The present state of soil resources in the Mediterranean countries

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SUMMARY - The so-called "neolithic revolution" consisting mainly of animal domestication and cultivation of crops, started some 6,500 years ago in Mesopotamia and extended rapidly from the naturally fertile lands of the Tigris and Euphrates area to the Nile valley and delta where the floods were progressively controlled. As far as the more specific Mediterranean regions were concerned, the most active agricultural regions were Greece and its colonies, as well as the Etruscan groups in the central area of Italy (Latium). The Mediterranean regions have therefore to be considered the longest and most intensively exploited agricultural lands. FAO has actively contributed to the development of a number of soil survey and classification methodologies with a more recent achievement which has been the digitizing of the Soil Map of the World and its use as a base to evaluate the problems of soils in the countries of the Mediterranean basin. The area around the Mediterranean has been distinguished by its singular climatic characteristics with rainfall concentrated in winter; these conditions extend over and estimated 420 million ha, space mainly located around the Mediterranean Sea but also in the coastal areas of Southern Australia, South Africa, California and Chile. The major soils of Mediterranean areas are the following: Fluvisols, Regosols, Lithosols, Rendzinas, Vertisols, Chromic Luvisols and Calcic Cambisols. Landform and steep slopes are the major problems in nearly everywhere in the region, bur particularly in the European part of the Mediterranean. This points to potential and actual soil degradation in large parts of this natural geographic area. Soil erosion, loss of fertility, soil salinization and its related problems have affected mankind ever since land was first settled and cultivated in the region. Systematic work of assessment and mapping soil degradation was started by FAO in 1975 in collaboration with UNEP. The PAP/RAC project within the framework of the UNEP's Mediterranean "Blue Plan" is one of the more recent programmes. A "Coastal Mediterranean Scheme" is being implemented to encourage and allow countries of the Mediterranean to work together in developing a programme to control and prevent soil degradation.

Key words: Mediterranean, soil resources, soil degradation, "Blue Plan", "PAP/RAC".

RESUMÉ - Ce que l'on connaît par "révolution néolithique" consistant principalement en la domestication d'animaux et la culture de végétaux, commença il y a quelques 6 500 ans en Mésopotamie et s'étendit rapidement des terres fertiles naturelles de la région du Tigre et de l'Euphrate vers la vallée et le delta du Nil, où les crues furent progressivement maîtrisées. En ce qui concerne plus particulièrement les régions méditerranéennes, les régions agricoles les plus actives se trouvaient en Grèce et dans ses colonies, ainsi que chez les groupes Etrusques de la zone centrale de l'Italie (Latium). Les régions méditerranéennes doivent être donc considérées comme les terres agricoles exploitées depuis plus longtemps et plus intensivement. La FAO a contribué activement au développement d'un certain nombre d'études de sols et de méthodologies de classification, avec un travail plus récent sur la digitalisation de la Carte Mondiale des Sols et son utilisation comme base pour évaluer les problèmes des sols dans les pays du bassin méditerranéen. Le pourtour de la Méditerranée se distingue par ses caractéristiques climatiques particulières avec les précipitations en hiver ; ces conditions s'étendent sur à peu près 420 millions d'hectares, qui se trouvent surtout autour de la

Méditerranée, mais aussi dans les zones côtières du sud de l'Australie, de l'Afrique du Sud, de la Californie et du Chili. Les principaux sols des régions méditerranéennes sont les suivants : Fluvisols, Régosols, Lithosols, Rendzines, Vertisols, Luvisols Chromiques et Cambisols Calciques. La forme des terres et les pentes abruptes sont les principaux problèmes pratiquement partout dans la région, mais particulièrement sur la façade européenne de la Méditerranée. Ceci indique une dégradation des sols potentielle et réelle dans de grandes parties de cette zone géographique naturelle. L'érosion du sol, la perte de fertilité, la salinisation des sols et les problèmes qui en dérivent, ont affecté l'humanité même depuis le début de l'établissement et de la mise en culture des terres dans la région. Un travail systématique d'évaluation et de cartographie de la dégradation del sols fut commencé par la FAO en 1975 en collaboration avec l'UNEP. Le projet PAPA/RAC dans le cadre du "Plan Bleu" de la Méditerranée de l'UNEP est un des programmes les plus récents. Une "Etude Méditerranéenne Côtière" est mise en oeuvre afin d'encourager et de permettre les pays méditerranéens de travailler conjointement au développement d'un programme pour contenir et prévenir la dégradation des sols.

***Mots-clés**: Méditerranéen, ressources du sols, dégradation des sols, "Plan Bleu", "PAP/RAC".*

Introduction

The origin of agriculture

For almost one million years human beings lived from hunting and gathering, depending entirely on what nature provided according to the seasons and places. This forced humans to be continuous on the move.

As soon as man learned to dominated the natural environment which he lived in, a major change occurred: man was now able to settle down in small organized, sedentary villages. According to the latest surveys, this event happened some 6,500 years ago in Eurasia in the temperate regions stretching from Palestine to Persia and Afghanistan where cereals were first cultivated.

The so-called "neolithic revolution" started with animal domestication and the cultivation of crops; these activities were probably not connected since women cultivated the land while men dealt with cattle and other domestic animals (see overhead Maps 1 and 2).

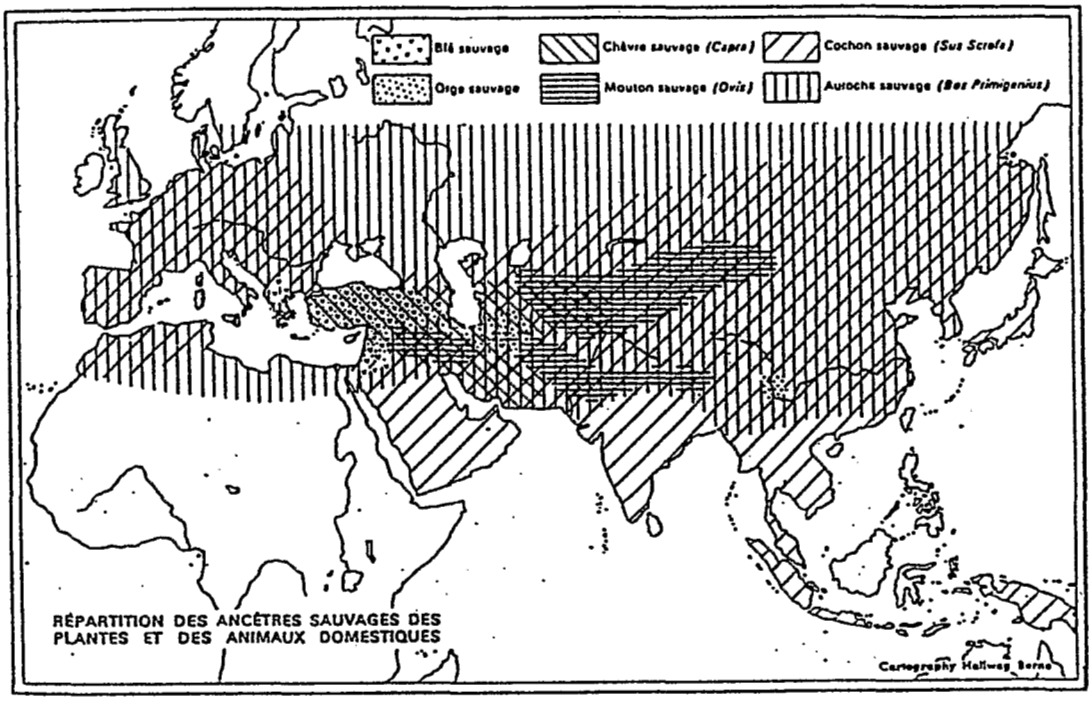
The revolution started in Mesopotamia and extended rapidly from the naturally fertile lands of the Tigris and Euphrates area to the Nile valley and delta where the floods were progressively controlled.

Both cultivation and stock breeding changed life and favoured population increases. China, Egypt, Mesopotamia, the whole of Minor Asia, Greece, Phemeia, Carthago, Etruria and Rome developed agricultural systems which were taken up by others.

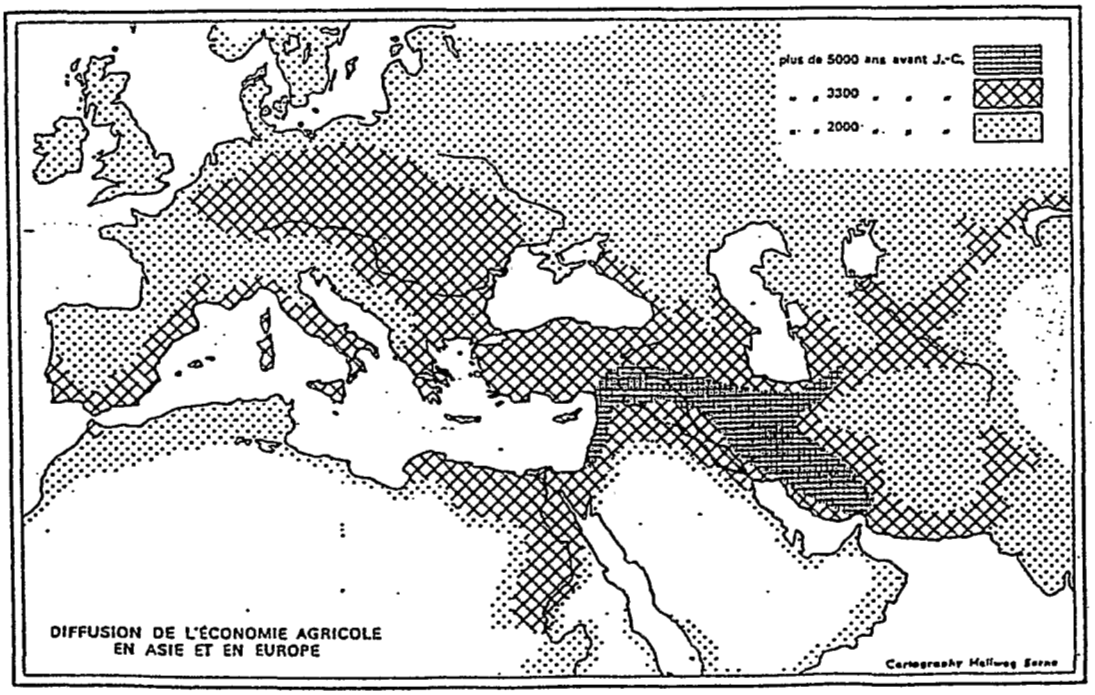
More intensive and organized agricultural activities and patterns appeared forcing periodic withdrawal from exhausted lands and the first rudimentary use of natural fertilizing and irrigation practices. Simultaneously horticulture improved and became more and more intensive.

As far as the more specific Mediterranean regions were concerned, the most active agricultural regions were Greece and its colonies, as well as the Etruscan groups in the central areas of Italy (Latium). These regions were experiencing a fast growth in the population, therefore they increased their arable land by terracing steep slopes, draining and reclaiming swamps and/or flood affected lowlands.

Simultaneously deforestation and related soil erosion processes began which since then have never been completely under control.



Map 1. Distribution of the wild ancestry of domestic plants and animals (Laffont, 1969).



Map 2. Diffusion of agricultural economy in Asia and Europe (Laffont, 1969).

The Mediterranean regions have therefore to be considered the longest and most intensively exploited agricultural lands mainly due to the combined effects of historical, cultural, geographical and technical factors.

Only very recently did the obvious need of a thorough and systematic soils resources assessment arise as a first step towards planning a more rational use of these resources.

The development of soil science, starting from the end of the last century, established the link that exists between specific environmental factors such as climate, geology, topography, vegetation and

fauna, time of development and human influence on the processes that take place in the soil. These in turn can be characterized by the specific chemical, physical and morphological properties of the soil. In earlier times most emphasis was placed on the environment in which the soil developed, which is still the basis of the Russian Soil Classification. Later most European soil science schools placed more emphasis on the pedogenetic processes as a basis for the classification of soils and more recently, the American school, from the Nineteen Sixties onwards, emphasized soil properties as the basis of distinguishing soils.

The link between environment, pedogenetic processes and soil properties is best served by a holistic approach in which all three aspects are given due attention. In recent years this development has been served by the considerable technical progress accomplished in other fields, among which remote sensing and computer technology, and particularly geographical information systems which permit the overlay of different thematic maps and the construction of associated databases.

FAO has contributed to the development of a number of methodologies in this field that deserve our particular mention.

In the field of soil survey and soil classification, the publication of the Guidelines for Soil Profile Description (FAO, 1990) and the Revised Legend of the Soil Map of the World (FAO/UNESCO/ISRIC, 1988) are international standards that facilitate technology transfer between countries.

The development of SOTER (Soil and Terrain Database, ISRIC/UNEP/FAO, 1992) is the latest and most integrated approach using an up-to-date methodology and it is being applied in several countries in Latin America and West Africa. While at a global scale the digitization of the Soil Map of the World (FAO, 1992) and the publication of a global assessment of human induced soil degradation (GLASOD/ISRIC/UNEP, 1990) contributed to a better understanding of soils and their status in individual countries and within countries.

A recent achievement has been the digitizing of the Soil Map of the World and its use as a basis to evaluate the problems of soils in the countries of the Mediterranean basin.

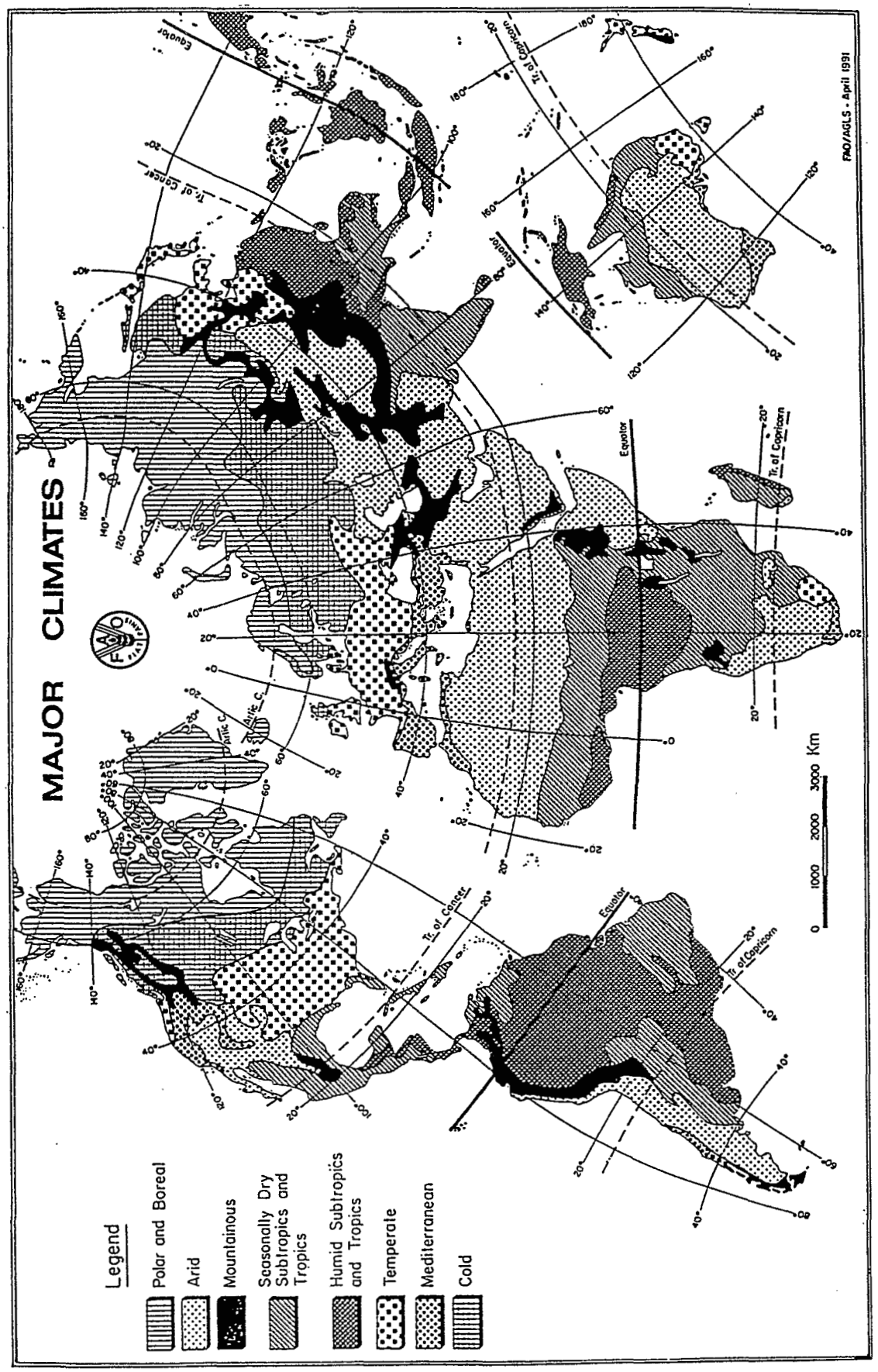
The present state of soil resources

The area around the Mediterranean has been distinguished by its singular climatic characteristics with rainfall concentrated in winter at a time when temperature and insolation are least favourable for plant growth. Frost risk that is generally limited to very short periods, while summer is dry to very dry. As a result the vegetation, land-use and soil formation acquire special characteristics quite distinct from those in other climates. The Mediterranean climate extends over an estimated 420 million ha, mainly located around the Mediterranean sea but also in the coastal areas of Southern Australia, South Africa, California and Chile (Map 3).

Typical agricultural crops of this zone include olives, grapes, figs, almonds and (durum) wheat. With irrigation this type of climate is ideally suited for citriculture. Natural vegetation in this zone consists of sclerophyllous forests (evergreen oak, chestnut and pistachio) and thorny thickets (maquis, degrading into *garrigues*).

Soil forming processes are often linked with changes in migration (winter) and accumulation (summer) of clay or calcium carbonate resulting in a dominance of Calcisols and Luvisols in this zone (Fig. 1). The warmer types of this climate also favours the formation of Vertisols. When soils are young or regularly rejuvenated Cambisols dominate, while in the parts of this zone that have a pronounced relief as in the Atlas or the Abruzzi the eroding landscape leads to the formation of Leptosols and Regosols.

A very general analysis of soils occurring in each country around the Mediterranean is presented in Table 1.



Map 3. Major climates (FAO/AGLS, 1991).

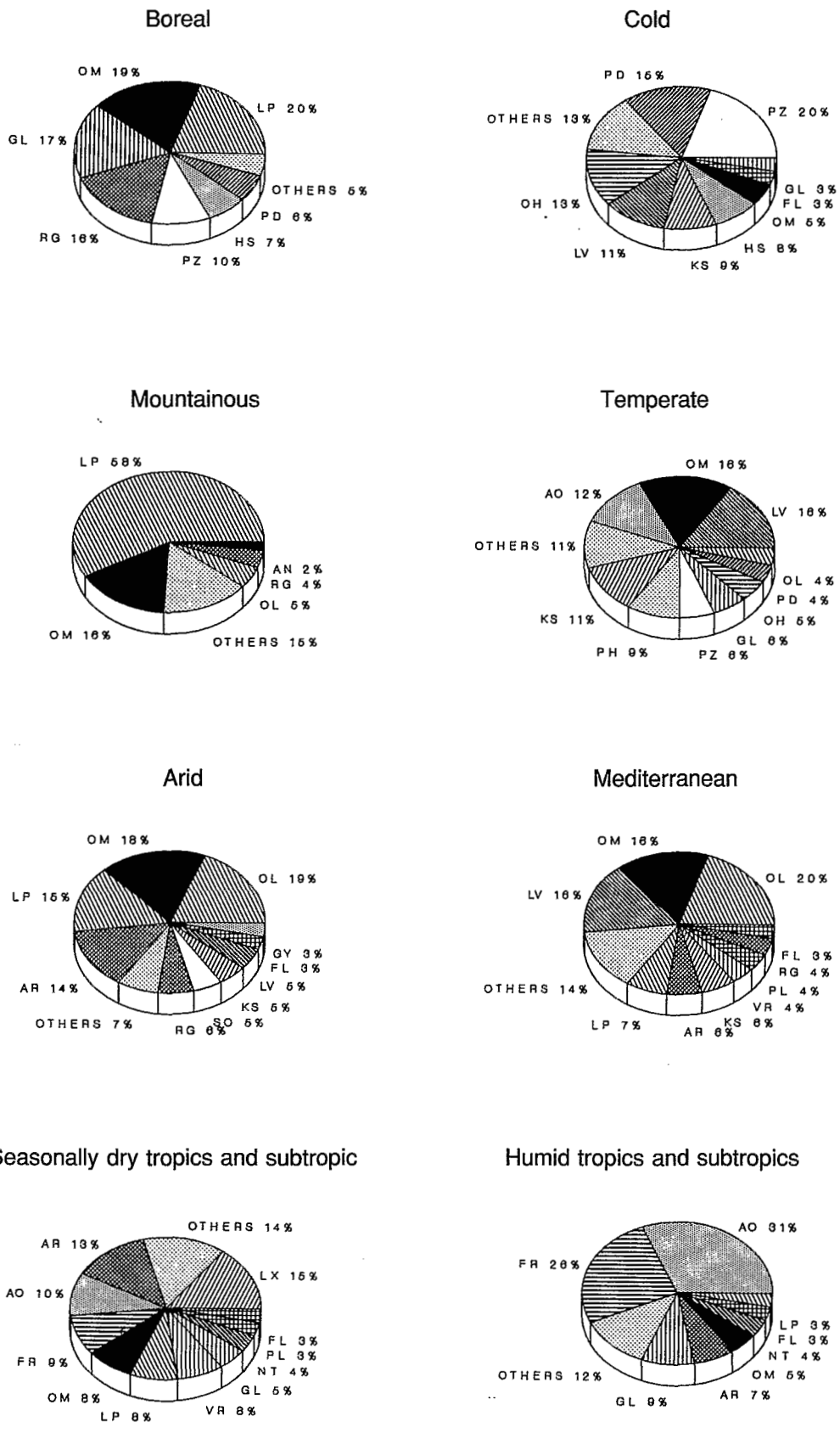


Fig. 1. Distribution of major soil groups by climatic zone (FAO World Soil Resources Map).

Table 1. Main soils distribution by country (% of total country area)(FAO World Soil Resources Map).

Country / Soil groups	Albania	France	Greece	Italy	Spain	Turkey	Malta	Cyprus	Israel	Lebanon	Syria	Algeria	Egypt	Libya	Morocco	Tunisia
Fluvisols	8	6	4	5	1	1	0	0	0	0	2	3	3	6	8	8
Gleysols	2	<2	<2	<2	<2	<2	0	0	<1	<1	<2	<1	<2	0	<1	<1
Regosols	8	22	5	11	4	5	0	2	13	1	3	7	18	8	9	2
Lithosols + Rock	16	5	27	10	9	20	10	22	23	21	17	29	16	9	17	18
Rendzinas	1	8	1	6	6	5	10	11	3	8	<1	<1	0	0	2	7
Rankers	<1	3	<1	1	11	1	1	0	0	0	0	0	0	0	0	0
Vertisols	0	<1	<1	<2	<2	<2	0	6	7	8	5	<2	<1	0	2	2
Andosols	<1	<1	<1	<2	0	<1	0	0	0	0	0	0	0	0	<1	0
Solonchaks	0	<1	<1	0	2	<1	0	2	2	0	<2	2	4	1	3	7
Solonetz	0	0	<1	0	0	0	0	2	0	0	0	<1	<1	<1	<1	<1
Yermosols	0	0	0	0	0	0	0	0	23	0	26	30	30	44	13	18
Calcic Yermosols	0	0	0	0	0	0	0	0	22	0	9	9	15	16	2	2
Gypsic Yermosols	0	0	0	0	0	0	0	0	1	0	13	3	2	8	1	10
Xerosols	0	0	0	0	0	0	0	0	4	11	32	1	<1	3	10	7
Calcic Xerosols	0	0	0	0	0	0	0	0	3	11	23	<1	0	2	3	2
Gypsic Xerosols	0	0	0	0	0	0	0	0	0	<1	7	<1	0	<1	<1	<1
Cambisols	19	29	10	37	40	20	10	46	4	30	3	3	0	<1	7	8
Calcic Cambisols	0	<1	0	<1	22	6	0	32	<1	17	1	2	0	<1	6	7
Luvisols	38	26	45	12	5	11	70	4	9	19	4	<1	0	<1	12	<1
Chromic Luvisols	37	3	43	9	2	7	70	2	8	19	4	<1	0	<1	11	<1

Note: Cumulative percentages by country might exceed 100% due to the desegregation of certain soil types such as: Yermosols (Calcic and Gypsic), Xerosols (Calcic and Gypsic), Cambisols (Calcic) and Luvisols (Chromic).

The following are the major soils of the area (excluding soils typical for a desert or semi-desert environment i.e. Xerosols, Yermosols):

FLUVISOLS (Fluvisols, FAO, 1988; Fluvents, Soil Taxonomy, 1975; sols peu évolués non climatiques d'apport alluvial, CPCS, 1967).

These are young alluvial soils that are the most fertile of the region. Nearly all are rich in bases or are slightly calcareous. These are highly important soils for agriculture occurring on a level topography along major rivers such as the Ebro, the Rhone and the Tisza. They are suited to a wide variety of crops and are highly productive particularly when irrigated.

REGOSOLS (Regosols or Arenosols, when coarse textured, FAO, 1988; Orthents, Soil Taxonomy, 1975; sols peu évolués non climatiques d'apport alluvial ou marin, CPCS, 1967).

These are young soils which often occur on steep sloping land or they are coarse textured. Topography and moisture stress are the main limitations in these soils although the finer textured ones are fertile. When topography is suitable they are devoted to intensive cereal and fruit production and are also associated with coastal sand dunes or recent sands deposited in deserts. Peaches and citrus are grown with sprinkler irrigation. In hilly and mountainous areas these soils are largely devoted to extensive livestock production from rough grazing or remain under forest.

LITHOSOLS (Leptosols, FAO, 1988; Orthents, Soil Taxonomy, 1975; sols mineraux bruts, CPCS, 1967).

These are very shallow soils over rock that often occur on steep to very steep slopes. These erosion prone soils should be left under natural vegetation and conservation measures should be taken when they are damaged. They are very extensive in the Mediterranean region. Forest and controlled extensive grazing are the recommended land uses.

RENDZINAS (Rendzic Leptosols, FAO, 1988; Xerolls, Soil Taxonomy, 1975; Rendzines, CPCS, 1967).

These soils rich in humus content, shallow over limestone and often high in gravel content occur generally in hilly areas. When slopes are moderate to gentle the development of intensive agriculture is possible (olives, figs, wines, barley, vegetables, winter pastures). Cultivation of chlorosis sensitive plants, such as citrus, should be avoided. On steeper slopes forestry and extensive grazing are the major land uses.

VERTISOLS These soils are characterized by a high clay content. They are often dark coloured and due to the smectic clay mineralogy they are very hard and crack when dray and sticky and plastic (often impassable) when wet. In the Mediterranean region they have a significant extent in Cyprus and the Near East and also in Morocco and Tunisia. Vertisols have great agricultural potential but special management practices are required to secure sustained agricultural production. Due to their poor workability they are less suitable for subsistence agriculture, and unless mechanization and irrigation is possible, they are best suited for grazing.

CHROMIC LUVISOLS (Rhodoxeralfs, Soil Taxonomy, 1975; sols Rouges méditerranéens, CPCS, 1967).

These soils, in general, are not calcareous but are still very rich in bases. They develop in various parent materials. The most well known is the Terra Rossa developed on hard limestone. In the mountain of Greece, Albania, Italy and Turkey they are stony in character. As these soils are fertile, they have been used since ancient time for agriculture. Many of them are degraded, due to long intensive

cultivation, deforestation and overgrazing. They are still extensively used in all countries around the Mediterranean for a wide variety of crops.

CALCIC CAMBISOLS (Calcisols, FAO, 1988; Eutrochrepts, Soil Taxonomy, 1975).

These are soils characterized by a significant accumulation of calcium carbonate in the subsoil, that occur in the drier parts of the Mediterranean climates. In Northern Africa the soils are generally on gently undulating terrain, land-use is winter cereals and extensive grazing. Olives and figs are grown and less frequently citrus, which may suffer from chlorosis. In Spain (Andalusia) and Turkey (West Anatolia) these soils are associated with a hilly and mountainous topography and are often stony. Cereals, vines, rough grazing or forestry are the main land-uses.

At the same scale of detail an analysis can be made of the soil depth, textural and slope attributes of soils in each of the countries concerned (Table 2).

Soil related problems are summarized by country in Table 3. From this general analysis it follows that although similar problems are present in every Mediterranean country, the intensity and extent is variable and differ from country to country.

Arid areas although strictly speaking not the subject of the conference are a major problem in all Mediterranean countries in the Near East and North Africa.

Landform and steep slopes are the major problem nearly everywhere in the region, but particularly in the European part of the Mediterranean (e.g. Greece, 36%). This points to potential and actual soil degradation in large parts of this area.

Shallow soils on gentler slopes are a distinct problem particularly in Algeria, Cyprus, Spain and Malta where more than one sixth of the countries' area is affected.

Severe fertility problems inherent to acid soils are rare in the area which is not surprising given the base rich environment and prevailing climate which is not conductive to intensive leaching.

Coarse textured soils with low moisture storage capacity and a low inherent fertility pose particular problems in Yugoslavia, Algeria, Libya, Egypt and Tunisia.

Vertisols with a high content of smectic clays pose a problem of workability and accessibility. High level management and high inputs are required to deal with the particular physical properties of these soils. These soils are important in Lebanon, Cyprus and Israel and to a lesser extent in Morocco and Tunisia.

Soil salinity and alkalinity problems are a significant problem in Tunisia and Cyprus and to a lesser degree in the other northern African countries.

Insufficient drainage, a high watertable and flood risk associated with hydromorphic soils are scarce in the region with the exception of Yugoslavia and France, but the majority of these soils occur in a temperate not in a Mediterranean climate.

No acid sulphate soils or peat soils occur in the region and hence these special problem soils do not require our attention.

Although the foregoing analysis is necessarily very limited, it should not be forgotten that the soil knowledge of the region still leaves much to be desired as national soil maps at an adequate scale, are according to FAO's information, still lacking in several countries (Table 4).

These partial deficiencies in basic data hinder seriously both soil quality and soil degradation assessments.

Table 2. Estimated distribution of slope classes, soil textural classes and soil depth in the Mediterranean region based on the Soil Map of the World (FAO World Soil Resources Map).

Country	Slopes class*			Topsoil textural class*			Soil depth			
	Flat <8%	Undulating 8-30%	Steep >30%	Coarse	Medium	Fine	<10 cm	10-50 cm	50-100 cm	>100 cm
Albania	14	53	30	3	66	29	16	2	0	80
France	42	51	6	10	72	17	5	11	0	83
Greece	20	43	35	1	60	37	27	1	0	71
Italy	18	56	24	6	72	17	10	7	0	82
Spain	20	59	19	3	87	8	9	18	1	70
Turkey	20	51	26	0	83	14	20	6	0	73
Malta	35	60	5	0	65	35	10	10	0	80
Cyprus	22	54	23	0	74	25	22	11	0	66
Israel	34	53	11	1	61	35	23	3	0	73
Lebanon	20	44	35	0	58	41	21	8	0	70
Syria	54	35	10	0	70	29	17	7	7	67
Algeria	34	26	6	21	62	2	30	2	2	66
Egypt	36	34	8	42	46	6	22	0	0	78
Libya	47	24	5	35	60	1	13	1	1	85
Morocco	40	37	23	3	91	6	18	7	4	71
Tunisia	41	34	15	26	66	7	19	13	6	62

* When total % does not add up to 100 (Algeria, Egypt, Libya, Tunisia) this is due to presence of miscellaneous land units having no topsoil texture or slope indications (e.g. Rock Outcrops).

Table 3. Problem soils in the Mediterranean region by country and by main constraint (%)(FAO World Soil Resources Map).

Country	B	C	D	E	F	G	H	I	J	K	Misc.	L
Albania	0	30	9	2	3	0	0	0	0	0	1	54
Algeria	51	4	17	0	17	0	0	1	0	0	0	9
Cyprus	0	23	17	3	0	10	0	3	0	0	0	44
Egypt	61	3	0	1	17	0	0	1	0	0	0	9
France	0	7	12	15	9	0	0	0	0	2	0	55
Greece	0	36	5	1	2	2	0	0	0	0	0	54
Israel	56	4	4	0	1	14	0	0	0	0	1	19
Italy	0	24	10	3	3	3	0	0	0	0	0	56
Lebanon	19	30	13	0	0	11	0	0	0	0	0	27
Libya	66	1	5	0	21	0	0	1	0	0	0	6
Malta	0	5	15	0	0	0	0	0	0	0	0	80
Morocco	55	9	2	2	2	3	0	1	0	0	0	27
Spain	2	20	16	5	2	2	0	0	0	0	0	54
Syria	81	2	1	1	0	5	0	0	0	0	0	10
Tunisia	44	11	11	1	11	3	0	6	0	0	0	14
Turkey	31	22	10	1	1	1	2	0	0	0	1	31

A = Too cold
B = Too dry
C = Too steep
D = Too shallow
E = Too wet
F = Too coarse
G = Vertic properties
H = Infertile
I = Toxic (Na)
J = Acid sulfate soils
K = Peat
Misc. Miscellaneous land
L= No problem

Land degradation assessment

Land degradation is not a new problem. In fact, soil erosion, soil salinization, and its related problems have faced mankind ever since land was first settled and cultivated some 7,000 years ago. At times the problem was so extensive that it contributed to, if not caused, the decline of great civilizations in such places as China, Mesopotamia, and here around the Mediterranean basin in Egypt, North Africa, Greece and Italy.

FAO has been very actively involved in the assessment and mapping of land resources since the 1950s. However, only a limited amount of work has been done on the mapping of soil degradation.

Systematic work started only in 1975 in collaboration with UNEP. Since then FAO has been involved in several efforts to develop a satisfactory system for classifying land degradation. So far this has

proved difficult: the subject is very complex and sufficient reliable data are seldom available to support anything but very general assessments.

The PAP/RAC project, within the framework of the UNEP's Mediterranean Blue Plan, is one of the few programmes which provides a practical framework to work towards developing and testing a suitable methodology. It complements and supports the work done by UNEP and ISRIC with their Global Assessment of Soil Degradation (GLASOD). Its timing coincides with a crucial period during which FAO is actively promoting new soil conservation approaches and strategies adapted to specific physical, social and institutional environments. Among other activities, FAO is presently collaborating with UNEP to assist several countries with the formulation of national soils policies.

With the present interest in the environment in general and land degradation in particular, the time is now ripe to develop a "Coastal Mediterranean Scheme" which would encourage and allow countries of the Mediterranean to work together in developing and implementing a programme to control and prevent land degradation.

Table 4. Soil map coverage by country (FAO World Soil Resources Map).

Country	Coverage/Scale	Date	Classification
Algeria	North only - 1:500 000	1954	Pre-CPCS
Albania	Complete - 1:2 000 000	1984	FAO/Unesco (1974)
Cyprus	Complete - 1:2 000 000	1970	FAO/Unesco (1974)
Egypt	Complete - 1:1 000 000*	1982	Soil Taxonomy
France	Complete - 1:1 000 000	1988	FAO/Unesco (1988)
Greece	Complete - 1:1 000 000	1988	FAO/Unesco (1988)
Israel	Complete - 1:500 000	1975	National and Soil Tax. and FAO (1974)
Lebanon	Complete - 1:1 000 000	1985	Soil Taxonomy
Libya	-	-	-
Malta	Complete - 1:30 000	-	British System
Morocco	-	-	-
Spain	Complete - 1:1 000 000	1985	FAO/Unesco (1988)
Syria	Complete - 1:1 000 000	1985	Soil Taxonomy
Tunisia	Complete - 1:500 000	1973	French (CPCS, 1967)
Turkey	Complete - 1:800 000	1954	USA - 1949
Yugoslavia	Complete - 1:1 000 000	1959	National/Russian

* Unpublished
Libya = Incomplete/inadequate data

Towards a scheme for the conservation and rehabilitation of the Mediterranean coastal lands

Over the centuries, people have developed strategies and practices to protect and rehabilitate their lands. Many have proved effective. Their remains can still be seen for instance in traditional soil and water conservation systems called Tabias and Jesours here in Tunisia. Modern research confirms that the basic principles of soil conservation have been known and practised by farmers for centuries. Unfortunately, due to a variety of pressures on the land, traditional conservation practices are breaking down, and traditional systems such as shifting cultivation and mixing cropping are being abandoned. At the same time, attempts to introduce modern-day soil conservation programmes have generally proved expensive and frequently ineffective. The reasons why traditional systems are breaking down and modern systems are not proving more effective need to be carefully studied before any new initiatives are launched.

From the experience gained in a number of countries, it is becoming apparent that new conservation and rehabilitation policies and strategies can be effective if they take into account not only the specific environmental conditions, but also the perceptions and actions of its individual farmers, pastoralists, foresters and other people who are actually using the land. Only these people have the ability to bring about fundamental changes in land use that maybe required. The challenge facing governments is to create the conditions that will provide the motivation for better land use. Their main role should be to promote the participation of rural people in finding and applying alternatives and improvements.

The first step needed is to identify and remove factors that are contributing to detrimental use. These are likely to include population pressure, agricultural pricing policies and land tenure systems. These are the kind of subjects rarely considered in the past when conservation programmes were developed. Even if solutions are not immediately possible, a sound understanding of the underlying causes of land degradation can prevent governments from embarking on ineffective programmes that simply deal with the symptoms.

If those ideas are accepted as a basis for soil conservation policy and strategy, the next step is to develop the necessary policies and measures for their implementation. Every country is different, and each must tailor its policy and strategy to meet its own unique needs. Nevertheless a number of general actions should be followed. These follow three main lines: improving land use, encouraging participation of land users, and developing national capacities.

As a starting point, every country should have an inventory of its land resources. All relevant information should be brought together and gaps identified. This can be done through the use of remote sensing and geographic information systems but where these are not available more traditional methods can be used. Additional studies will be needed in most countries to identify the extent and the intensity of land degradation and, as previously said, to find out the reasons for the poor land use. The constraints towards the adoption of alternative practices and measures have to be identified. These include individual land users' rights, priorities, or investment capacities and consideration of the overall land users' community regulations.

The ideal strategy is one in which the land users plan and implement solutions for their own benefit. To this end, the role of governments must change from that of implementer of soil conservation projects to facilitator that helps identify the problems and then encourages the land users in setting up or strengthening their own local or professional organizations.

Provision must be made for back up services to the land users which will rationalize and coordinate the actions of national institutions plus provide appropriate training, research and legislation to support the conservation effort. A thorough review of all relevant legislations is essential to ensure their appropriateness and effectiveness. Regional and sub-regional programmes need to be developed to give the country the chance to benefit from other countries successes and failures in the land conservation efforts.

Governments should commit themselves to long-term policies, programmes and financial requirements that can bring about sustainable forms of land use. Governments should be thoroughly responsible for coordinating the technical assistance within an overall national programme. New land conservation and rehabilitation policies, programmes strategies have to be harmonized with those that exist in the country's National Economic Development Plan, the National Desertification Plan or the National Conservation Strategy when there is one (Sanders, 1990; Sanders, 1991).

Conclusions

Initially efforts should concentrate on developing and refining simple methodologies of assessment of land degradation. PAP/RAC's first exercise in Tunisia and Turkey to develop acceptable methodologies have almost been completed. This should now be extended to all countries around the Mediterranean basin.

The problem of lack of reliable, usable and comparable data still exists. This means that programmes must be rational and not over-ambitious. The increasing use of geographical information systems should greatly facilitate work in this field.

The task many individual Mediterranean countries face of conserving and rehabilitating their lands is formidable. Countries may need the support of non-governmental or professional organizations, technical agencies, and international financing institutions. A strengthened cooperation between the North and the South will enhance the step forward in land conservation.

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