physical features	Zone bordering the sea and extending up to the mountain zone at the end of the Taurus mountain range. Hot summers, moderately hot springs and autumns, mild winters
Vegetation	Typically Mediterranean. Single natural forest of <i>Cupressus sempervirens</i>
Fauna	Animals and birds in abundance. (A special breeding centre for rare species has been set up)
Other features	Archaeological site: Greek and Roman remains. Historical city of ancient Side
Modification by man	The effect of tourism on the coastal strip is considerable. The government is considering taking measures to control it
Scientific research potential	On account of its rare Mediterranean vegetation, the unique ecosystems of the "Alops" Taurus, the rare and interesting marine flora and fauna and the opportunities for under-water exploration, this region is an outstanding natural laboratory for scientists: botanists, entomologists, zoologists, archaeologists, sociologists and specialists in marine biology The Turkish authorities are prepared to establish a research and training centre in the reserve, within the framework of the MAB Programme, and desire the collaboration of those responsible for this Programme in undertaking international research projects

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#### YUGOSLAVIA

Name	NATIONAL PARK OF THE VELEBIT ALPS
Geographical location	Coastal region of Croatia, northern coast of the Adriatic (approx. 44°-45° N), some 70 km south of Rijeka
Altitude	Sea level to 1,500 m
Area	130,000 ha, extending over 145 km, from the town of Senj to the Zrmanja canyon
Legal protection	There are already a few small individual reserves (Hajducki, Rozanski, Kukovi and Stirovaca). A national park covering the entire region is to be established
Administration	Region managed by the Forestry Department (Senj and Gospic)
Physical features	Coastal chain of the Croatian mountain mass with highly-varied karstic formations. Mediterranean climate on the coast, Alpine-continental in the hills and mountains, and modified semi-continental in the continental zone
Vegetation	All the major types of vegetation are represented: - sub-Mediterranean zone with forests of <i>Quercus pubescens</i> and <i>Carpinus orientalis</i> - Mediterranean hill zone with <i>Quercus pubescens</i> and <i>Ostrya carpinifolias</i> - euro-Siberian sub-Mediterranean hill zone with <i>Sesleria autumnalis</i> and forests of <i>Fagus sylvatica</i> - euro-Siberian mountain zone with forests of <i>F. sylvatica</i> and <i>Abies alba</i> - euro-Siberian sub-Alpine stratum, with forests of <i>F. sylvatica</i> , <i>Picea abies</i> and <i>Pinus mugo</i> - alpine grassland stratum with <i>Sesleria juncifolia</i> This region contains numerous neo-endemic species and few palaeo-endemic ones
Fauna	Abundant and varied
Modification by man	Isolated region, depopulated as a result of migration to the towns, with no tourist industry. In the north-east and south-west the coast is linked to the hinterland by roads



Scientific research  
potential

Studies of the flora have been carried out and maps have been prepared showing the potential and actual vegetation. The Institute for the Protection of Nature has completed its preliminary study relating to the establishment of a national park. Within the park there will be a botanical garden of exceptional interest, containing a representative selection of the flora of the region.

For the purposes of an international research programme, the Velebit park provides a good example of the coastal part of the Illyrian province with the characteristic vertical strata of the vegetation. It is also a gene pool for most of the trees, bushes and herbaceous species in the region.

## DESCRIPTION OF FIELD STATIONS

The Integrated Geomorphology Centre of Potenza

Location. Potenza, Region of Basilicata, Italy.

Programmes of regional development should be based on an integrated approach taking into account geomorphological, ecological, botanical, hydrological and geological aspects. With this intention, centres of integrated geomorphology have been established in several countries, namely in the Mediterranean region where they have an especially important rôle owing to the social and cultural heritage to be preserved, the complexity of soil conservation problems and pollution control.

In 1973, a meeting organized under the auspices of Unesco and the Region of Basilicata, in Potenza, with the participation of the three principal Schools of Integrated Geomorphology of Europe (the Netherlands, the United Kingdom, France), pointed up the need for a single co-ordination centre, within the Mediterranean area, to deal with the specific and comparable problems of regional development in the countries around the Mediterranean basin.

It was unanimously decided to house such a centre in the Basilicata Region because of its large geographical, geological and ecological diversity, the beauty of its landscape and the possibility to establish biological reserves of international interest. Moreover, the approach taken in that region to the social and economic problems is of interest. The Basilicata coastal area, on either side of Italy, borders two seas, towards the West and the East, creating a natural Mediterranean vocation for this region.

The preceding considerations are the origins of the establishment of the Centre of Integrated Geomorphology of Potenza, the statutes of which, approved in April 1975 by the Council of the Basilicata Region, set down the following objectives:

- (1) orientate towards the Basilicata region Italian and foreign scientists and research workers specialized in geomorphology with a view to establishing a rapid and balanced development scheme which would serve as a model for other Mediterranean regions; co-operation between researchers from the Mediterranean region and those from the Basilicata would thereby be developed;
- (2) perfect integrated mapping instruments, easy to understand and utilize, which would furnish programmers, regional planners and technicians in general tools adapted to their respective fields; these maps should take into account *all* the principal influences on a determined scientific sector or the inter-acting influences;
- (3) form new generations of Mediterranean region technicians, namely in the field of integrated geomorphology applied to regional development, through special training programmes on the national and international (Unesco) levels;

- (4) promote and encourage the preparation of integrated multidisciplinary working groups of technicians and researchers interested in cartography, and organize their field activities on either an experimental or practical level;
- (5) co-ordinate the activities undertaken throughout the Mediterranean basin by meetings, publications, etc., with a view to a continual exchange of acquired experiences and solutions to problems, particularly those of an ecological nature;
- (6) compile cartographic, photographic and bibliographic documentation, necessary for the Centre's function.

Furthermore, the Potenza Centre could undertake the study, organization and application of assistance programmes to developing countries, namely in professional training, in Italy and other countries, and carry out any projects entrusted to it by national or international organizations and administrative bodies.

Mount Ventoux Field Centre

Location. Ventoux Massif (altitude 1,900 m), in the southern part of the Rhône channel, 30 km north-east of Avignon.

Physical features of the site. The massif constitutes the most western part of the limestone Prealps Secondary chain. The southern slope is Mediterranean in terms of its vegetation and contains a remarkable sampling of altitudinal strata (eu-, supra-mountainous and oro-Mediterranean).

The vegetation of the southern slope is particularly significant in the Mediterranean region: forest ecosystems of holm-oak, Aleppo pine, pubescent oak, sylvestre pine, beech and mountain pine. On the northern slope the fir tree is also found. Since the end of the last century large reafforestations have been carried out at different altitudes namely with *Quercus ilex*, *Q. pubescens*, *Pinus nigra* sp. *austriaca* and *Cedrus atlantica*, which have created diverse substitution forests of extremely variable ecological and economic value.

Integrated research. The exceptionally interesting plant and animal populations of this mountain area, and the problems of the ecological interpretation of its forest ecosystems, has inspired research studies to be conducted, during the past fifteen years, by the neighbouring universities - Aix-Marseille and Montpellier in particular - and by the laboratories of the INRA (Avignon) and the DGRST in the "Biological Equilibrium" programme.

The following disciplines have participated in the research work:

- (1) Foresters: study of the production of various species in terms of the large topographical and ecological parameters.

- (2) Botanists: definition of the distinctive phytosociological units and of the series of vegetation in terms of altitude; establishment of a phytoecological map of the massif (1/20,000).
- (3) Zoologists: biological cycle of caterpillars, and the rôle of climatic factors and the biological regulation by parasites: dipterans and hymenopterans or hyperparasites; study of the distinctive groups of the pedofauna and of the birds.
- (4) Climatologists: installation of twelve meteorological stations on the western slope, which have afforded a good knowledge of the thermic and hydric factors on the massif; integrated research with plant ecologists.
- (5) Economists: drawing up a map of the environment of the massif and its adjacent valleys, indicating the agricultural and forest land uses and the sensitivity of various natural environments.

The combined studies and the fruitful collaboration between the researchers have made Ventoux one of the better-known areas of the Mediterranean region, and a veritable field laboratory.

A project, under MAB Project 2, based on the utilization and improvement of marginal land in the Mediterranean region, could find an immediately utilizable area in the Ventoux, where nearly all the fundamental studies relating to the environment have already been carried out. This massif could serve as a field laboratory for the training of researchers, or for the developing of new research projects, which would benefit from the onset from the acquired knowledge, and certain logistical resources, as well as from the highly-qualified research centres situated in a 150 km radius of the Ventoux Centre.

Indeed, for many years there has been a small field laboratory, organized by the forestry research, at Ventoux, near Malaucène, which could receive a certain number of researchers in favourable working and scientific conditions.

It should be mentioned that the forest research centre in Avignon of the Institut National de la Recherche Agronomique (INRA), was the starting point for the integrated research work on forest ecology pursued at Ventoux. Likewise, several laboratories of the Universities of Aix-Marseille and Montpellier, and the CEPE Louis Emberger, have participated in research programmes on the Ventoux and are directly involved in the projects relating to MAB Project 2. They can provide the necessary framework in the specialization of researchers and the implementation of new programmes, according to the respective areas of study.

## INTERNATIONAL CENTRE FOR ADVANCED AGRONOMIC STUDIES IN THE MEDITERRANEAN

## (CIHEAM)

The International Centre for Advanced Studies in the Mediterranean is an inter-governmental organization created by the Agreement of 21 May 1962 between the seven countries of southern Europe (Portugal, Spain, France, Italy, Yugoslavia, Greece, Turkey) at the initiative of OECD and the Council of Europe.

The object of the Centre is to provide complementary economic and technical instruction and to develop a spirit of international co-operation among the agriculture staff of the Mediterranean countries.

The CIHEAM is directed by a Board of Administration formed by a representative from each of the member countries and, in advisory capacity, Secretary-Generals of the Council of Europe and the OECD.

To define the pedagogical and scientific policy of the Centre, the Board of Administration consulted the Advisory Committee, composed of competent authorities in education and research.

The Centre is composed of a General Secretariat, and three specialized institutes called Instituts Agronomiques Méditerranéens, located in Bari (Italy), Montpellier (France), and Saragossa (Spain). The General Secretariat, in charge of co-ordinating the activities of these institutes has its offices in Paris, 11, rue Newton, 75116 Paris (720.70.03).

CIHEAM's activities can be divided into the following five categories:

- (1) post-graduate level education open to university graduates with some years of professional experience;
- (2) organization of specialized courses, at the request of a government or of an international organization;
- (3) research studies to improve original training methods and to broaden knowledge of the region's economy;
- (4) operational activities through participation in assessment or development programmes in the countries of the region;
- (5) documentation network on the problems of development in the Mediterranean countries with the participation of interested documentation centres, following the documentation systems of the international organizations.

The courses are taught by a highly-qualified professional staff of resident or visiting professors selected among internationally-known specialists.

The Centre receives in priority trainees from the member countries, other Mediterranean countries, and, whenever possible, those from other regions. The 1,143 graduates of the Centre in 1975 came from sixty-three countries of all areas of the world, with 82% from the Mediterranean region.

The Institutes offer programmes integrating the techniques and methods in the overall pro-

cesses of development, considered in the framework of the existing socio-economic systems in the Mediterranean region. They are of an interdisciplinary nature, constantly adapted, to enable the participants to thoroughly study concrete problems, and are innovative and naturally original in order to avoid repeating work of international or national institutions already in existence. Courses and seminars are given on request.

The following courses were offered in the three Institutes during the university year of 1975-1976:

Institute of Bari (Casella Postale 135, 70100 Bari, Italy). Tel.: 65.24.01:

- (1) general course on the "Bonifica integrale" (17 November 1975/30 June 1976): organic examination of the obstacles in the valorization of a perimeter, proposals of technical solutions, alternatives and their programming in harmony with regional planning;
- (2) specialized course on "Soil conservation and water control" (17 November 1975/30 June 1976): specific examination of elements relating to water erosion, surface runoff and flood formations;
- (3) specialized course on "Irrigation": determination of water distribution according to crop rotation programmes and irrigation methods; project of water supply, transport and distribution works;
- (4) five-week course (May 1976) on the "Economic evaluation of irrigation projects": *a priori* and *a posteriori* evaluation, collecting basic data, determination of the profitability in terms of development and for the community;
- (5) two short-term courses are in preparation:
  - (a) "Management of water resources". General outline of the resources. Evaluation and classification of supply sources. Answer to the needs in space and time. Methodology of management systems.
  - (b) "Water pollution".

Institute of Montpellier (31-91, Route de Mende, B.P. 1239, 34011 Montpellier). Tel.: 63.28.80:

- (1) a general course on the "Problems of Growth and Development", viewed within the framework of the existing socio-economic systems in the Mediterranean countries. The Third World is considered in some fundamental aspects of development (agrarian, political, industrial reforms, etc.) and in relation to developed countries (international commerce);
- (2) specialized courses to be chosen (January-May 1976):

- (a) "Methodology of decision-making": at the micro-economic and overall level.
- (b) "Agro-food economy": structures and management of agro-food enterprises, markets and agro-food markets.
- (c) "Analysis and development of rural areas".

There are also shorter courses from eight to sixteen weeks for professionals. Seminars could also be organized on the following themes: progress diffusion, simulation of regional development, agro-alimentary co-operatives, planification, selecting investment projects, agro-alimentary economy, methods of agricultural management and development, pedagogical and technological educative structures, social and environmental formations, etc.

Lastly, two series of courses are presently in progress at the Agronomic Institute of Montpellier at the request of the Algerian government (for students of the ITA of Mostaganem and the ITPEA of Algiers), on the one hand, and for the FAO and Brazilian government, on the other.

Institute of Saragossa (Apartado 202, Saragossa, Spain). Tel.: 29.72.07:

- (1) advanced horticulture course (15 October 1975/11 June 1976): technical and economic aspects of agricultural development; soils

and sub-strata; plant physiology and amelioration; vegetable plantations; ornamental plants; sanitary plant pathology; industrial horticulture; cooling of plant products;

- (2) advanced animal production course (15 October 1975/11 June 1976): technical and economic aspects of agricultural and animal development; use of the resources of the Mediterranean climate regions in the zoo-technology of the ruminants, animal husbandry and behaviour; industrial zoo-technology, conservation and commercialization of meat and carcasses, freezing installations;
- (3) from May or October 1976, a course on "Rural management in relationship to the environment": cold conservation of aliments; monographic cycle of genetics and amelioration of sugar beets.

Moreover, CIHEAM is undertaking several other projects, one of which comprises a four-month course on viticulture, which will take place in several wine-producing countries.

Lastly, the Centre publishes a magazine every two months since 1970, entitled "Options méditerranéennes"; each issue is devoted to an important theme for the region (environment, water management, soil conservation, Mediterranean features, commercial exchanges, olive trees, etc.).