Republic of Lebanon

Ministry of Agriculture

United Nations
Environment Programme
(UNEP)

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BIOLOGICAL DIVERSITY OF LEBANON

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1. Liste des espèces
2. Facteurs socio-économiques affectant la biodiversité
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LEBANON COUNTRY STUDY

ON

BIOLOGICAL DIVERSITY

Agricultural and Livestock Habitats

and

Nature Reserves

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Lebanon country study on biological diversity ; Project GF/6105-92-72.

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Lebanon is characterized by a great variability in soil-climatic conditions due to its relief where mountains and plateaux are often. The fluctuations in temperature, cosmic radiations, humidity and variations in soil fertility favored the new formation of plants leading to a great diversity in plant forms.

Wild ancestors and relatives of several cultivated species mainly cereals, food legumes forages are still abundantly found in different eco-geographical zones of the country and for food security purposes.

Inspite of the great importance of these wild relatives for the improvement of cultivated species, no efforts were made to conserve these species at the national level.

*Reliable data for domesticated plant and livestock species are not available.
The reason is to complete absence of any official records on seeds or embryos currently used in Lebanon in the Ministry of Agriculture and other institutions.

*The seed industry and seed distribution is mainly based on imported improved lines. This area is controlled by the private sector.

*Lack of gene banks and collection of domesticated species.

*The problem became more acute during the 17 years of instability that were the reason for the lack of official control. Even after the war, any kind of variety or cultivars from any source could have been introduced in the country and widely used by farmers in their fields, orchards and animal husbandry's.

It is almost impossible to obtain records on the available domesticated species for both plant and livestock in Lebanon. However, the information was collected from sparse and isolated reports, surveys and impersonal farmer's interims. However, some field crops like wheat and the livestock species were monitored with the help of international organization and might be used as a base for the study.

*Research programs and surveys in this field are still weak. Effort of scientists are focused on the introduction of new cultivars or species, to replace the conventional and non productive species without taking into consideration the potentials which might be obtained through local genetic resources.

*Constraints at the level of domesticated species directly influence their economical and social importance. They need more attention from all the agricultural sector.

The present study is aiming at reviewing the status of agriculture crops and livestock biodiversity and to identify the basic threats and needs for an effective conservation and rational use of national biodiversity. This will contribute to the formulation of a national biodiversity strategy.

The agricultural sector has played a diminishing role since the Lebanese economy in the 1960's. Its share for the GDP has declined from 12% in 1960 to 8% at present with a corresponding decline in agricultural labor from 38.3 to 7.3%. At present, Lebanon is an exporter of fruits and vegetables, self sufficient in poultry and produces 15%, 45 and 10% of its wheat, legumes and sugar needs respectively. It also imports 78% of its dairy and meat products.

Trends in agricultural land allocation to various crops are presented in table 1.

Table 1: Trends in Lebanese Agriculture (Area 1000 Ha)

Crop	Period 1965-70	Period 1990's
Wheat	79.400	13.200
Barley	13.500	3.999
Favabeans	4.380	0.941
Potatoes	8.922	1.600
Onions	1.970	1.600
Citrus+orange	1.000	12.000
Bananas	2.500	1.150
Sugar beets	1.700	3.000*
Tobacco	6.034	0.740*
Apples	12.000	5.000
Olives	28.000	35.000

* subsidized crops area depends on public policy

The livestock sector contributes about 3% of the total lebanese GDP and 25% to the total agricultural GDP. Livestock numbers according to 1993 estimates of MOA are the following :

Poultry:	40 million day old chicks
	35 million broilers
	1.5 millions layers
Sheep:	250000 heads
Goat:	450000 heads
Cattle:	77000 heads
Beehives:	65000 hives
Swine:	40000 heads
Horses:	12000 heads
Donkeys:	23000 heads
Mules:	8000 heads
Camels:	55 heads

No estimates are available on other livestock catergories such as rabbits, turkeys, quails, pigeons, partridges and other.

The Lebanese farmer has shifted his interest from large animals to smaller size animals. Animal production became more intensive and new farms are continuously being established to cover what may be called exotic industries for the Lebanese agriculture. Quail farms, fresh water fisheries, snail and rabbit are raised under intensive farming. The number of dairy cows dropped from 200 to less than 80 thousands, the number of goats dropped from about a million to 450000. Other large animals faced similar conditions. Grazing animals are becoming more sedentary as land holdings become smaller and public awareness is unfortunately being oriented through public media against grazing animals. It may be fair to note that the local farmer is being socially and administratively pressed to hide his animals under a roof or far from residential areas.

The cropping system is a result of interaction between the environment, the geographical location, the human factor and the economic status of the specific area. Traditional agriculture continues to stand high on many crops and all over the country. However, there are areas which excel in producing specific crops and many have adopted the most advanced technologies. It is customary for a Lebanese to try obtaining his chickpeas from Nabi-Sheit, Lentils from Talia, Onions from Bsaba, Bsous and Shadra, Cherries from Baskinta, Apricots from Baalbeck, Olive oil from Koura, etc. These micro environments look to be the most suitable for the specific produce and there must be something behind the tradition and the quality of production. Whether these areas are the highest producers in quantity or not remains a question to be answered or an issue to be studied. The whole range of extensive cropping down to the very intensive systems are applicable under Lebanese agriculture. Perhaps, the most suitable for Lebanon would be a cropping system which makes best use of the scarcely available resources in terms of space, time, efficiency and technology. The most apt system would be a very intensive program of production utilizing multiple crops, integrated animal and plant systems and using the most effective cultural practices in irrigation, plant nutrition and protection. With respect to sustainable agriculture and the renewable use of natural resources. The present situation of agricultural practices is summarized in Annexes 3, 4 and 5 for fruit trees, vegetables and field crops, respectively .

Most agricultural land in Lebanon is considered dry even though the total rainfall in some areas (coast and mountain) would fall in the classification of humid climate. Rainfall comes during the slow growth season and soils are too shallow to keep the moisture for future plant use. The effectiveness of precipitation is very low and very few crops could tolerate such harsh environments. Other than pasture and forest plants the few crops that are agriculturally suitable for rainfed agriculture are as follows: Tobacco, mostly produced in south Lebanon, barley, chickpeas, lentils, lupines are typical crops of the dry areas in the Bekaa and the South. Olives are the most widespread trees which are predominantly rainfed. Almonds, figs, pistachios etc are also produced under rainfed conditions. The most interesting approach to tree production under dry conditions would be orientation towards agroforestry where forest

plants could produce some kind of a good product. Pine, carob, sumac, azarlus, etc. are good examples on this issue. There are very few summer crops which can withstand the dry and hot conditions. Watermelon, cucumber and sunflower are major examples of the crops that still produce under the dry climate of the Bekaa. One must consider that rainfed agriculture is extensive, less economical, however proper management could improve the productivity of these areas especially when oriented to grazing and pasture.

Gifted with water availability in some areas, the possibility of intensive cropping becomes a reality and the potential for high productivity could be exploited. Record yields could be obtained from crops under Lebanese conditions. Subtropical fruits and vegetables could be produced on coastal areas. Temperate crops are produced at high elevation mountains and traditional crops in the Bekaa area.

1.Multiple cropping: Farmers try to concentrate on short season crops so they can produce more than one crop annually, for example an early crop of potatoes is usually followed with a late plantation of the same crop. Lettuce follows winter crops and beans follow early vegetables as lettuce or potatoes.

Inter cropping is practiced in coastal areas more or less representing sequential pattern. For economical purposes and to compensate the weak profit, farmers try to make the best use of land and the maximum use of the growing season. Many times the risk factor becomes high as they are faced with an early winter or a late spring.

2.Protected Environment: Many vegetables (cucumbers, tomatoes etc.) and ornamentals (carnation, gerbera, etc.) are produced under protected environment (greenhouses, plastic channels, etc.). This environment makes advantage of the high priced land to fully exploit the agricultural potential which has to compete with other socio-developmental processes. Being the most intensive production system, it requires high agricultural and economic inputs. Drip irrigation could be considered as a semi-protected system which produces very intensively and has recently invaded Lebanese agriculture in many areas. It is widely spread in North Bekaa and is concentrated on producing tomatoes and watermelons. The impact of the intensity of production on the micro and macro levels of the environment must be scientifically assessed.

Huge greenhouses are recently being used to produce bananas and to generate transplants from tissue culture. These techniques reflect on intensity of production and could possibly keep some land under agriculture.

The lebanese farmer sounds to be fed-up of his status. He complains of the public sector poor interest and little care. This phenomenon is not new in the farming community as farming is and has been a very risky business depending on climatic conditions, weather changes and marketing problems. Production is becoming more expensive, farming life more difficult and city opportunities extremely luring and highly attractive. Only the elderly stay on the farm, new generations exploit their chances somewhere else. This implies negative future changes in agriculture production.

Nevertheless, life is as continuous as change is. The picture cannot be black or white, it is light to deep color depending on planning, technological changes, social demand and the international situation. It is true that social and public developments are using agricultural land to much higher degrees than poor marginal land. It is also true that population increases at higher rates than social or agricultural developments but it is imperative to note that many of the fearful theories did not matter and the post world war II food shortage atmospheres were dissipated by the appearances of surpluses in the world.

The presently available technologies have opened way for sharp increases in productivity. Present day varieties of cereals, potatoes, tomatoes and many other crops can outyield their traditional predecessors by at least four fold releasing at least theoretically 3/4 of the arable land for other uses. It is unfortunate that when agricultural land is used in socio-developments as buildings, roads, etc cannot be used again for agriculture production. How far could technology go in producing food for four millions on smaller arable land (250000 Ha) remains a question for the future.

The major expected changes in lebanese agriculture would be as follows:

a- Shift towards more intensive cropping e.g. ornamentals replacing vegetables and vegetables replacing field crops. (cash crops)
b- More concentration on utilizing modern technologies e.g. tissue culture, drip irrigation, embryo transfer, protected cropping, etc.
c- Expansion on some crops of uniqueness to lebanese conditions e.g. temperate fruits, agro-forestry and related activities as bee production, mushrooms, snails and artificial fisheries.
d- Concentration on producing a quality commodity e.g. seeds in lieu of grain, propagules for produce, organing farming, etc...
e- Introduction or domestication of new crops. e.g. Medicinal plants from wild to commercial wild plants to use for production aspects like thyme, sumac, etc.

Modern farming is dependent on the technology developed during the past centuries. Starting with the proper planting material and the right environment the farmer has to use :

a- fertilizers
b- fongicides
c- insecticides
d- herbicides

These farm chemicals are becoming major requirements for producing a marketable and economic crop. There is a general feeling that the lebanese farmer is using excessive fertilizers and pesticides which constitute a threat to humans and to the quality of the lebanese environment. These products have become expensive during the past decade and the extent of use became more restricted. As irrigation water is scarce and run off could be repumped an increase in water salinity was detected recently. The presence of nitrate in water pumped from drill wells is becoming an alarming issue as it indicates excessive use of nitrogen fertilizers. In sugar beet production very low levels of sugar 10-12% instead of 18% are obtained as a result of high levels of nitrogen fertilizers.

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The use of herbicides is not very extensive in farming. Mostly winter cereals, potatoes and sugar beets are chemically needed. This may not constitute a big risk on the national scale for the time being.

Fongicides and insecticides are becoming more questionable with time. These are generously applied under intensive cropping systems as drip-irrigated vegetables and greenhouse crops. It could be more of a social issue than an actual plant residue problem which may constitute a great hazard in the future. Many agricultural products, likely to carry farm chemicals, e.g. milk and its products were very low in the specific products under testing. International standards are available while local studies are extremely short of meeting the actual need. One may note that, though public awareness is high, the actual levels of farm chemicals in the lebanese produce cannot be alarmingly high. We should also consider that some crops in some off-season might be taken with reservation at least until scientific proof becomes definitive and available.

[illegible]

It is important to note that only few areas in Lebanon could be considered agriculturally suitable for cropping; 360-500000 Ha or 50% of the total area. Most land may be considered relatively poor to produce good crops. The government of Lebanon has established an institution (Green Plan) to rehabilitate agricultural land and make it more suitable for crops. Artificial soil is being used under protected environment. Ancient farmers have established terraces to keep soil in place and make land more suitable for the root system. Almost all temperate fruit trees and mountain plants are planted on some sc of terraces. Examples on cherries, apples, pears, figs and most summer vegetables are key crops on terraced land. Technically, areas in central and west Bekaa and the Akkar plain are most suitable for almost all crops. However, crops are scattered all over the country and the produce is generally of good quality and yields are high.

In general, there is a traditional tendency in Lebanese agriculture to extend practices to areas of very low suitability. e.g. apples were planted at elevations much lower than 900 m and in the Bekaa valley where they performed poor and were unrooted and replaced. Olive and pine trees were in similar situations. More economic crops are invading land which is not very suitable e.g. wheat is grown in areas where barley could be more suitable.

[illegible] Improvement and Research

Lebanon is an excellent importer of technology, an excellent adopter and a country that utilizes, improves and extends these technologies. All crops of commercial value are improvements made in other countries with the exception of winter cereals and grain legumes. The traditional varieties of fruits and vegetables, field crops and many animal breeds and flacks are giving way to the improved international germplasm.

Private and public research activities are concentrated on selecting the most appropriate technologies. New varieties of crops are being locally produced only in wheat and barley. The private sector imports and markets new technologies while academic and research institutions are very active in testing the technologies and controlling the performance and security of these technologies.

[illegible]

The wild life of almost all plants and animals are subjected to strong genetic erosion as a result of which many species could become extinct and certainly many valuable genes could be lost. The main threats to biodiversity are essentially social, economic, political, agricultural and cultural.

2.1. Urbanization

Urbanization could be considered the major threat to biodiversity as a whole. It was estimated that, during the last 20 years, Lebanon had lost about 20.000 hectares of its cultivated land as a result of expansion of cities and suburbs towards the rural areas. Due to population growth and socio-economic factors, the coastal ecosystem along the lebanese coast is destroyed, where the development of cities, roads, highways and industry were concentrated. The threat to biodiversity in forest ecosystems along the western slope is still existing and could be considered as an ecologically sensitive area.

[illegible]

The intensive use of natural resources, such as logging, overgrazing of wild vegetation by small ruminants is prohibiting the regeneration of the plant cover in rangelands. The growth in the number of herds and their size on range lands, without pasture establishment and to make extra profit without supplementary costs, put a great load on the wild vegetation of such areas, prohibiting the seed set of several wild species and consequently the enrichment of the seed bank in the soil and its preservation endangering them to be lost, especially the annual species of legumes.

2.3. Agricultural practices

The intensive method of agricultural production has a great impact on the loss of habitats endangering several species of wild plants and animals. In this aspect, some human activities, although legislated by the law are imposing a great threat to wild life of plants and animals, such as the amelioration activities carried out by governmental and non governmental organisms by destroying the upper layer of the soil, where the seed bank of wild plants is deposited.

Furthermore, the transfer of the fertile soil layer from one habitat to another for creating better condition for some cash crops to be grown in greenhouses is causing a serious damage to the habitat in both sites. Annex 3, 4 and 5. Annex 2 describes agricultural patterns for fruit trees, vegetables, field crops. Codes for these tables are explained in Annex 1.

In the past twenty years, technology-based agriculture had penetrated the conservative systems, and high-yielding cultivars, oftenly bred for other countries are displacing the heterogeneous landraces, and mixtures.

The misuse of pesticides is another hazard to biodiversity, although there is no alternative for their use at present time. Pesticides, if used properly, will not have any direct impact on biodiversity and the health of man and animals. But in developing countries, the overuse of pesticides and chemical fertilizers especially the nitrogenous is the major cause of pollute contamination of underground water. In Lebanon, several internationally prohibited chemicals are still intensively used such as the methyl bromide. The most dangerous chemicals are the herbicides which have the most dangerous effect on ecosystems. But their use in Lebanon is not common with the exception of paraquate. In Lebanon, the main cause of pesticide pollution is the misuse of chlorinated insecticides that stay in the soil for long periods causing a serious damage to the drinking quality of water and to microorganisms. A sound example about the misuse of pesticides is that of cucumber and tomatoes grown in protected conditions, where during the 4-months growing period, about 10 to 12 insecticides applications are practiced.

Pollution is the major reason for the degradation of the environment. Many governments had been awared about the dangers associated with pollution and its impact on the environment and consequently on the loss of biodiversity.

In Lebanon, the problem is much more severe than in any other country, due to the absence of laws and regularities and the impossibility to enforce the laws whenever existed because of the instability and war activities during the past 20 years. Among the most important factors that may lead to degradation of the environment are the following:

a- Industrial wastes that are thrown directly to lakes, rivers and to the sea.
b- Dumping of chemical wastes imported from industrial countries.
c- The absence of recycling technology of different human wastes.
d- Quarries to extract stone sand.

The outbreak of fires in the hot summer is common in Lebanon. Some of them could be spontaneously started, others, with the intervention of men, whether on purpose or unconsciously; safety pecautions are not sufficient. Big fires are intentively caused by Israeli bombardment of different zones with internationally forbidden armors.

Whatever were the reasons, such fires that usually occur in the period of seed set of the greatest part of wild plant forms prohibits the enrichment of the seed bank in the soil.

Other than fires, the occasional floods that may take place due to heavy rains, and the mountainous relief of the country where sharp slopes are common have a very serious impact on the degradation of biodiversity by destroying the natural habitat of many wild plants where fertile soils including the seed bank to the sea or to other places where conditions could seem inappropriate for the growth of this or that species.

Land is abused in many ways. First, it has been subjected to natural hazards where the soil was eroded by wind and water for thousands of years. Erosion of valuable cropland can also occur because of poor agricultural practices. Land is also abused by sporadic excavation of mountains for the production of construction materials.

The relative high prices of land, was a major limiting factor in agricultural development, especially in field crops, pasture management and production of foodstuff. In agro-ecological zones, and because of small size land holdings, farmers are replacing their traditional crops, by more profitable ones leading to monocropping system.

Besides, several sites could be considered as sensitive zones and the biodiversity is strongly endangered with complete destruction, since sooner or later, they will be used for construction purposes mainly touristic projects that usually bring very quick and high profits to the land owners. This land abuse is encouraged by many policy-makers who consider that Lebanon is not an agricultural country and expensive land should be used more often for providing industrial and touristic services.

Natural species information for various agricultural crops in terms of conservation status, habitat, economic significance, threatened relatives and status of domestication are detailed in annexes 6, 7, 8, and codes for these tables are listed in Annex 1. In addition the wild relatives of various crops with their geographical locations are listed in annexes 9, 10, 11, 12, 13, 14, and 17.

The major threats to the agrobiodiversity in Lebanon as discussed in previous section could be summarized in order of priority as following

1. The expansion of urbanized center in the Coast and in the Bekaa valley are threatening the large scale traditional cultivation of subtropical fruits, olives and including many land varieties. This coupled with a lack of land use planning and land zoning is leading to the massive conservation of agricultural lands into more profitable sectors (services, industries, and transport)
2. The introduction and adoption of high production inputs such as high yielding monocultures, in addition to abuses and misuses of fertilizers and pesticides gradually resulting in the disappearance of many local varieties of cereals, fruits and vegetables (Hawrani Wheat, Wild Pear, and the Kahale cucumber)

Other threats to agricultural biodiversity include environmental pollution, overgrazing and natural hazards, i.e. fire, floods, hot spells, etc.

The indicators and parameters that may be used to monitor the evolution of agroecosystems and local varieties include:

- Land availability and distribution
- Habitat degradation
- Market availability in terms of relative scarcity of local and land varieties versus other exotic ones

- Socioeconomic and cultural factors or attitudes promoting the management and conservation of landraces
- Market trends promoting traditional products and produce thus providing incentives to local germplasm utilization

Other indicator may be associated to conservation status, economic significance on the international, national, and community levels, degree of natural resource degradation, and research status.

The following analysis will discuss the major livestock species with special emphasis on impact on biodiversity and measures of conservation if needed.

Data are summerized in Annex 15 (National species information) and Annex 16 (Livestock production data). Annexes and codes are explained prior to tables.

The poultry production sector in Lebanon mainly chicken (broilers and layers) is highly developed and highly intensive. The animals and inputs used are imported from the international markets.

The traditional poultry production using local breeds (baladi) is quickly disappearing from rural areas. Efforts to characterize and conserve local breeds of chicken are lacking.

Other domesticated poultry species such as turkeys and pigeons, and quails are not economically significant. The only conservation efforts are restricted to ex situ private collections.

Wild relatives of these species mainly pigeons and quails that are indigenous to Lebanon in addition to the Lebanese Partridge are threatened by extinction due to excessive hunting. Recently, a three year hunting moratorium was declared (by Ministry of Agriculture & Ministry of Environment) starting 1993. In addition the National hunting council is in the process of establishing ex situ farms for the multiplication of the Lebanese Partridge and other species to be released in the wild. In situ conservation efforts will be made possible with the recent establishment of a protected areas system in Lebanon.

Cattle are mainly raised for dairy production with about 50% of the stock in large dairy farms of the exotic Holstein breed. The rest consists of small holders. Flocks (4-5 heads) of the local Baladi breed and Baladi-Friesian crossbred. However the Baladi breed is being gradually replaced through crossbreeding with exotic breeds. Conservation efforts are needed to preserve this rustic breed and study it.

Sheep and goats have been an integral part of the farming systems in Lebanon.

Sheep are dominantly of the regional Awassi breed with local characteristics and goats are mainly of the local baladi breed. Sheep and goats are still managed under extensive nomadic and semi-sedentary systems subristing on native pastures and crop residues.

They are distributed all over Lebanon with a high concentration in the Bekaa valley. Because of their economic importance at the community and national levels there is little risk of losing these breeds.

However ex situ conservation efforts (experimental stations) are needed to characterize the local Awassi sheep and especially the baladi goat.

Wild goats that once roamed the Lebanese mountains have disappeared and are thought to be extinct.

In light of the breakdown of traditional grazing rights and overgrazing of pastures and rangelands by small ruminant especially goats, natural pastures have deteriorated and threats to native plant species and range biodiversity are increasing.

Swine production is restricted in Lebanon because of limited demand. However, swine farms consist of many exotic imported breeds.

Equine production is limited to private farms where racing horses are mainly raised. A national breeding and pedigree program is lacking except for the modest efforts of the Association of Arabian horses. Serious conservation and breeding efforts are required to preserve the purity of the arabian stock scattered in Lebanon, because of their economic and lucrative importance.

Donkeys are to be found in rural areas and are used mainly in agriculture. They consist of regional breeds. Their number is dwindling down, and at risk of extinction because of the loss of their need.

Rabbit production is limited to small holders farms and private collections. A variety of breeds are available mainly French. Information on local breeds are scarce.

Urbanisation and modernisation may be considered as major threats to biodiversity in contrast to the declining agricultural areas and the rapid decrease in grazing animals.

Traditional agriculture including on-farm animals has maintained a continuously balance ecosystem where crops, animals and native plants continued to flourish together for probably thousands of years. The traditional farmer continues to use local breeds and plant landraces and constitutes a major component of the in-situ conservation. Unfortunately, the number of traditional farmers is decreasing as the younger generation finds rural migration more attractive and less cumbersome. Many countries are implementing national programs to encourage farmers to continue using the traditional crop varieties and the local breeds of animals. The radical return to full resources protection could negatively influence the net agricultural production. Resource management to exploit potential without drastically changing ecosystems could keep crops flourishing and animals producing. Systems involving rotational light grazing, field fencing with natural microhabitat, organised hunting, wise and proper use of agrochemicals are good examples for progressive agriculture and sustained biodiversity.

The Middle East, including Lebanon, is an important center of origin and diversity of major crops of temperate agriculture. In this region many crops were domesticated. A great diversity of wild ancestors and relatives including landraces are still found.

Long ago before N.I. Vavilov established his theory about center of origin and diversity of plant forms, botanists were interested in the flora of Lebanon, Syria and Palestine. This interest in the wild flora of Lebanon, continued till our day where expeditions were organized to collect wild relatives of the world most important crop "wheat", barley, food and feed legumes and their races. The wild relatives of some crops are listed in Annexes 9 to 17.

In this respect, the national program had done little about this problem, only recently since 1993 some joint collection missions were executed.

The pressure imposed on natural ecosystems and genetic variability of domestic plants and animals had urged many countries (Lebanon) to take different measures to protect the threatened species from extinction. These measures varied according to the country from storage in ordinary refrigerators to huge specially constructed gene banks, where hundreds of thousands of accessories could be maintained.

So the need for genetic conservation is generally agreed upon in almost all crops and is an urgent one in many crops, especially in Lebanon, where genetic erosion is more severe than in many other countries.

The methods of conservation to be adopted depend upon the biology of the species and its method of reproduction. Basically, all cultivated plants could be devided into:

1- seed-propagated annuals, biennials and a few perennials.
2- seed-propagated perennials, the seeds of which cannot be effectively stored.
3- Vegetatively propagated perennials.

In-situ conservation could be applied to all three groups of cultivated plants. It could be done in several ways.

a- Establishment of Reserves: The choice of sites for the establishment of reserves will be predetermined by political, social and economic considerations. The chosen site must be distinguished by diversity of plant forms, and preferably the presence of the already declared threatened species. Natural preserves must cover all the different eco-geographical zones of the country. The least expensive will be the establishment of preserves on the public property, or the involvement various communities to declare some of their land holdings as natural preserves. Private properties may not be used for this purpose because of high land cost. Nevertheless, in reserves, only naturally growing plants could be conserved and a few species of agricultural significance.

b- On-farm conservation: The technology-based agriculture is penetrating the most conservative cropping systems, and is continuously spreading into new areas. As a result, new improved, high-yielding cultivars, usually bred in temperate regions are

quickly displacing the traditional, heterogeneous local varieties and old landraces for the production of greater quantities of food and to get more profits from the same piece of land. In contrast of landraces, improved cultivars are characterized by high level of uniformity and a better norm of reaction thus leading to narrowing the genetic base of the crop, where few modern cultivars occupying great areas of land displaced hundreds of local plant forms and consequently causing a significant decline in genetic variability of the crop. In technology-based agriculture, it would be illogical to go back to the landraces use, but, in extensive agriculture, improved varieties may not have any advantage over landraces that were grown in a certain zones for a long period of time and inspite of their low yields, farmers may get higher prices for their quality product.

On-farm conservation could be considered an indirect effective method of conservation of horticultural crops. But at the same time, local varieties of some trees are threatened, because of the introduction of improved foreign varieties as in olive trees, where Italian and Spanish varieties are strongly displacing the local varieties in almost all olive growing regions.

3.2. Ex-situ conservation

At present time, it could seem inconceivable to conserve genetic variability by preserving primitive agricultural ecosystems and crops, so it could be conserved in collections specially designated for this purpose.

a- Seed-storage: Although, almost all annuals, biennials and some perennials can be conserved by storing their seeds, yet species differ strongly between each other by their aptitude to dry and cool storage.
Predried seed to 5±1% moisture content stored at -18°C seems to be an effective system of long conservation for the following self-and cross-pollinating crops : cereals, food legumes, tobacco, tomato, pepper, brassicas, beets, vetches, sunflower and forages.
Cold storage of seeds is practiced in almost all countries, where the cooling system varies according to the availability of funds from simple ordinary freezers to fancy gene-banks, through refrigerated rooms.
According to the size of the samples and the possibility of duplication of genetic materials, hundreds up to tens of thousands of accessories could be conserved.

b- Seed-Propagation: some fruits can propagate only by sexual means, such as all kinds of palms and coconut (in this study, only the date palm is applicable). Such plants produce seeds with short longevity and they cannot be conserved by seed-storage, since such seeds must germinate as soon as the fruit is matured. So, such crops must be maintained as long-lived plantations.
Field for seed-propagation must be accurately chosen. Soil-climatic conditions must be appropriate for the crop. Several fields must be chosen in all different eco-geographical zones of the country. These fields would be used for the renewal of the genetic material conserved in cold-storage and to check-up the variability of the stored seed.
The stations of the Agricultural Research Institute could be used for this purpose.

c- Clonal propagation: most of fruit trees can reproduce by sexual and vegetative means. Yet, the only conceivable method of maintenance is by clonal propagation since they will strongly segregate upon sexual reproduction. Beside on-farm conservation of fruit trees, the threatened local varieties and exotic ones could be conserved as clones in specially designated fields.

d- Botanical gardens: the establishment of Botanic Gardens, could serve as an effective method of ex-situ conservation of several perennial crops local and introduced species, such as forest trees, ornamentals, shrubs and flowers.

e- Personal collections: Personal initiatives of individuals may also help in the conservation of several plant and animal species, some of which could be considered endangered.
In spite the lack of most conditions necessary for successful conservation. These individuals were able to conserve such variability by periodical renewal of the genetic material, which is usually kept at room conditions.
In this way several small collections of wheat, barley, forages and their wild relatives were established.
Collections of animals, mainly birds, are more expensive than plant forms, and they are usually established by welfare hobbyists.

f- Herbarium: several plant species could be conserved in Herbaria. The maintenance of genetic variability through this technique is usually practiced by academic and research institutions. Some plant forms are conserved in Herbarium at AUB and ARI.

g- In vitro techniques: due to totipotency of plant cells, it became possible to regenerate an adult plant from a single cell, mainly of meristematic tissues. This technique could be effectively used in genetic conservation pollen storage at extremely low temperature is a great possibility for long conservation of some plant species. In animals, the conservation of semen is the only method. Yet, for long conservation. Frozen meristems, callus/and or cell culture could be maintained for a long period of time with one transfer a year and adult plants could be regenerated at any time when needed. This method offers several advantages over greenhouse and field conservation because of the limited area needed, the little risk of loss due to diseases and the easy passage through the quarantine services.
The in vitro techniques are quite feasible for fruit trees and ornamentals.

3.3. Advantages of conservation

The need for conservation is generally agreed, since the genetic resources in Lebanon are eroded enough, so that any delay in taking the appropriate measures may lead to disastrous consequences concerning the destruction of natural habitats, loss of several agriculturally important species and perhaps the whole vegetation.

Wild progenitors and relatives of several food and forage crops are invaluable source for the development of agriculture not only in the region, but also the developed countries which are considered the main users of genetic resources. Landraces, that have been cultivated for centuries, elaborated & high level of adaptation to the environment, and their yield could be

increased by incorporating to them, factors of high productivity and at the same time maintaining their adaptation level.

These plant forms could be used as plant materials for the development of new better yielding varieties, with acceptable level of resistance to biotic and abiotic factors with efficient use of water and fertilizers. The development of such varieties and the improvment of the already existing landraces will maintain the broad genetic base of any crop on an acceptable level.

In order to secure the economic livelihood of farmers and pastoralists, they must be convinced to be involved in the process of conservation, mainly the in-situ and on-farm conservation for the rehabilitation of the eroded lands. Natural reserves as a sole mean of conservation will hardly be accepted by land-users. So, measures must be taken to keep the productive value of the land through the appropriate management of vegetation, land and water. Among, wild growing plants of legumes there are certain forms that produce seeds on the underground part of the plant such as Vicia amphicarpa and Trifolium subteraneum, a factor that could be effectively used for the natural regeneration of pastures.

On-farm conservation of landraces could be managed with the participation of farmers only on small-scaled cropping system with extensive method of agriculture where the production inputs are low, otherwise it would be unacceptable for the farmer to grow low-yielding varieties on large scale.

The impact of conservation of plant vegetation, land and water resources on the natural and agricultural ecosystems will be invaluable, where eroded lands could be rehabilitated, plant forms-regenerated and possibly the life of some wild animals especially when legislations and laws of hunting wild games were enforced.

Domestication of new species especially among medics, trifoliums and vetches and the introduction of perennial shrubs adapted to drought and the adoption of new methods of cropping systems and integrated agriculture will improve the economic livelihood of farmers and pastoralists and at the same time maintain the diverse plant forms.

4. NATURE RESERVES

Lebanon is the crossroad between three continents: Europe, Africa and Asia. This special, privileged position is enhanced by its situation in the Eastern Mediterranean. A whole mosaic of biotopes and natural environments are found there, dominated by a typically Mediterranean climate. Trees of hot climates, such as banana trees and orange trees, are grown on the coastal plain. Twenty kilometres higher, in the mountains, we find fruit trees that belong to cold climates, such as cherry and apple trees. In a country with such strong contrasts in its vegetation, it is natural to find a similar range of animals, with very varied needs from the point of view of climate.

Several ecological factors acting together form a natural biotope. The topography of the land and its composition on the one hand, the microclimate determined by this topography, the vegetation and human interference on the other, are the factors that determine the maintenance of the biodiversity of fauna and flora, as well as their richness.

The wild fauna and flora are an essential element of the country's heritage. They have an ecological function and a social/economic function. Today, many species are falling in number, while others are disappearing.

The factors that contribute to this phenomenon are: the destruction of habitats in order to develop towns, the weakening of ecosystems as a result of modern agricultural practices, pollution, over-grazing, deforestation, forest fires, hunting, etc.

There are two means of protecting the biodiversity and maintaining existing ecosystems: *in situ* conservation with the creation of protected zones and *ex situ* conservation.

4.1. In situ conservation

Since the threats to the biodiversity in Lebanon are anthropic, attempts must be made to save the existing ecosystems before it is too late. With this in mind, urgent action must be taken:

a) identify natural zones of special interest from the points of view of ecology, fauna and flora;
b) make an inventory of vulnerable ecosystems;
c) protect these zones by removing the different factors that threaten them, thus providing better protection for the animal and plant species at risk;
d) implement legislative and administrative means of providing complete protection for natural sites, particular ecosystems and precise species of animals and plants.

Several types of *in situ* conservation of the biodiversity can be envisaged, such as the creation of nature reserves, integral reserves or protected zones. The choice of the type of protection will depend on:

The diversity of the terrain: forests, humid land areas, humid coastal areas, specific zones: gorges, gulfs, caves, scrubland, etc.

The diversity of the problem: zones seriously threatened by urban development and touristic development such as: the coast, the inner mountains, gorges in valleys, the areas around sources, etc., or zones that have been intensively dried out to the point where they are in danger of disappearing, such as: humid land zones, Yammouneh, Ammiq, etc. Finally, zones endangered in certain conditions: cedar groves, fir plantations, pine forests, karstic zones, etc.

The protection of forest zones goes a long way back in the history of the country: the Roman Emperor Hadrian (2nd century) defined the limits of the main forests and protected the main species, i.e. the cedar, the fir tree, the juniper and the cypress. Orders were inscribed on rocks marking the edges of the protected zones.

From the beginning of the century, laws and ministerial orders on the protection of forests have been passed in Lebanon.

The anarchy caused by the war in Lebanon has sharpened the desire of many young scientists and naturalists to form associations in support of the protection of certain remarkable ecosystems.

Following the Conference of Rio in 1992, which stressed the importance of the biodiversity, the Ministries of the Environment, Agriculture, Culture and Higher Education, with the assistance of international bodies and national non-governmental associations (NGOs), have supported the creation of nature reserves in Lebanon.

a) The concept:

Nature reserves are protected zones which fulfill a number of purposes, covering the following aspects:

- in situ conservation in an open system,
- continuous research and supervision,
- education, training and heightening of public awareness,
- cooperation and development.

Nature reserves should be considered as an open system, structured within a regional land development programme and directed towards the quest for solutions to the ecological and social/economic problems of the zone in question. They should constitute pilot zones for the establishment of models for land development and the management of natural resources, taking into account the traditional systems of using the earth and the present needs of the population.

Nature reserves are multifunctional sites directed towards: the conservation of biological diversity, biocenoses, environments and the countryside; the establishment of methods of regeneration and the restoration of degraded ecosystems, and the rational use of these ecosystems with a view to harmonious and long-lasting social/economic development.

With these considerations in mind, the national and regional authorities must grant nature reserves all the attention and means that they require in order to fulfill the various ecological, economic, social and cultural functions assigned to this type of protected zone.

The distribution and density of nature reserves to be created must take into account the diversity, and interest for the public and scientific community, of the ecosystems to be conserved, the final objective being the possession of a network that covers all the major ecosystems.

b) Specific problems in rural zones:

Since they represent only a minute part of the countryside, protected zones cannot, alone, guarantee the safeguard of resources and potential. They do, however, play an essential role in the conservation of biological diversity, including genetic resources of economic interest, as well as in the fields of experimentation, education, training and demonstration.

People will only remain in rural areas if there is rational management of all open spaces, thus minimising the risks resulting from the choice of unsuitable crops, over-grazing, the elimination of woody plants and the irrational use of water resources.

In this context, it is necessary:

-to increase public motivation for rational management and long-term conservation of natural resources, through popular campaigns to arouse public awareness;
-to keep watch over certain agrosystems: sources, habitats like those of the cedars, fir trees and umbrella pines, agricultural habitats,etc.;
-to consider that complete protection is not the only method of conservation. It can sometimes be harmful and may, in the long term, end the dynamism of the ecosystem in question, thus leading to its destruction.
-to take into consideration available cultural and historical data; it may provide invaluable information on the potential and conditions of evolution and exploitation of the environment.

c) Status and financing:

Lebanon has legislative texts on the protection of certain zones, such as the forestry law, but it does not possess any specific legislation defining the status, role and means of financing nature reserves. The creation and implementation of such legislation would facilitate financing by international organisations and in particular by the EC, of various activities have been undertaken, in particular in relation to the following functions:

-conservation of the biological diversity;
-long-term ecological research;
-social/economic and historical studies;
-continuous watch on local and global changes;
-exchanges of information and personnel.

The density of population in Lebanon, as in other Mediterranean countries, makes it impossible, even temporarily, to use land that is suitable for farming for any other purpose. These countries do not always have the means to finance preliminary studies on the creation of nature reserves, nor to establish experimental projects or long-term management plans. The call for international solidarity on the conservation of a heritage of common concern was clearly expressed in the International Convention on Biological Diversity.

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4.1.2. Present status of the nature reserves in Lebanon

There are three categories of protected zones in Lebanon:

1) Three classified nature reserves are at the concern of a project to develop them by the Ministry of the Environment, with the assistance of the Global Environment Fund (GEF) and the UNDP. These three reserves are: the three "Iles des Palmiers", the forest of Ehden and the cedar groves of Jabal Barouk. The first two were classed as nature reserves by a law dating from March 1992 and the third in July 1996.

These reserves are managed by commissions named by the Ministry of the Environment and they include representatives of NGOs and local authorities.

2) Communal woods and terrains declared to be protected zones by ministerial decrees from the Ministries of Agriculture or the Environment. There are 12 of these.

3) Zones that are protected *de facto* as the result of private initiative. This is the case of the pine forest at Bentaël, the Animal Encounter Centre and the forest of Baabda.

Scientists in Lebanon find that these three classified reserves do not cover the whole of the biodiversity of the country and that certain extremely important zones are still not protected, such as the Ammiq marshes, the valley of Nahr Brahim, the high plateau of Sannine, Aqoura, Sir ed Dannyé and many others.

Reserves classed by law as protected zones
(cf. Map of Protected areas in Lebanon & Legend, next page)

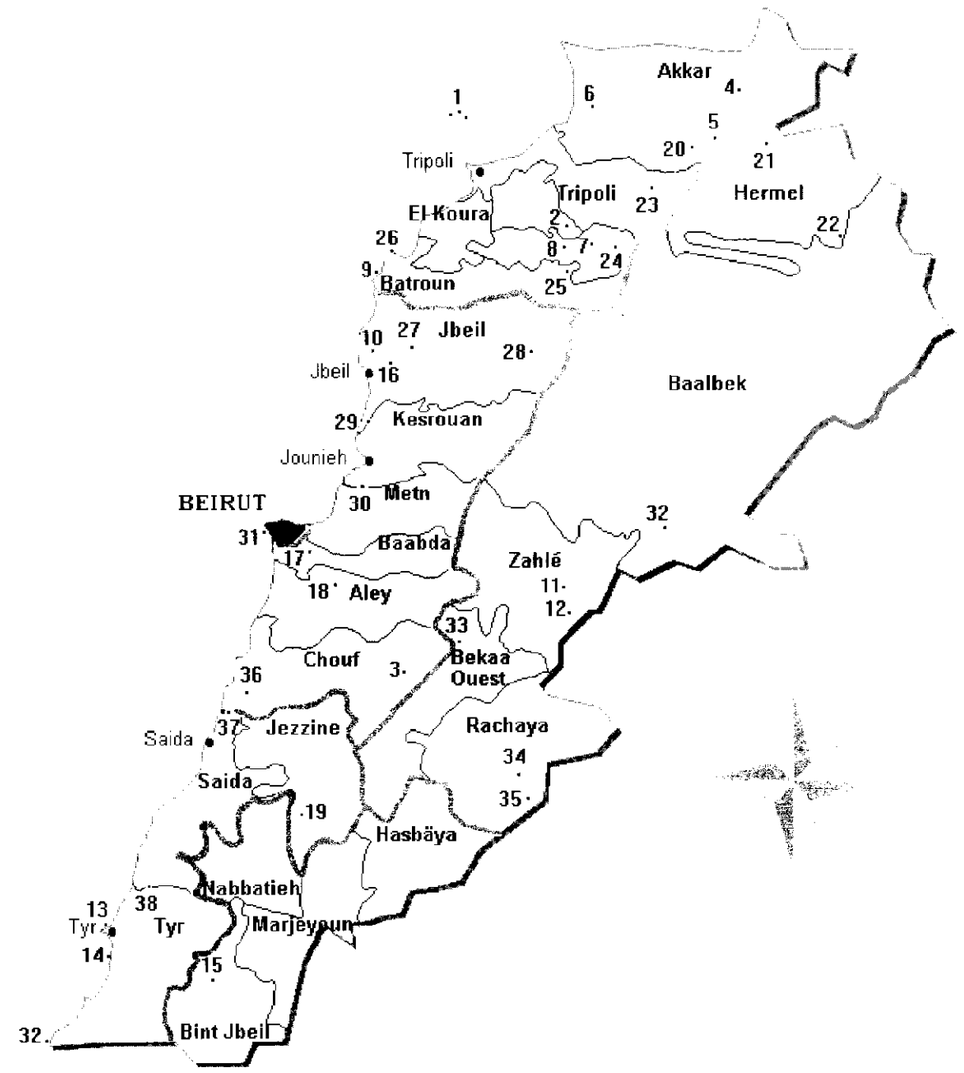
1. The Park of the "Iles des Palmiers"

A "project for the establishment of a zone of biological protection in the "Iles des Palmes", Tripoli, Lebanon" was presented by Tohmé in 1973, in the name of the NCSR, within the framework of a study of the Lebanese environment at the Intercommunal World Conference for *the* protection of the Mediterranean Sea from pollution (Beirut, 4-6 June, 1973).

It was in March 1992, and thanks to an initiative of Lebanese NGOs, that a law gave official status to this group of islands as a nature reserve. These islands are the property of the State; they are domanial land attached to the municipality of El Mina (Tripoli).

Description

11 kilometres to the north-west of the town of Tripoli, there are three islands: the "Ile des Palmiers", Sanani Isle and Ramkine Isle, with, respectively, the following surface areas: 150,000, 55,000 and 45,000 m2. The whole of the marine basin of the Park covers a surface area of 5km2, and is a typical Mediterranean marine ecosystem, with a sandy coast to the east of the "Ile des Palmiers" and the rest formed of limestone rocks of the mid-Miocene, an extension of the neogenetic platform around Tripoli. The south of Sanani Isle is formed of fixed dunes (ramleh). These islands are uninhabited, without freshwater (an artesian well would be enough to provide a water supply), battered by the prevailing winds from the south-west, with no notable relief (maximum altitude 6 to 7 metres); they are inhospitable platforms.



Legend

⇨ **Reserves classed by law**

1. The parc of "Iles des palmiers"
2. The nature reserve of Horsh Ehden
3. The reserve of Jabal el Barouk

⇨ **Areas whose protection has been decreed by ministerial orders**

4. The reserve de Karm Chbat
5. The fir forest of Qammouaa
6. The nature reserve de Saïssouk
7. The protected zone of Arz Bcharré
8. The Valley of Qannoubine
9. The Batroun maririme reserve
10. The reserve of Hbeline
11. The reserve of Jabal Turbol
12. The reserve of Kfar Zabad
13. The reserve in the region of Bass in Tyre
14. The coastal reserve of Ras el Ain
15. The reserve of Kherbet Silm

⇨ **Private initiatives to conserve natural areas**

16. The park of Bentaël
17. The mixed forest of Baabda
18. Animal Encounter
19. Kallet Khazem

⇨ **New areas that should be protected**

20. The Quercus cerris forest in Fneidek
21. The cedar of Souaissi
22. Reserve of Assi
23. The plateau of Sir Dinnyeh
24. Reserve of Kornet el Saouda
25. The cedar groves of Tannourine & Hadath el Jobbé
26. Reserve of Ras el Chakka-Hannouche
27. Houjoula & Hakel
28. The high plateaux of Aqoura
29. The valley of Nahr Ibrahim
30. The valley of Nahr el Kalb
31. The Pigeon Rocks
32. Reserve of Yahfoufa
33. The marshes of Aammiq
34. The region of Balou Ayha
35. Reserve of Jabal el Cheikh
36. The mixed forest of Dalhoun
37. The valley of Nahr ed Damour (7km)
38. The valley of Kasmieh

Archaeology

On the "Ile des Palmiers" there are traces of the foundations of a church of the Crusader period. Ramkine Isle has an old lighthouse.

Vegetation

The reserve is rich in wild flowers. The interest of this reserve from the point of view of plant biodiversity is that it could serve as a natural botanical conservatory for marine coastal species of the eastern zone of the Mediterranean. The coastal zone has over a hundred species of plants, endangered by rapid demographic growth and the invasion of urban development on the coast. In order to save them, these species could be transplanted in this park.

Fauna

These islands, as a whole, are of unique interest from the point of view of East Mediterranean fauna because they are uninhabited and far enough from urban zones to escape direct pollution.

a) Ornithological interest

135 species of birds have been observed on the coast of Lebanon (Tohmé and Tohmé, 1985); however, over 300 species of birds have been observed from these islands (Tohmé and Neuschwander, 1973). This is due to the special position of these islands as a resting place for migratory birds.

Of special ornithological interest for the Mediterranean area is the fact that in 1973 a nesting colony of *Larus audouinii* (Payraudeau) was observed here, an exclusively Mediterranean species and one of the last in the Mediterranean. This was the main reason why Tohmé et al (1973) proposed this island as a nature reserve.

During the winter season, the Larus audouinii is joined by numerous other pelagic or coastal species, such as:

-Seagulls: Larus marinus L., Larus fuscus L., Larus argentatus (Pont.) (also a nester), Larus canus L., Larus genei L., Larus ichthyaetus (Pallas).

-Gulls: Larus ridibundus L., Larus minutus (Pallas), Rissa tridactyla L.

-Terns: Chlidonias niger L., Chlidonias leucopterus (Tem.), *Chlidonias hybridus* (Pallas).

-Terns: Gelochelidon nilotica (Gmelin), Sterna sandviscensis (Latham), *Sterna* hirundo L. (nester), Sterna albifrons (Pallas) (nester).

Another point of great interest, linked to the insularity of the location, is that the islands are resting places for migratory birds. The Eastern Mediterranean, which is known for spectacular migrations, is a meeting place, the crossroad of the two main migratory axes and of a large number of secondary migratory routes, half-way between Europe and Africa. An infinite variety of species rests on these islands and their groups, often highly concentrated, stay several hours, or even several days, on this small area of land. Anatidae, charadriiformes, birds of prey and small passerines can be seen on the islands from August to November and from February to May.

b)Interest for the study and conservation of marine communities

This is the ideal place to establish an observatory for marine research. The geomorphology and nature of the coastlines and the rocky sea bed encourage marine organisms and varied biocenoses to establish themselves there.

2. The nature reserve of HORCH EHDEN.

The second nature reserve named in the law of March 1992 is Horch Ehden. This is a mixed forest of cedars and fir trees.

It was as a result of the efforts of two NGOs (Friends of Nature and the Friends of Horch Ehden) that this project was accepted. Since 1979, the political leaders of the region had thought of protecting the forest from their fellow citizens.

Description

The mixed forest, situated 3.5km. to the north-east of the village of Hehden, has a surface area of around 350ha., and the reserve, which stretches from 1,350m. above sea level to the peaks of the Western Chain at 1,900m., has an estimated surface area of almost 1,000ha. A multitude of small sources flows throughout the year. The forest is the property of the municipality.

Scientific interest

1. From the point of view of the flora:

The forest has been visited by foreign and Lebanese naturalists who have identified several species of endemic plants there.

Cedrus libani is found at Ehden in clusters or in groups mixed with other species: *Abies* cilicica, Juniperus excelsa and Juniperus foetidissima, Acer syriacum, Quercus cerris, Quercus infectoria and Quercus cedrorum.

Of the Lebanese herbaceous species that are rare and endangered and that have found refuge in Horch Ehden, we note:

a) Astragalus ehdenensis sp. nova.
b) Cicer incisum (Willd.) K. Maly. var. libanoticum (Boiss.)
c) Vicia canescens Labill.
d) Linum carnosulum Boiss.
e) Viola libanotica Boiss.
f) Puschkinia libanotica Boiss., above 1,500m.

Among the plants found at Ehden, there are many phenotypical variations. This leads one to believe that there are new sub-species. An in-depth study should be conducted.

2. From the point of view of the fauna:

a) Horch Ehden is an ideal place for nesting birds. Of these birds, we should mention the mistle thrush Turdus viscivorus and the Finsch's Chat Oenanthe finschi.
b) Wild mammals in danger of extinction in Lebanon, such as the squirrel Sciurus anomalus syriacus, the marten Martes foina syriaca, the weasel Mustela nivalis and the badger Meles meles canescens are found in Horch Ehden, safe from outside threats.
c) The insects found at Ehden are linked to the particular vegetation of this ecosystem. Apart from butterflies, there have been almost no in-depth studies. The specimens of ants collected here are the same as those found in Corsica.

To conclude, we can say that the systematics of all the animal and plant species in this forest, and especially of lower plants and invertebrates, should be examined closely.

3. The reserve of BAROUK, MASSER EL-CHOUF and AIN-ZHALTA

The whole of the forest region of Jabal Barouk has been the subject of a reforestation programme since 1965 (Green Plan, Ministry of Agriculture), with assistance from the FAO. A ministerial order, no. 1/127 (Ministry of Agriculture) of 23.10.91, made this forest region into a nature reserve. At present, this is in the process of being formalised by a law.

The forest of Jabal Barouk is in the caza of the Chouf and consists of three cedar woods, separated by grazing zones. They are:

Arz Aïn Zhalta (110 hectares),
Arz el-Barouk (100 hectares),
Arz Maasser el Chouf (6 hectares).

The last of these is the most southern forest of *Cedrus libani*. The southern limit of the species is about ten kilometres south of this forest where isolated cedar trees can be found, representing a former forest that is disappearing.

Several species of trees and plants that have already disappeared from the country would grow again here if they were replanted, for example, *Juniperus phoenicia (sabina)*, a medicinal plant, the savin الابهل. Moreover, the people of Maasser el Chouf call their woods Al-Oubhoul.

The total surface area of the reserve is 2,700 hectares and it stretches as far as Dahr el Baïdar. This protected zone is situated in the central part of Mount Lebanon on the western slopes and its direction is north-east south-west. Its altitude varies between 1,200 and 1,948 metres. The forest is domanial land attached to the municipalities of the following villages: Maasser el Chouf, Barouk, Aïn Zhalta, B'mouhray and Aïn Dara.

Vegetation

Cedrus libani (Rich) is the only forest species that forms the dominant layer. The under-layer is poor and isolated trees of Quercus brantii are found there at the upper altitudes of the forest, with Quercus calliprinos and Quercus infectoria in the lower parts. A Juniperus drupacea and a J. oxycedrus can be found here and there. The cedar is vigorous and in good health; it regenerates naturally and the trees are relatively young. Only the forest of Maasser el Chouf has a few old, majestic trees. A list of under-wood species can easily be made with reference to the work of Pabot (1959); Chouchani, Kouzami and Quézel (1974) and Abi-Saleh (1979).

Fauna

This generally unexploited vast terrain is the ideal refuge for the large wild mammals of Lebanon. Hyenas and wild boar have been observed there. The wolf and wild cat, both becoming extinct in Lebanon, may be found in this region.

Nesting birds, especially birds of prey, would find this park to be a peaceful haven for their nesting activities.

The insects that have been studied in this region are butterflies (Larsen 1974) and ants. The arboreal species of the latter are only found in this region of Lebanon (Tohmé 1969).

Zones whose protection has been decreed by ministerial orders

1. The protected zone of ARZ BCHARREH

Arz Bcharreh was classified as a protected site by decree no. 434 of 28.3.1943. This group of cedars of Lebanon, the most majestic, stand on the peaks of Bcharreh. They are known as "The Cedars of the Lord". The cluster includes around 400 trees, 6 of which are very old and remarkable for their branches that give shade to a wide area of the ground.

This group is of great historical and scientific importance. Queen Victoria financed the construction of a fence around the woods. The Committee for the Safeguard of the Forest of Bcharreh supervises the protection of the woods and their touristic development.

2. The Fir forest of QAMMOUAA.

The fir plantation of Qammouaa, caza of Akkar in North Lebanon, statutory order of the Ministry of Agriculture no. 1/165 of 22.12.1991.

The surface area of the forest of Qammouaa, situated on a remarkable site at an altitude of between 1,500 and 1,900 metres, is about 2,000 hectares. It has been seriously exploited, decimated and mutilated. The few trees that remain are dying in their turn.

The fir plantation of Qammouaa is dense in the part facing the east. It should be classed as an integral reserve because of its particular ecosystem, with its fauna and flora of Alpine dominance and its animal and plant diversity belonging to Mediterranean countries. The degradation of this fir plantation has allowed the establishment of Juniperus excelsa, which is found in very weak formations, accompanied very locally by Juniperus foetidissima and Quercus cedrorum.

3. The reserve of SAISSOUK

The reserve of Saissouk in the Akkar was created by a statutory order of the Ministry of Agriculture, no. 1/166 of 22.12.1991. It is the property of the State, managed by a six-member committee of villagers. Situated at 350m., it is a scrubland of oaks, pines and carob trees. The people of the village would like to transform it into a wild animal reserve.

4. The nature reserve of KARM CHBAT

The nature reserve of Karm Chbat in the Akkar was created by a statutory order of the Ministry of the Environment, no. 1/14 of 6.10.1995. It is managed by a committee of six members. It is the property of the State, consisting of a forest zone where the species of Cedrus libani, Abies cilicica and Juniperus excelsa are found, mixed with various oaks. Altitude between 1,200 and 1,400 metres.

5. The valley of QANNOUBINE

Situated at an altitude of between 600 and 1,500 metres in the caza of Bcharreh in North Lebanon, the valley of Qannoubine was classed as a protected zone by the statutory order no. 13 of 22.3.1995, of the Ministry of the Environment. It is private and communal property and includes the valley of Nahr Qadisha and the caves of Qadisha.

Remains of the Roman era are to be found here (2nd century). It was a very important crossroad between the coast and Baalbeck. Caves with the remains of frescoes and ancient inscriptions (12th century) on the walls; ruins of hermitages and ancient monasteries, etc.

Flora
Very rich; should be studied in depth.

Fauna
It is a place preferred by numerous passing migratory birds. Diurnal birds of prey have been seen flying over the valley and nocturnal birds of prey are known to shelter in the caves in the valley. The valley is visited regularly by the hoopoe, the roller, the bee-eater and various species of larks, swallows, thrushes, blackbirds and several species of warblers, goldfinches, finches and many others.

Traces left by mammals show the presence of foxes, jackals, porcupines, field-mice, voles, hedgehogs and shrews. At dusk, certain species of bats can be seen in flight.

There are numerous species of arthropods: butterflies, coleoptera, ants, spiders, etc. multiply in such ecosystems.

6. The reserve of HBELINE

Created by a statutory order of the Ministry of Agriculture (no. 1/152 of 15.10.1992), the reserve of Hbeline in the caza of Jbeil in Mount Lebanon is the property of the State. The Ministry of Agriculture plans to plant trees in this zone to transform it into a nature reserve where birds and animals specially bred in captivity will be released into the wild.

7. The reserve of KFAR ZABED

Created by a statutory order of the Ministry of Agriculture, no. 1/71 of 13.5.1992, the reserve of Kfar Zabed in the Bekaa, caza of Zahlé, is situated in the Anti-Lebanon and is the property of the State. The Ministry of Agriculture plans to plant this zone with trees to make it into a nature reserve where birds and animals bred in captivity will be released into the wild. Kfar Zabed is at an altitude of 975 metres.

8. The reserve of JABAL TURBOL

Created by a statutory order of the Ministry of Agriculture, no. 1/104 of 5.9.1991, the reserve of Jabal Turbol, caza of Zahlé in the Bekaa, is the property of the State. It consists of two stretches of water (lakes or wide parts of river) of 23.7 ha., which are 2 kilometres long, along the Litani river. Around this humid zone there is a forest zone with hydrophilic trees. The Ministry of Agriculture has placed this reserve under the guardianship of the Agronomic Research Centre, which is responsible for studying, maintaining and protecting it. This reserve is very interesting from the point of view of its biodiversity.

9. The reserve of KHERBET SILM

The reserve of Kherbet Silm, in South Lebanon, is near the village of the same name and at an altitude of 450 m. in the caza of Bint-Jbeil. It was created by a statutory order of the

Ministry of Agriculture, no. 1/21 on 12.2.1992. It is State property. Oak trees are the most common species. The threat of deforestation is a very real one; the Ministry plans to make it into a protected zone for wild animals and birds.

10. The coastal reserve of JAFTALAK RAS EL AIN

Created by a statutory order of the Ministry of Agriculture, no. 1/106 of 11.9.1991, the humid zone of Jaftalak Ras el Aïn, caza of Tyre in South Lebanon, is the property of the State. It is situated on the coastal plain; its surface area is 100 hectares. It is surrounded by three sources which are like natural artesian wells and have been exploited for a very long time. These sources are two kilometres from the sea. The walls of the wells date back to Phoenician times; the aquaducts are covered by enormous tufts of maidenhair fern (Adianthum capillus veneris). In the water there are quantities of small turtles (Emys caspica). The Ministry of Agriculture has placed this reserve at the disposition of the Agronomic Research Centre, which is responsible for studying, maintaining and protecting it.

11. The reserve in the region of BASS in TYRE

Created by a statutory order of the Ministry of Agriculture, no. 1/107 of 11.9.1991, the Bass zone in the caza of Tyre, South Lebanon, is the property of the State. It is situated on the coastal plain. The Ministry of Agriculture has placed this reserve at the disposition of the Agronomic Research Centre to make it into a botanical garden for natural plants and a zoological garden for wild animals.

12. The BATROUN maritime reserve

On 23.10.1991, the Ministry of Agriculture created a maritime reserve by statutory order no. 129. This reserve is attached to the Institute of Marine Sciences for fishing, and it stretches along the coastal zone of Batroun. It aims to study and conserve marine fauna and flora.

Private initiatives to conserve natural zones

Several zones are protected as a result of private initiative. The best known examples are: the pine forest of Bentaël, the scrubland of Abadieh, the mixed forest of Baabda, etc.

1. The park of BENTAEL

The park of Bentaël is domanial land covering 200 hectares. It is situated 7 km. to the North-East of the town of Jbeil, at an altitude of between 260 and 520 metres. The neighbouring villages are: Bentaël, Mech'alane, Mazraat and Jmayel.

Created in the 1980s under a rent contract between the Ministry of the Environment at the time and the domanial authorities, it was officially inaugurated on 23rd May 1987. It is managed by a local NGO.

The park covers a stretch of limestone rocks, marly limestone and marl with silica layers. The rock appears chalky, whitish, with some large grey layers appearing at the bottom

of the valley (cenomanian limestone). Fossiles of marine organisms (Nerinae, Pectinae) have been found in the limestone of the zone around the park.

This valley is very deep and seriously eroded.

The zone is essentially a wood of umbrella pines (Pinus pinea L.), which, at the lower edge, includes shrubland and an oak grove with Quercus calliprinos.

Traces of mammals have been observed which show the presence of foxes, jackals, porcupines, field-mice, voles, hedgehogs and shrews. At dusk, several species of bats have been observed in flight.

The dry, sunny biotope of the reserve encourages reptiles and the reproduction of snakes, chameleons, geckos and agama.

There are numerous arthropods: butterflies, coleoptera, ants, spiders, etc. multiply in this ecosystem.

This reserve satisfies the following requirements:
-the conservation of animal and vegetable species and their habitats.
-the conservation of geomorphological formations.
-the prevention of hunting in order to safeguard the migratory routes used by birds.

The originality of Bentaël is that it came about as a result of the desires of the people of the region. These people have continued to fight to give their reserve official status because the region was in danger of being classed as an industrial zone.The people of the region want to keep it as a rural zone.

2. The mixed forest of BAABDA

This is a natural zone that has been conserved and developed and is open to the public. On the initiative of the Antonin Fathers, the owners of the land, and a young ecologist, work to clean and develop the land was undertaken in order to save the area, which is very rich in species, and to transform it into a place for bio-ecological recreation. Situated in the South-Eastern suburbs of Beirut, between Hadath and Baabda, this mixed forest of pines, oaks, lentisks, etc. is of great social and educational interest. It is in danger of being partly destroyed by the construction of a motorway.

3. Animal Encounter.

In Aley, two young Lebanese have undertaken to find and shelter wild animals, with the aim of providing them with care and protection. The centre is basically educational. This initiative should be encouraged.

4.1.3. New zones that should be protected

In order to extend the network of protected areas so that it covers all the natural ecosystems in Lebanon, the following regions should be examined:

a) Low and medium altitude mountains (up to 800m.): it would be advisable to protect the bottoms of valleys which have not yet been affected by strong urban development, e.g. the valleys of Damour, Nahr Ibrahim (upstream), Nahr el Kalb, Bisri, Ouadi Jouhannam, etc.

b) High altitude mountains (1,200-1,800m.): in this zone there are leafy forests with Quercus infectoria, Q. calliprinos, Q. cerris pseudocerris and also cedar and juniper forests, such as the zone betwen Fnaïdek and Sir ed Danniyeh (North Lebanon) and the high forest zone in Hermel district. Such a large reserves (State property) would also make it possible to conserve large vertebrates and birds of prey.

c) Very high altitude mountains (>1,800m.): it would be easy to stop the urban development of large areas on the high arid plateaux of the two mountain chains, which are home to birds of prey, small mammals and specialised invertebrate fauna (plateaux of Sannine, Aaqoura, Qornet es Saouda and Hermon).

d) Humid marshy places, such as the marshes of Aammiq, shamsines.

The priorities of the new zones to be protected are as follow:

1. The marshes of Aammiq

This zone is situated in the central Bekaa, at the foot of the eastern slopes of Jabal Barouk, at an average altitude of 860m. This aquatic land environment (wetland) is formed by the source of Aammiq and its river, Nahr el Riachi. The source is the outlet of an underground flow of water which springs in the plain of the Bekaa. As a result of intensive pumping through artesian wells, the water level has become much lower and sometimes the source is dry. It has been suggested that this zone should be classed as a nature reserve (Tohmé 1974).

Aammiq is private land belonging to a large Lebanese family. The fields around it are edged with reeds and bramble bushes. The overall aspect is that of a coppice, which gives the plain an original feature in a region where cereals grow in open fields.

Fauna and Flora

135 species of birds were observed in one year by a team of ornithologists (Tohmé and Neuchwander 1978). It is essentially a resting place for migratory and aquatic birds.

The freshwater environment of Aammiq has characteristic lacustrine fauna, such as: Alisma plantago-aquatica L., Lemna minor L., Ceratophyllum d L. El Hage (1979) observed 4 species of trees with roots in the water; 10 species of above-water hydrophytic plants and 12 species of submerged or floating hydrophytic plants.

Interest

The temporary and former marshes of Aammiq and their cane plantations with reeds and typha, are of undeniable biological interest because of the routes of migratory birds that cross them. This is the last environment of its type on the territory of the Republic of Lebanon.

A number of Lebanese and foreign authors have spoken of the attraction and value of these marshes, but unfortunately they are now endangered by drainage and abusive hunting. In addition to their biological interest (the flora and fauna in general, and ornithology in particular), the economic interest of such a biotope, if it is well preserved, will draw tourists and bird-spotters and these marshes will be saved, like a rich sponge filled with water that will supply the underlying ground water, especially in periods of drought.

2. The cedar groves of Tannourine, Hadath el Jebbeh

This is a cedar forest of 600 hectares made up essentially of young, vigorous specimens. Superb karst provides the background. Afforestation is fragmentary and irregular; the underwood is varied.

The mother-rock consists of Jurassic limestone. The soil is relatively deep in general, except on reliefs, and is covered with rock debris and shattered pebbles. On the edges of the surrounding zone, there are volcanic rocks. Fossiles of higher plants have been collected in the quaternary levels of the forest.

From the ornithological point of view, the forest is very rich. The hoopoe and around fifty species of birds have been observed on this site many times.

At the bottom end of the site, in the valley, there is a place called Balaa, consisting of a deep gulf with three natural bridges over it, sculpted in the Jurassic rock. Several species of bats find shelter here.

3. The valley of Nahr Brahim

To the north of Beirut, in the rocky steep-sloped thalwegs of the valley of Nahr Brahim, there are beautiful communities of Fraxinus ornus L., or flowering ash, and Ostrya carpinifolia Scop., or hornbeam-hop.

According to Abi-Saleh (1978), the *Ostryae* in Lebanon indicate the most southern limit of hornbeam-hop in the Eastern Mediterranean. Yet in view of the restricted surface area that they cover in the country and their biogeographical interest, they should be protected in order to save them from extinction, especially as this is the furthest south that they can be found.

On the poorly drained slopes, groups of trees form important communities of Sambucus ebulus L., whereas Spartium junceum L. is the dominant feature in well-drained zones.

The study of mosses and hepatica has shown that out of 179 species of moss known in Lebanon, 65 species have been observed in this valley, as well as 21 species of hepatica, out of the 40 species that exist in Lebanon (Charouk 1982).

The biodiversity of the fauna of the Nahr Brahim basin is very rich. A study (Tohmé et al. 1986), directed by the NCSR of Lebanon mentions several dozen species.

4. The valley of Nahr el Kalb

This valley, situated to the north of Beirut, is in danger of invasion by urban development which would soon destroy it, yet it possesses biological, geological and archaeological advantages that are unique in their kind.

From the geological point of view, this valley contains the famous Jeita caves, situated in Jurassic rock, with little-known particular cavernicolous fauna. Moreover, the bed of the valley, and especially near the mouth, the rock of the Nahr consists of a Miocene coral reef containing very varied fossiles: corals, gasteropoda, crabs, marine algae, etc.

From the archaeological point of view, at the mouth of the river there are the famous stelae which tell the story of the country's history, from the Assyrians, Babylonians and Egyptians to modern times.

5. The high plateaux of Aaqoura

These Cenomanian plateaux, situated in the caza of Jbeil at an altitude of between 1,400 and 2,000m., have a remarkable ecosystem dominated by the cypress-leaved juniper, Juniperus excelcea, and contain the highest group of oaks in Lebanon, superb Quercus cerris pseudocerris at an altitude of 1,980m., with, of course, the special entomological fauna that goes with them. Birds of prey, small mammals and a specialised fauna of invertebrates also find shelter there.

If building activities in this area were stopped, the numerous sources of water found lower down would also be saved from pollution. This region is rich in caves (at least 5) with special cavernicolous fauna. On the archaeological level, Hani Abdel-Nour (unpublished information) has found more than six inscriptions by Hadrian (2nd century), all of which speak of protecting the forest.

6. The plateau of SIR EL DENNIYEH

This is a group of mountains that range between altitudes of 1,000 and 2,000m., limited on one side by Wadi Jouhannam, and on the other by Wadi el Sirri. Its surface area is 100,000 hectares, mostly wooded. There are three small villages in the region where wheat is grown on the flat stretches. The group of mountains has few sources and two rivers flow at the bottom of the Wadis. This plateau and the valleys that define it should be protected because they contain rich fauna and flora, very representative of Lebanon.

7. Houjoula and Haquel

The locality belonging to two villages in the caza of Jbeil contains limestone deposits of the Cenomanian era in which we find: fossiles of cartilaginous and bony fish (the skate fossiles are unique); a great variety of invertebrates: crustaceans, octopus, cuttle-fish, squid, sea-urchins, nautilus, jelly-fish; and filamentous marine algae, etc. in the rock, thus confirming that this limestone was formed under marine conditions. (Arslane et al. 1995). Certain pieces of land should be protected.

8. The mixed forest of Dalhoun

The locality of Dalhoun in the caza of the Chouf (central Lebanon) is domanial land, consisting of a forest of 4 hectares in which the oak and the lentisk are the most common trees. The land is on a slope with a stream flowing at the bottom. The altitude is between 300 and 400 metres. On the edge of this land, there are sarcophaguses and other archaeological remains. The people of Dalhoun have expressed the desire to turn the land into a protected zone, yet open to the public.

From the point of view of the biodiversity, it is a rich, varied ecosystem, of great scientific interest for the same reasons as those given concerning Bentaël. In fact, this forest is also on the same migratory route for birds such as the Turdidae and birds of prey and it provides them with an ideal refuge.

9. The region of Balou Ayha

This region is situated in the Anti-Lebanon at the foot of the Hermon. This "lake", or outlet of the Ayha, is a natural dam. It is a special ecosystem that should be studied and protected.

10. The Pigeon Rocks

The Pigeon Rocks are situated in the sea, in the rocky South-West zone of Beirut. They consist of a steep limestone cliff (Cenomanian) and two rocks near the coast. There is a series of caves sculpted in the rock and which can only be reached by sea. Fifty years ago, the Pigeon Rocks were the natural habitat of seals. Today, these rocks are an ideal refuge for bats and Beirut swifts. Small groups of dolphins sometimes appear in the distance, and once every few years a whale or a lunefish comes adrift there. This rocky region should be classified as a protected zone before it is completely destroyed by urban development.

4.2. Means of *ex situ* conservation

As ex-situ means of conservation, it would be interesting to create:

a) A museum of natural history with an experimental farm (the nucleus of a zoological garden) in order to study the breeding and conservation of endangered species.
b) A botanical conservatory, or aboretum, consisting of a reserve of plant species that are endangered, rare or remarkable.
c) A conservatory of the coast and riverside plants.
d) A Mediterranean botanical garden.

4.2.1. A natural history museum with an experimental farm

As an annex to the Natural History Museum (a project being studied by the Faculty of Science of the Lebanese University) or partially integrated into the buildings of the latter, an experimental farm where the breeding and conservation of endangered animals could be studied, would complete this museum of the living world. This "living museum" of 2,000m2 would form the nucleus of a zoological garden where live mammals and wild birds of Lebanon could be kept, with a vivarium for amphibians and reptiles, and freshwater and marine

aquariums for vertebrates and invertebrates of freshwater and marine environments. For example, the freshwater species of fish: Varicorhinus trutta (Hkl.), V. damascinus (C. & V.) and Phoxinellus libani (Lor.), are three species that used to be common in Lebanese rivers before 1975, and which are becoming extinct today because of the herbicides that are thrown into rivers and because of fishing with dynamite. There is still, perhaps, a chance of saving them.

In addition to the scientific interest of such a zoological garden, there is even greater educational interest. The impact of such a project on the general public, and especially on young people, cannot be underestimated. Learning to observe animal life and to take care of animals will encourage respect for these animals and thus contribute to their conservation.

The general objective of a conservatory of genetic resources is to make an inventory of old fruit tree species, related to certain present-day trees, and of the fodder plants, leguminous plants and cereals which are the ancestors of today's species, in order to conserve their vitality and their ability to reproduce. They can then be used in the management of the genetic resources of fruit trees, fodder plants and cereals.

At the practical level, the activities of the conservatory of genetic resources can be summarised in the following points:

a) inventory and description of wild plants and trees *in situ*;
b) collection of their seeds and their conservation;
c) deposit of these seeds in a bank (to be established, for example, at Tel-Amara, Lebanon, Institute of Agronomic Research);
d) establishment of a local bank for the conservation of the *germoplasma* of local or indigenous genetic resources.

1. Varieties of fruit trees

Certain fruit trees of the Mediterranean region can be found in Lebanon in different forms. From the point of view of production, only a very small number of varieties is available on the local market, on display from time to time in the shops. Foreign and exotic varieties of fruit, with greater commercial value, have been introduced. Farmers have, therefore, neglected local varieties and started to replace them with foreign varieties. This could cause serious genetic erosion. Until less than a decade ago, people saw no interest in maintaining, protecting or selecting local wild varieties. As a result, non-commercial varieties began to gradually disappear. As examples, we can quote the varieties of fruit trees identified by students at the Faculty of Pedagogy of the Lebanese University in the 1960s:

-Fig trees: 17 varieties are known in Lebanon, without counting wild varieties. The fruit differs in size (between the size of a nut and that of a pear), in shape (oblong or flat), in the colour of its skin (yellow, green or black) or the colour inside the fruit (red or yellow).

-Plum trees: around ten varieties: spherical or oblong fruit; large or small; black, red, pink, green, white or yellow; scented or not.

-Varieties of apple trees, vines (around thirty), pear trees, quince trees, pomegranate trees (a dozen), wild cherry trees, medlar trees, almond trees, etc.

Because of the competition from new imported varieties with qualities sought by farmers and consumers alike, local varieties are becoming rare and starting to disappear.

Local species have the advantage of being adapted to the climate of the country, being able to withstand conditions of drought and the salinity of the soil and are more resistant to predators.

Before it is too late and local species disappear completely, adequate measures must be taken as soon as possible to determine local distribution, to identify the species in different places in Lebanon, to collect their seeds and young shoots and place them in a genetic conservation bank at the Agronomic Research Centre of the Ministry of Agriculture at Tell Amara, or elsewhere. They could then be reproduced by the technique and means of tissue culture or their seeds could be kept in a thermostatic cold room, in order to be able to plant them at a later date in plant nurseries, free of external contamination.

List of certain wild species of fruit trees and their origin.

Species	Locations
Amygdalus agrestis	north of the Bekaa
Amygdalus communis	mountains > 1,200m.
Amygdalus korschinskii	mountains > 1,200m.
Amygdalus orientalis	north of the Bekaa
Ceratonia siliqua	coast and inner mountains
Crataegus azarolus	from the coast to the high mountains
Crataegus monogyna	from 300 to 1,200m.
Ficus carica	coast
Ficus sycomorus	coast
Malus trilobata	mountains >1,200m.
Mirtus communis	coast: centre and north, 300-1,200m.: north and south.
Persica vulgaris	mountains >1,200m.
Pistacia lentiscus	central coast - lower mountains
Pistacia mutica	southern coast and north Bekaa
Pistacia palaestina	from the coast to the high mountains
Prunus cerasus	coast up to 800m.
Prunus mahaleb	Lebanon: western slopes 200 - 1,200m.
Prunus microcarpa	mountains >1,200m.
Prunus prostata	mountains >1,200m.
Prunus tortuosa	mountains >1,200m.
Prunus ursina	Lebanon: western slopes 200 - 1,200m.
Pyrus syriaca	coast: south and north
Rubus collinus	from the coast to the high mountains
Rubus hedycarpus	mountains >1,200m.
Rubus sanctus	from the coast to the high mountains
Rubus tomentosus	mountains >1,200m.

2. Herbaceous wild plants in Lebanon

The same can be said for herbaceous plants as was said for trees.

Herbaceous plants are distributed as follows, (According to M. Hamzé et al. Report on the biodiversity in Lebanon, 1996):

Alfalfa	Clover	Vetch
Medicago granatensis Willd.	Trifolium subteraneum L.	Vicia ervilia (L.)
M. itertexta (L.) Miller	T. cherlei L.	V. monantha Retz
M. murex Willd.	T. fragiferum L.	V. narbonensis L.
M. turbinata L. Willd.	T. hirtum All.	V. pannonica Jacqu.
M. aculeata Gaertner	T. pilulare Boiss.	V. peregrina L.
M. constricta Durieu	T. resupinatum L.	V. sativa amphicarpa Dorthes
M. rigidula (L.) Desr.	T. tomentosum L.	V. sativa angustifolia Roth
M. truncatula Gaertn.	T. alexandrinum L.	V. sativa cordata Wulf
M. litoralis Rohde	T. campestre Schreb.	V. villosa Roth
M. polymorpha L.	T. scabrum L.	
M. minima Lam.	T. purpereum L.	
M. laciriata All.		
M. praecox D.C.		
M. rotata Boiss.		
M. blancheana Boiss.		
M. rugosa Desr.		
M. scutellata Mill.		

Wild wheat	Wild oats	Chick peas	Wild lentils
Triticum thaoudar Reut	Hordeum spon C. Koch	Cicer arietinum	Lens culinaris
T. dicoccoides (Koern)	H. bystrix Roth	C. inicisum	L. ervoides
T. urartu Tum.	H. leporinum Link	C. pinnatifidum	L. orientalis
T. boeoticum Boiss.	H. bulbosum L.	C. judaicum	

Aegilops sp. (related to wheat)	
Aegilops ovata L.	A. cylindrica (Host)
A. triaristata Willd.	A. caudata L.
A. columnaris (Zhukovsky)	A. comosa Sibth & Sm
A. biuncialis Vis.	A. squarrosa L.
A. triuncialis L.	A. crassa Boiss.
A. kotschyi Boiss. sub. Eu- variabilis Eig.	A. ligustica (Sav.) Coss.
A. multiaristata	A. speltoides Teusch
A. intermedia	A. longissima Schweinf & Muschler
A. peregrina (Hackel) Maire & Wieller	A. searsii Feldman & Kislev
A. brachyatera	A. vavilovii

Other means of conservation

In order to complete the measures proposed to conserve the biodiversity of Lebanon, the following could also be established:

a) A conservatory of coastal life and riverside plants where animal and plant species that are already endangered or becoming extinct could be reproduced and conserved.
b) A Mediterranean botanical garden where all the typically Mediterranean species found in Lebanon could be grown and a botanical garden for desert species which would group together all the plants from around the country that grow in desert conditions.

Complementary measures

All the above recommendations should be accompanied by a series of general administrative measures:

- The regulation of hunting: it should be forbidden outside the pre-winter and winter seasons. The hunting season should be closed by 15th January at the latest. Fishing in boats on the lake of Qaraoun should be forbidden because it disturbs the behaviour of the aquatic avifauna.
- Imports of new species should be severely controlled because they might endanger, or even eliminate, indigenous species.
- Studies should be conducted on terrestrial invertebrates. What has been done so far is insufficient as it is still impossible to define precisely the species or specimen groups that are indicators of the biodiversity.
- In addition, the number of specialists in this field is insufficient. The training of taxonomists is a priority.
- Suitable educational programmes should be developed for schools and the media to increase public awareness on the subject of conservation of the biodiversity and its long-term development. These problems should be publicised and the application of legislation should be facilitated.
- The existing scientific structures in Lebanon (NCSR, etc.) should be assisted in the creation of a data base which would serve as the starting point for new research on the ground.

STRATEGY HIGHLINES AND PRIORITIES OF THE ACTION PLAN

5.1. Research, education and training needs

At the precollege level, the official Lebanese curriculum does not include any significant component on biodiversity conservation and management. A recent protocol has been signed between the Ministry of Environment and the Ministry of Education to incorporate environmental conservation education. At the college level, several universities in Lebanon offer components of courses in natural conservation.

However degrees pertinent to biodiversity conservation and management are non existent.

The American University of Beirut and the Lebanese University Faculty of Agricultural Sciences, are in the process of introducing multidisciplinary programs dealing with sustainable agricultural production.

In addition, multidisciplinary research projects in cooperation with regional and international centers involved in sustainable agricultural production should be strengthened.

Scientific institutions, such as the ARI, the LNCSR, the Lebanese University and AUB are already cooperating with ICARDA and others on improving the productivity of field and forage crops in Lebanon in a sustainable manner, in reliabilating marginal rangelands, collecting germplasm, and evaluating agricultural and livestock farming systems.

In view of the above, if Lebanon is to achieve an acceptable standard of knowledge about its agricultural and livestock biodiversity how to protect it and use it in a sustainable manner and how to restore it, the following actions are needed:

- the organization and updating of a national biological inventory.
- the monitoring and measurement of the status of agricultural biodiversity.
- formulating successful biodiversity, conservation strategies through multidisciplinary research on sustainable land use including biological, physical and socio-economic components.
- the development of databases and the use of remote sensing and Geographical Information System for agricultural Ecosystem monitoring.

The present level of training in Lebanon is highly inadequate, training opportunities are available to very limited staff who usually have to travel overseas and specialist degrees in agricultural and livestock biodiversity conservation and management are non existent. Therefore human resources needed to survey, monitor and manage biodiversity should be strengthened.

A special emphasis should be oriented to build taxonomic expertise both at the professional and at the paraprofessional level. Expertise in seed conservation, gene bank management and in situ strategies.

A major goal for Lebanon should be to train sufficient number of qualified people at all levels (farmers, technicians and scientists) and to involve local rural populations in developing strategies for conservation of agricultural and livestock biodiversity.

5.2. Public awareness Programs

Public Awareness Programs dealing with sustainable agricultural practices and agricultural biodiversity conservation are generally lacking with few exceptions. An initiative was started in 1991 on the occasion of the annual FAO World Food day on biodiversity during which several public awareness activities were undertaken (TV spots and debates, calendar and pamphlets). However awareness programs are in general conducted by environmental NGOs which often are centered on wildlife and natural conservation and tend to neglect or sometimes are very partial regarding agricultural activities and livestock production.

5.3. Institutional and Policy Framework

Several institutions have a role (direct or indirect) dealing with environmental conservation in Lebanon. The Lebanese parliament is gradually developing a better understanding of environmental issues and is ratifying laws for Treaty for conservation of Biodiversity. In addition to the Ministry of Environment newly established in 1993, other ministries including Agriculture, Health, Public Works, Industry and Petroleum, Hydro-Electric Resources, are concerned with many issues related to environmental conservation with no or little coordination mechanism among them. Municipal councils have an important role especially in rural areas and most of the environmentally related issues fall under their jurisdiction. Their role is expected to be reinforced with the creation in 1993 of the new Ministry for Municipal and Rural Affairs.

Scientific Institutions including the National Council for Scientific Research (NCSR), the Agricultural Research Institute, the Marine National Research Center related to (NCSR), the Geophysical National Center related to (NCSR), the American University of Beirut (AUB), the Lebanese University and others have been actively involved in various aspects of environmental conservation. Non governmental organizations are also playing an increasingly important role in conservation and environmental protection, both at the national and local levels.

As to existing policies, Lebanese legislature covers most aspects related to nature conservation. There are legal provisions for the creation of natural reserves, for the protection of forests and agricultural lands, the use of fertilizers and chemicals, the protection and conservation of water resources. However, most of these laws are scattered among various administrations with a complete absence of coordination.

In addition, most of the policies are becoming obsolete in their formulations and in view of socioeconomic and technical developments. Lebanon has signed several international conventions dealing with nature conservation including the convention on biological diversity. Lebanon and Jordan are the only two countries who ratified the Basle convention on biodiversity. However, there are no established and properly managed protected areas despite the officially declared areas of Bentael Park, Palm Islands, Horsh Ehden and soon Jabal

Barouk. Staffing to protect the natural heritage is lacking and specialization and technical training in conservation management are non existent.

The National Emergency Reconstruction Program (NERP) initiated by the Lebanese government does address the environment as a sector but without any specific reference to biodiversity conservation and with an absence of intrinsic mechanisms to integrate conservation issues and sustainable development into the rehabilitation project.

On the other hand, the Lebanese Ministry of the Environment has quickly identified biodiversity conservation as an area of priority and is presently cooperating with UNDP towards the building of the national capacity in terms of institutional frame work and human resource training. In addition, a GEF biodiversity conservation project was developed and designed to assess the Ministry of Environment to conserve selected areas of significant biodiversity namely: Hersh Ehden, the Palm Islands and Jabal Barouk. If adopted, the project will help the Ministry establish a new department of wild life and protected areas. It will also provide research grants to several scientific institutions and will strengthen the institutional capacity of national and local Non Governmental Organizations through their active participation in the management documentation and monitoring of the protected areas.

The Ministry of Agriculture and the ARI are presently involved in two national and regional projects dealing with agricultural and livestock biodiversity. ARI's ten stations scattered all over Lebanon can play a critical role for both *in situ* and *ex situ* conservation strategies.

In addition, the Forests and Natural Resources Department of the Ministry of Agriculture is officially responsible for the protection and management of forests.

The Green Plan, a semi-autonomous agency of the Ministry of Agriculture, if reactivated can play an important role in land reclamation leveling mountain land, constructing agricultural roads and water reservoirs and replanting the land with income producing trees. The Ministry of Agriculture is fully endorsing the hunting moratorium, particularly in view of the agricultural importance of birds.

The National Hunting Council was founded in 1974 to regulate hunting activities and increase the game bird population in the country.

It recently received financial support from both the Ministry of Agriculture and Ministry of Environment and started wild game farms (partridge in several areas). However the council is also introducing exotic birds which constitute a threat to indigenous species.

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Production Intensity	1	very low
Use of fertilizers	3	Fair/Medium
Pesticides	5	Very high
Herbicides		
Changes in 10 years	1	Negative
Land suitability	2	Stable
Improvement Status	3	Slightly Positive
Research Status	4	Positive
	5	Highly Positive
Disease Control	= Use of fertilizers (1-3-5)	
Stock movement control	1	Sedentary
	2	Low mobility
	3	Mobile
	4	Highly Mobile (migratory)
Harvesting	1	Low
	2	Medium
	3	High/Dangerous/excessive

National Species Information-Coding System
Scale 1-7

Conservation Status	No Conservation/Farming		1
	Conservation in situ/Protected areas		2
	Conservation ex situ/Personnel		3
	Conservation ex situ/Herbarium		4
	Conservation International		5
Habitat	Coastal area (0-300 m)	North	1.1
		Center	1.2
		South	1.3
	Western Slope (300-1200 m)	North	2.1
		South	2.2
	High Mountain over 1200 m		3.0
	Eastern Slope		4.0
	Bekaa valley	North	5.1
		Center	5.2
		South	5.3
	Anti-Lebanon	North	6.1
		South	6.2
		Artificial	7.0
Economic Significance		Low or none	1
Value for community		Medium/Fair	3
Value for National Level		High/Valuable	5
Threatened Relatives		Extinct	1
		Endangered	2
		Threatened	3
		Save/stable	4
Domesticated Status		Wild	1
		Domesticative	2
	Advanced stage of domestication		3

Crop	Prod. intensity	Changes in 10 years	Use of fertilizers	Pesticides	Herbicides	Land Suitab.	Improvem. status	Research status
Olive	3	3--4	1--3	1	1	4--5	3	3--4
Grape	3--5	4--5	3--5	5	3	5	4--5	1
Apple	1--3	1	3	5	3	3--5	1--2	2
Peach	5	4	3	5	3	5	4	1
Lemon	1--3	1--2	5	5	5	5	3	1--2
Banana	3--1	5	5	3	5	3	3	1--2
Mandarine	3--5	3	5	5	5	5	3	1
Pear	5	4	3	5	3	5	3	1
Orange	5	2--1	5	5	5	5	2--1	2
Apricot	3--5	2--1	3	3	1	5	3	1
Almond	1	1	1	1	1	5	1	1
Cherry	3--5	3--4	3	5	3	4	3	1
Plum	3	2--3	3--1	3	1	5	2	1
Pomegranade	1	1	1	1--3	1	3--4	1	1
Loquat	3	2	1	5	1	4	2	1
Persimomon	3--5	2	3	3	3	5	2	1
Fig	1	1	1	1	1	4	1	1
Walnut	3	1	1	3	1	3	1	1
Avocado	3	4	5	5	1---3	3	3	2
Cherimoya	3--5	5	5	3	3	3	3--4	1
Pistachio	3--1	1--2	3	1	1	3	1--2	1
Date	1	1	1	1	1	1--3	1	1
Mango	1	1	3	1	1	1	1	1
Kiwi fruit	3	3	3	1	3	3--4	3	2
Grape fruit	5	1--2	3	5	3	5	3	1
Jujube		3				2--3	2	1

Agricultural practices (Vegetables)

Crop	Prod. intensity	Changes in 10 years	Use of fertilizers	Pesticides	Herbicides	Land Suitab.	Improvem. status	Research status
Tomatoes	3,5	2	5	4	1	4	4	2
Cucumber	3,5	2	5	4	1	3	4	2
Beans	4	3	4	3	1	3	4	2
Cabbage	3	2	3	1	1	3	3	2
Cauliflower	3	2	3	1	1	3	3	2
Squash	3	2	3	2	1	3	4	2
Strawberry	3,5	4	4	3	1	4	5	2
Eggplant	4	4	4	3	1	3	3	2
Onion	3	1	4	1	1	3	2	2
Garlic	3	2	4	1	1	3	2	2
Carrots	3	3	3	1	2	3	2	2
Okra	2	3	2	1	1	2	1	2
Lettuce	3	3	4	1	1	3	3	2
Watermelon	3,4	4	4	2.,3	1	4	4	2
Gerbara	5	4	5	4	1	4	4	2
Carnation	5	3	5	4	1	4	4	2
Roses	5	4	5	4	1	4	4	2

Agricultural practices (field crops)

Crop	Prod. intensity	Changes in 10 years	Use of fertilizers	Pesticides	Herbicides	Land Suitab.	Improvem. status	Research status
Wheat	4	3	3	3	3	5	4	4
Corn	2	3	4	4	3	5	1	1
Barley	3	2	1	1	2	1	3	3
Sorghum	1	2	1	1	1	3	1	1
Millet	1	2	1	1	1	3	1	1
Favabean	4	3	4	4	3	4	3	3
Lentils	3	2	3	2	3	3	3	3
Chickpea	3	3	3	2	3	3	3	3
Peas	4	2	3	2	3	4	4	4
Lupine	2	2	2	2	2	2	1	1
Sugarbeet	4	4	5	4	4	5	3	3
Ground nut	3	3	3	3	3	3	1	1
Sesame	2	2	3	2	2	3	1	1
Sunflower	1	2	4	3	2	3	1	1
Potatoes	5	2	5	5	5	5	3	3
Tobacco	3	5	3	3	3	3	2	2
Alfalfa	3	2	2	1	1	4	2	2
Vetch	2	3	2	1	1	3	2	2

Annex 6.

National Species Information (Fruit Trees)

Crop	Scientific name	Common name	Wild relatives	Threat. relatives	Conserv. status	Habitat	Economic importance	Value for commun.	Value at National level	Domestic status
Olive	*Olea europea esculentum*	زيتون			1-5	1-2(-) 5	5	5	5	2-3
Grape	*Vitis vinifera* L.	عنب			1-5	1-5	5	5	5	2-3
Apple	*Malus domestica*	تفاح	Malus trilobata (Lab.) C.K.Schneider	2	1-5	2(+)-3-4 5.3 rare endemic	5	5	5	2-3
Peach	*Prunus persica* (L.) Batsch	دراق			1-3-5	2+-5	3	3	3	3
Lemon	*Citrus limonum* Risso	حامض			1-5	1	5	5	5	2-3
Banana	*Musa acuminata*	موز			1-3	1	5	5	5	2-3
Mandarine	*Citrus reticulata*	مندارين			1-3-5	1	5	3	3	2-3
Pear	*Pyrus communis L.*	اجاص	Pyrus syriata Boiss.		1-3	Coast عيناتا بعلبك الهرمل	3	3	3	3
Orange	*Citrus sinensis L.*	برتقال			1-5	1	5	5	5	3
Apricot	*Prunus armeniaca L.*	مشمش			1-2	2-5	3	3	3	2-3
Almond	*Prunus amygdalus* Batsch	لوز	Amygdalus communis Prunus korschinskii Hand-Mazz.		1	1-2 2	1-3	1	1	2
Cherry	*Prunus cerasus* L.	كرز			1-2	2+,4,5	3	3	3	2

Crop	Scientific name	Common name	Wild relatives	Threat. relatives	Conserv. status	Habitat	Economic importance	Value for commun.	Value at National level	Domestic status
Tomatoes	*Lycopersicum esculentum*	بندورة		N.A.	1	1,2,3,4,5,7	5	5	5	3
Cucumber	*Cucumis sativus*	خيار		N.A.	1	1,2,3,4,5,7	5	5	5	3
Beans	*Phaseolus vulgaris* Savi.	فاصوليا		N.A.	1	1,2,3,4,5,7	3	4	3	2
Cabbage	*Brassica oleracea*	ملفوف		N.A.	1	1,2,3,5,6	3	4	3	3
Cauliflower	*Brassica oleracea botrytis*	قنبيط		N.A.	1	1,2,3,5,6	3	4	3	3
Squash	*Cucurbita pepo*	كوسى		N.A.	1	1,2,3,5,6	3	4	3	3
Strawberry	*Fragaria grandiflora*	فريز		N.A.	1	1,2,3	4	3	4	2
Eggplant	*Solanum melongina*	باذنجان		N.A.	1	1,2,3,5	3	3	3	3
Onion	*Allium cepa*	بصل		2	1	5,1	4	3	4	2
Garlic	*Allium sativum*	توم		2	1	5,1	4	3	4	2
Carrots	*Daucus carota*	جزر		2	1	5	3	2	3	2
Okra	*Abelmorchus esculentus*	بامية		2	1	5	2	3	2	2
Lettuce	*Lactuca sativa*	خس		1	5,1	4	3	4	2	
Watermelon	*Citrulus vulgaris*	بطيخ		2	1	5,1.3	4	3	4	3
Gerbera	*Gerbera hybrida*	جيربيرا		N.A	1	1,2	4	2	4	3
Carnation	*Dianthus caryophylla*	قرنفل		N.A.	1	1,2	4	2	4	3
Roses	*Rosa spp.*	ورد		N.A.	1	1,2	4	2	4	3

Crop	Scientific name	Common name	Wild relatives	Threat. relatives	Conserv. status	Habitat	Economic importance	Value for commun.	Value at National level	Domestic status
Peas	*Pisum sativum* L.	البازيلاء	N.A.	N.A.	3,5	1,2,3,5	2	3	2	4
Lupine	*Lupinus luteus* L. *Lupinus albus* L.	ترمس اصفر ترمس ابيض	N.A.	N.A.	1	2	1	2	1	2
Sugar beet	*Beta vulgaris* L.	الشمندر السكري	N.A.	N.A.	1	5.2	5	4	4	3
Ground nut	*Arachis hypogaea* L.	الفول السوداني	N.A.	N.A.	1.1	3	3	2	2	3
Sesame	*Sesamum indicum* L.	السمسم	N.A.	N.A.	1	1.3	2	2	2	2
Sun-flower	*Helianthus annus*L.	عباد الشمس	N.A.	N.A.	1	1,2,5	3	2	1	2
Potatoes	*Solanum tuberosum* L.	البطاطا	N.A.	N.A.	1	1.1,2.1, 5.2,5.3	5	5	5	3
Tobacco	*Nicotiana tabacum* L.	التبغ	N.A.	N.A.	1	2.2,6.2 5.1	4	5	4	3
Alfalfa	*Medicago sativa* L.	الفصة	*Medicago spp.*	3	2,3,5	1.3,2.2 5.2,5.3	3	3	2	2
Vetch	*Vicia sativa* L.	الباقية	*Vicia spp.*	3	1	1.3,2.1 2.2,5.2 5.3,6.3	2	3	2	2

Lucerne	Clover	Vetch
Medicago granatensis Willd.	*Trifolium subteraneum* L.	*Vicia ervilia* (L.)
M. itertexta (L.) Miller	*T. cherlei* L.	*V. monantha* Retz
M. murex Willd.	*T. fragiferum* L.	*V. narbonensis* L.
M. turbinata L. Willd.	*T. hirtum* All.	*V. pannonica* Jacqu.
M. aculeata Gaertner	*T. pilulare* Boiss.	*V. peregrina* L.
M. constricta Durieu	*T. resupinatum* L.	*V. sativa amphicarpa*
M. rigidula (L.) Desr.	*T. tomentosum* L.	Dorthes
M. truncatula Gaertn.	*T. alexandrinum* L.	*V. sativa angustifolia* Roth
M. litoralis Rohde	*T. campestre* Schreb.	*V. sativa cordata* Wulf
M. polymorpha L.	*T. scabrum* L.	*V. villosa* Roth
M. minima Lam.	*T. purpereum* L.	
M. laciriata All.		
M. praecox D.C.		
M. rotata Boiss.		
M. blancheana Boiss.		
M. rugosa Desr.		
M. scutellata Mill.		

Annex IV

Wheat Recently Found in LEBANON

Species	Reference	Year	Location in Lebanon
***Triticum thaoudar* Reut.**	Paul Mouterde Dr. G. Post	1965 1928	KFARKOUK, EL KALAA BAALBECK, DEIR EL AHMAR, IA'AT
***T. dicoccoides* (Koern)**	Paul Mouterde Dr. G. Post	1965 1928	BOUAREG, WADI EL ARAYECH, WADI EL KARM, RACHYA, KFARKOUK.
		1993 1994	KARAOUN, YANTA, BAKKA AITA AL FOUKKHAR, AIHA, AITA AL FOUKKHAR, KFARMISHKI AIN-ATA, AIN-HORCHI, KAOUKABA, RACHYA.
***T. urartu* Tum.**	ICARDA - ARI	1993 1994	RACHAYA, IA'AT AINATA, YAMMOUNI
***T. boeoticum* Boiss.**	ICARDA - ARI	1993 1994	AITA-AL-FOUKKHAR YANTA, AINATA.

Species	Reference	Year	Location in LEBANON
***Hordeum spontaneum* C. Koch**	Paul Mouterde Dr. G. Post	1950	RAYAK, ZAHLE, BAALBECK, DEIR EL-AHMAR, TALIA
	ICARDA - ARI ICARDA - ARI	1993 1994	YAMMOUNI, RACHAYA AIN-ATA, JABAL KNEISSE.
***H. bystrix* Roth**	Paul Mouterde	1950	BEYROUTH, HAZMIYE, TRIPOLI, MDEIREJ, JABAL KNEISSE, CHTAURA, AMMIK
***H. leporinum* Link**	Paul Mouterde	1950	BEYROUTH, TRIPOLI, BIKFAYA, HASBANI, EHDEN.
***H. bulbosum* L.**	Paul Mouterde Dr. G. Post ICARDA - ARI	1950 1896 1994	TYR, SAIDA, BEYROUTH TRIPOLI, JAMHOUR CHEKKA, SOFAR, RAYAK, RACHAYA, BAALBECK

Wild chickpeas collected from Lebanon and conserved at ICARDA's GI

Species	Variety or Landrace	Number of collected accession	Year	Location
Cicer arietinum	Local chickpea	28	1972	BEIRUT, TRIPOLI, AL-KAIYAA, NABATIEH, TYR, AL-KAROUN, KORIABI
	Local Jurdi	3	1972	TRIPOLI
	Haurani	2	1972	NABATIEH
	Leb. local	7	1972	KORIABI
	Loc. Begaain	1	1972	NABATIEH
C. inicisum		1	1974	CEDRES
C. pinnatifidum		1	1975	JBAIL
C. judaicum		17	1975-85	JBAIL, SHWEIFAT, SIBLIN
			1992	KOSBA, MAJDAL, BETROUN

Wild [illegible]

Species	Variety or Landrace	Number of collected accession	Year	Location
Lens culinaris	Lebanese local	6		ZAHLE
	Khuraibi	1		BAALBECK,SOUR,
	Baalbecki	7		YAHMOUR
	Various	105		TALYA, KFARZABAD, TAYBI, AL-MARJ, SAID, AL-MENIEH
L. ervoides		15		BEIT-EL-DEEN, BAAKLINE, SHWEIFAT, MUSHREF, SIBLIN, BETROUN, JBAIL, BSHERI, KALB RIVER
L. orientalis		1		BAALBECK
Undetermined		3		AITA ALFOUKHAR, YAMOUNI, RASHAYA
Vicia faba	Beqaai	9	1972	SAID, NABATIEH, SOUR
	Lebanon small	1		
	Leb. large	1		
	Egyptial b.b.	1		
	Shami b.b.	2		
	Cypriot b.b.	4		
	Old Cypriot b.b.	2		
	Various	16		

Species	Reference	Year	Locations
Aegilops ovata **L.**	Dr. G. Post Paul Mouterde ICARDA Report	1896 1950 1993 1994	BAALBECK, BEYROUTH HAZMIYEH, BAROUK MKALLES, BHAMDOUN TAWMAT NIHA, JABAL EL KNEISSE, HASROUN, TAANAYEL, ZAHLE, BAALBECK, AINATA, RACHAYA, JIB-JANNINE, TALIA, AIN-ATA, AIN-HORCHI, KAOUKABA.
A. triaristata **Willd.**	Dr. G. Post	1896	BHAMDOUN
A. columnaris **(Zhukovsky)**	Dr. G. Post Paul Mouterde ICARDA	1896 1950 1993- 1994	RACHAYA, KA'A EL RIM, I'AAT, JIB-JANNINE DEIR-EL-AHMAR
A. biuncialis **Vis.**	Dr. G. Post Paul Mouterde ICARDA	1896 1950 1993 1994	CHEKKA, KFARCHIMA, MROUJ, RAYFOUN, HASROUN TALIA, AIN-ATA, AIN HORCHI, KAOUKABA, RACHAYA, KFARMISHKI
A. triuncialis **L.**	Dr. G. Post Paul Mouterde ICARDA-ARI	1896 1950 1993 1994	BEYROUTH RASHAYA, DEIR EL AHMAR I'AAT, RASHAYA, KAOUKABA
A. kotschyi **Boiss.** **sub. Eu-** *variabilis* **Eig.**	G. Post Paul Mouterde	1896 1950	JIB JANNINE TRIPOLI DEKWANEH, KFARCHIMA, CHEKKA, BHAMDOUN, DHOUR-CHOUEIR, KA'A
A. multiaristata	Dr. G. Post	1896	BEYROUTH, KATTIN
A. intermedia	G. Post	1896	SIDON, ABAYH
A. peregrina **(Hackel) Maire & Wieller**	P. Mouterde ICARDA - ARI	1950 1993 & 1994	TYR, SAIDA, BEYROUTH, TRIPOLI, WADI-CHAHROUR TALIA, AIN-ATA, AIN-HORCHI
A. brachyatera	Dr. G. Post	1896	JABAL ABTADIR

Species	Reference	Year	Locations
A. cylindrica **(Host)**	Paul Mouterde ICARDA - ARI	1950 1993- 1994	BHAMDOUN MARJHIN, FNEIDEK AINATA
A. caudata **L.**	Dr. G. Post Paul Mouterde ICARDA Report ICARDA-ARI	1896 1950 1993 1994	AINATA AINATA DEIR-EL-AHMAR I'AAT, AL-SAFRA (BAALBECK)
A. comosa **Sibth&Sm**	Dr. G. Post	1896	AL-MASNAA
A. squarrosa **L.**	Dr. G. Post	1896	AL-MASNAA
A. crassa **Boiss.**	G. Post	1896	MOUNTAINS
A. ligustica **(Sav.) Coss.**	G. Post P. Mouterde	1896 1950	TRIPOLI TYR, TRIPOLI, DHOUR-EL-CHOUEIR, SIR-EL-DINNYEH, SANNINE
A. speltoides **Teusch**	G. Post Paul Mouterde	1896 1950	TRIPOLI SAIDA, DAMOUR, NAHR-BEYROUTH, NAHR-EL-KALB, CHEKKA, TRIPOLI, BSARMA, BEIT-MERI
A. longissima **Schweinf&Muschler**	P. Mouterde	1950	BEYROUTH, KHALDE
A. searsii **Feldman&Kislev**	ICARDA - ARI	1993 & 1994	TALIA
A. vavilovii	ICARDA - ARI	1993 & 1994	I'AAT, YAMMOUNE AL-SAFRA

Annex 15

National Species Information (Livestock)

Livestock	Scientific name	Common name	Wild relatives	Threat. relatives	Conserv. status	Habitat	Economic importance	Value for commun.	Value at National level	Domestic status
Poultry Layers		Breed White eghorn	N.A.	N.A.	1	7	5	5	5	3
Layers		Baladi	N.A	N.A.	1			3	1	3
Broilers		Hybrid	N.A.	N.A	1	7	5	5	5	3
		Exotic								
Sheep	*Ovis anes*	Awassi	Ovis ouenblis	1	2	1.1-1.3 2.1-6.2	5	5	5	2
Goat	*Caprus hicus*	Shami	Caprus falconeri	1	2	2.1-6.2	3	5	3	2
		Baladi		1	2	2.1-6.2	5	5	5	2
		Exotic		N.A.	N.A.	2.1-2.2	1	1	1	2
Cattle	*Bos taurus*	Baladi	Bos pingenus	1	2	2.1-6.2	3	5	3	2
		Holstein	Bos libius	N.A.	N.A.	2.1-6.2	5	5	5	2
Swine	*Sus serota*	Exotic	Sus scrofa lybicus	2	1	3	1	1	1	2
Turkey		Exotic	N.A.	N.A.	N.A.	Artific.7	1	1	1	2
Pigeon		Baladi	N.A.	N.A	3	1.1-1.3	1	1	1	1
Quail	*Coturnix coturnix*	Baladi	Coturnix	2	3	5.1-6.2	1	1	1	1
Pheasants	*Phasianus saxculis*	Pheasant	Phasianus	N.A.	3	Artific.7	1	1	1	1
Partriage	*Alectoris*	Partridge	Alectoris	2	3	3.0-6.1 6.2	1	1	1	1
Horse		Arabian		1	3	Artfic.7	3	1	3	2
Donkey	*Equis Anius*	Donkey	Equs hemionus	1	1	2.1-6.2	1	1	1	2
Rabbit		Rabbit	Lepus capensis syriacus	2	3	4.0-6.2	1	1	1	2
Bees					1	2.1-6.2	3	3	3	1

Specie	Common Name	Arabic name	Location
1. Pyrus syriaca	Pears	اجاص بري	1.1-1.3
2. Mirtus communis	Mirtle	حب الآس	1.1-1.2-2.1-2.2
3. Malus trilobata	Apple	تفاح	3
4. Crataegus azarolus	Azarole	زعرور	1-2-3
5. Crataegus monogyna	Azarole	زعرور	2-3
6. Ceratonia siliqua	Carob	خروب	1-2
7. Ficus carica	Figs	تين	1
8. Ficus sycomorus	Figs	جميز	1
9. Prunus cerasia	Prunes	خوخ	1
10. Prunus ursina	Prunes	خوخ الدب	2-3
11. Prunus mahaleb	Prunus	كرز	2
12. Prunus prostata	Prunus	كرز	3
13. Prunus microcorpa	Prunus	كرز	3
14. Prunus tortuosa	Prunus	كرز	3
15. Rubus hedycarpus	Mulberry	توت	3
16. Rubus tomentosus	Mulberry	توت-عليق	2-3
17. Rubus collinus	Mulberry	توت-عليق	1-2-3
18. Rubus sanctus	Mulberry	توت-عليق	1-2-3
19. Pistacia palaestina	Pistachios	بطم	1-2-3
20. Pistacia mutica	Pistachios	برزق	1.3-5.1
21. Pistacia lentiscus	Pistachios	فستق حلب	1-2
22. Amygdalus communis	Almonds	لوز	3
23. Amygdalus korschinskii	Almonds	لوز	3
24. Amygdalus orientalis	Almonds	لوز شرقي	5.1
25. Amygdalus agrestis	Almonds	لوز	5.1

Republic of Lebanon

Ministry of Agriculture

United Nations
Environment Programme
(UNEP)

BIOLOGICAL DIVERSITY OF LEBANON

Project: GF/6105-92-72

Executed by
The Ministry of Agriculture of Lebanon

With the assistance of
The United Nations Environment Programm (UNEP)

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Project Studies

1. Liste des espèces
2. Facteurs socio-économiques affectant la biodiversité
3. Flore terrestre
4. Faune terrestre
5. Faune et flore marines et côtières
6. Faune et flore aquatiques
7. Agricultural and livestock habitats and nature reserves
8. National current capacity and economic evaluation
9. Comprehensive report
9. Rapport de synthèse
9. التقرير التحليلي

Republic of Lebanon

Ministry of Agriculture

United Nations
Environment Programme
(UNEP)

LEBANON COUNTRY STUDY

ON

BIOLOGICAL DIVERSITY

National Current Capacity

and

Economic Valuation

National Current Capacity
Lawyer Zakhia Abdallah ..... **Institutions & Legislation**

Economic Valuation
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Lebanon country study on biological diversity ; Project GF/6105-92-72.
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1. ECONOMIC ASSESSMENT OF BIODIVERSITY IN LEBANON

1.1. General background

1.1.1 Demographic information

The Civil War events have affected the size, composition and geographical distribution of Lebanon's population. During the war, the size of the population has change due to the massive migration of the Lebanese from Lebanon. At the same time, the arrival of many foreigners to the country changed the composition of the population. There has also been a continuing move towards increasing urbanization. The Lebanese population has centered specifically in the coastal zone thus affecting the geographical distribution of the population. Current estimates of population in Lebanon are largely built on estimates developed from earlier studies. These estimates vary widely from one source to another. Some sources reveal estimates as low as 2.7 million[1], while others reveal estimates of 4 million[2] individuals.

Table 1 represents the population of Lebanese and non- Lebanese residents for the year 1994.

Table 1. Estimated population for Lebanese and non-Lebanese residents, 1994.

Citizen Classification	Number ('000)
Lebanese citizens	2,500
Syrian residents	1,100
Other non-Lebanese	100
Palestinians in camps	200
Total	3,900
Total excluding Palestinians in camps	**3,700**

Source: Assessment of the state of the Environment, 1995.

Spatial distribution and urbanization

The spatial distribution affected largely environmental quality conditions. These impacts are both in terms of demand for land resources and for environmental services such as; waste water treatments, water supplies, and generation and disposal of solid wastes. During the past two decades, the spatial distribution of population has changed mainly due to the combined effects of socio-economic changes and forced internal migration (internal displacement) due to the civil war events.

[1] UNEP, 1993.
[2] Faour, 1994.

The population displacement combined with the lack of statistics have resulted in an unsecured population distribution data. However, it is important to obtain an idea of the likely distribution in order to assess the future implications of population growth on environmental resources and environmental management.

Several studies revealed that there are sharp regional variations within the country, as shown in Table 2. The coastal zone[3] contains about 60% of the Lebanese population, with an average population density of about 1,600 person/km^2. These statistics illustrate the intensity of demand on natural resources in the narrow coastal zone; even in the hills, up to 1,000 meters, population densities are high compared with other parts of the country, thus causing a considerable pressure on the coastal ecosystems, land, and water resources.

Table 2. Population density in some selected areas in Lebanon for 1988, (persons/km^2).

Area	Mohafazat	Population 1988	Area ('000 ha)	density ('000)
Coastal zone[4]				
	All	2,094.4	130.0	1,610
	Excluding Beirut	993.0	125.0	790
Between 250 - 500m contour				
	Mount Lebanon	68.2	18.1	380
	South Lebanon	199.3	39.6	500
Between 500 - 1000m contour				
	Mount Lebanon	192.9	43.6	440
	South Lebanon	120.9	46.7	260
	North Lebanon	134.8	35.2	380
	Bekaa	410.0	335.5	120
Beirut				
	Municipal Area	33,000		
	Inner ring			40,000+
	Outer ring and suburbs			4,400-15,000
	Tripoli			12,000

Urban-rural trends

Before 1975, the benefits of the commercial and industrial activities in Lebanon were concentrated in the capital area of Beirut, Mount Lebanon and Zahle for agro-processing activities. These activities were less around the coastal towns of Tripoli and Saidon. The rest of the country had a lower overall standard of living, lagging behind in social and infrastructural development. Prior to the war, the average index of income in Beirut and its suburbs was 2.5 times higher than in other towns, and 4 times higher than in the less prosperous regions of the North, South and Bekaa.

[3] Defined as the area from the shoreline to the 250 m contour, except in Akkar where the zone extends to the 550 m contour.
[4] Coastal zone defined as shoreline to 250 m contour (except in North Lebanon when it is taken to the 500 m contour).

These disparities fueled strong rural-urban migration, mainly to Beirut and its suburbs, thus increasing the pressure on the demand of different resources and services. Studies carried out in 1987[5] confirmed that the relative economic position of the rural areas in the North, South and Bekaa had changed very little. However urbanization has been expanding at the expense of arable agricultural land (estimation of 20,000 ha for the last decade).

The Lebanese labor force

A study that was conducted by the American University of Beirut (AUB) showed the impact of the civil war and its aftermath on the labor force. It stated that in 1974 the non-agricultural labor force was 597,778. By 1979, During the war time, the number was reduced to 426,239, had there been no civil war the number would have reached 791,354 for the same year. The reduction in the Lebanese domestic force was due to the fact that in 1975 only 98,000 persons were working abroad.

However, in 1979 the number had risen to 210,000. While Lebanon's recovery was hampered by the drain of skills and brains, there was at the same time a pool of unemployed people, estimated at more than 200,000 in 1979. The sectors in which there was the greatest contraction of the work force between 1974 and 1979 were industry (from 138,359 to 86,941), followed by construction (from 46,517 to 25;256). Many of those not in regular employment were engaged in paramilitary activities.

In 1985 it was estimated that 28% of the active population (18-68 years old) were unemployed, whereas before the civil war the rate had been 5%. Unemployment was estimated at almost 50% in 1987 and was reduced to 35% in 1990. Table 3 shows the estimated Lebanese labor force for some selected years between 1970 and 1990. Table 3 indicates the continuous and steady increase in the labor force in Lebanon.

Table 3. Lebanese active population (excluding non-Lebanese) for some selected years

Year	Persons	Source
1970	572.000	Central Direction for Statistics
1984	701.783	ESCWA (1985)
1987	883.000	(Survey on the displaced population)
1990	914.000	

Source: Socio-economic study of biodiversity, 1995. Unpublished report.

It is important to note that labor force involved in more natural resource management has declined tremendously especially in the agriculture. The labor force that was involved in agriculture in the sixties was 30% of the population, in the nineties it declined to only 7%. Currently the Ministry of Agriculture employs around 290 persons.

[5] Lebanon at Present and its needs for Rehabilitation and Development, Hariri Foundation 1987.

1.1.2. Contribution of various sectors to the Lebanese Economy

In terms of sectoral shares of the Lebanese GDP, various studies have found that the tertiary sector, mainly trade continues to rank first in the 1980-1990s (30%-35%) of the GDP, followed by the industrial sector (20-25%) and agriculture (7-10%). The contribution of tpurism which was 20% before 1975 declined to 8% in the 80s. It is evident that the two sectors directly or indirectly related to the management of natural resources Agriculture and Tourism) are declining in the favor of other sectors that are antagonistic to the conservation of natural resources namely biodiversity; services and industries.

1.1.3. The Lebanese civil war impacts on biodiversity

Lebanon was engaged in a civil war for over a period of 17 years (1975-1991). Prior to the war, a comprehensive study was initiated in 1970 by the National Research Council to define and monitor the natural ecosystems and their diversity in Lebanon. Unfortunately the second phase of this study was interrupted by the war events. The current available data are the results of the first phase of the 1970 project and could not reflect the present status of the biodiversity which was seriously affected by the war events. Out dated or unavailable data concerning the stocks of biodiversity in natural resources, and resource degradation were some of the outcomes of the Lebanese civil war.

With respect to data collection, the team was faced with great difficulties in obtaining data concerning the different topics of the study. Data were either out of date or unavailable as formal or published reports. When data were available great discrepancies existed between different sources. For instance, the Lebanese population varied from one report to another and ranging between 2.7 to 4 million individuals. Technical data concerning biodiversity were available to some extent, however studies about the economic valuation and assessment were not. Therefore, the team has found it legitimate and necessary to develop some limited study cases to generate some values that could be used as a guide lines for the assessment of biodiversity in the future.

With respect to resource degradation, the long years of war and in the absence of a central government control, many resources have been misused and some times even abused, which ultimately affected the ecosystems and their natural habitats. This continuos misuse has led to an over all degradation of many biological systems in Lebanon. Once again, this drastic changes made the prewar data obsolete and unreliable ones, which legitimized the need for the studies that were conducted by the team.

Lebanon enjoys a great deal of biodiversity. Since the area of the country is relatively small and given that the Lebanese economy is highly diversified, thus maintaining and sustaining the biodiversity is a very complicated task that requires an intensive and collaborative work among the concerned parties.

1.1.4. Biodiversity status in the National Emergency Reconstruction Programme

The development plan (Reconstruction Plan) for the whole economy did not include any direct allocation of the budget to biodiversity. The duration of this plan is 10 years starting 1993, and its budget is US $11.7 milliards. The amount allocated for the public health and the environment is 7% and that allocated to municipal and waste water projects is 13%. In addition to that, an amount of US $360 millions is allocated to agriculture and irrigation. Therefore, a total of US $2.7 milliards was allocated to sectors that can be indirectly related to the biodiversity.

These figures indicate that biodiversity issues are not a priority in the government plan or budget. In fact, the Lebanese case is rather a unique one, since the country is in the process of reconstructing most of its infrastructures that were severely damaged during the war time. Therefore, priorities went to the more basic infrastructures such as domestic water, electricity, roads, telephone, etc.

On the other hand, the current status of the ecosystems require more attention and more funding to prevent further damage to the biological and natural resources. Moreover, domestic and international NGOs should step in and initiate funding to sustain and conserve the biodiversity habitats, specially the endemic and threatened species that the Lebanese and the rest of the world might be interested in their existence and conservation.

Thus the economic assessment for different threatened species and natural resources is needed to set priorities of what should be done first. The newly established Ministry of Environment has quickly identified biodiversity conservation as an area of priority and is presently cooperating with UNDP towards the building of the national capacity in terms of institutional framework and human conservation. resource training. The Ministry of Agriculture and the Agricultural Research Institute are presently involved in two national and regional projects dealing with agricultural and livestock biodiversity.

1.1.5. NGO's studies related to biodiversity

The Lebanese NGO's took the initiative after the war and initiated a series of public awareness campaigns to preserve the national biodiversity. It culminated by the development of a national project for the establishment of the protected area systems, funded by Global Environmental Fund (GEF) and scheduled to be implemented in the near future. In addition small spot projects were initiated by different NGO's dealing either directly or indirectly with biodiversity. Nevertheless all these initiatives were limited by the lack of a national inventory of the biodiversity, moreover by contradictory and scarce reports on the actual status and threats to the biodiversity in Lebanon.

1.1.6. Report objectives

This report represents a basic step towards a comprehensive survey and valuation for some of the biodiversity resources in Lebanon. The main objectives of this report were: 1) to estimate the economic values related to some activities of the major biological and natural resources in Lebanon, and 2) to identify potential threats to their biodiversity habitats. This was accomplished through the analysis of two selected case studies representing the major biological and natural resources in Lebanon. They are: forest biodiversity including medicinal plants and fresh and marine water biodiversity. The report also includes; public

expenditures on various resource categories from different sources and agricultural sectors production activities. Potential threats to biodiversity in each ecosystem were addressed at the end of each chapter.

1.2. Public expenditures related to biodiversity in Lebanon

Only about US $50 millions were allocated to biodiversity related activities. Table 4 represents public expenditures from major sources: government, bilateral and multilateral, and NGOs for 1995, in details. The bilateral and multilateral expenditures related to biodiversity for the same year amounted to US $8,222,000 while other NGOs spent approximately US $2,168,000. Table 5 represents public expenditures by major sources on aggregate and the total amount spent by each source from 1993 to 1995. While Table 6 represents the percentage contribution of each source in each year. It can be noted from Table 6 that the government expenditures on biodiversity related activities over the last three years have increased significantly from 0.11% to 82.8% from 1993 to 1995 while a reduction in bilateral and multilateral share were noticed; however it remains almost the same for other sources. Table 7 represents the change in the total spending to biodiversity by all sources and percentage change for each year starting from 1993.

Concerning the year 1996, the estimated budget from the different sources are as follows: US $62,859,500 from the government, US $10,722,000 from the bilateral and multilateral sources, and US $2,148,000 from other sources adding up to US $75,729,500. That means that the additional total spending from all different sources to biodiversity has increased by US $15,380,000, which represents almost 25% increase than 1995.

Table 8 represents the expenditures on major categories related to biodiversity. From the Table it can be seen that site and species management are almost US $41,247,500 which represent the major share of expenditures from different sources for 1995.

N.B. The exchange rate of US 1$= Lebanese Pound (L.L.) is:

For 1991	US 1$= (L.L.) 982.23
For 1992	US 1$= (L.L.)1712.84
For 1993	US 1$= (L.L.)1741.38
For 1994	US 1$= (L.L.)1679.74
For 1995/1996	US 1$= (L.L.)1600.00

Table 4. Major Sources of Expenditures by Resource Categories

Year: 1995 Currency: US $

Resource	Agriculture	Forestry	Livestock	Protected Areas	Fisheries	Marine	Total
Source: **1) Government**							
Site or species management	17,255,000	169,500	8,370,000	25,000		7,080,000	32,899,500
Economic Incentives	10,280,000						10,280,000
Education	3,000,000						3,000,000
Data Management	180,000						180,000
Policy Planning and Analysis							
Institutional Capacity Building	3,600,000						3,600,000
Subtotal 1	**34,315,000**	**169,500**	**8,370,000**	**25,000**		**7,080,000**	**49,959,500**
2) Multilateral and Bilateral							
Site or species management	930,000		5,250,000				5,180,000
Economic Incentives							
Education							
Data Management			1,660,000				1,660,000
Policy Planning and Analysis	382,000						382,000
Institutional Capacity Building							
Subtotal 2	**1,312,000**		**6,910,000**				**8,222,000**
3) Others							
Site or species management		2,158,000		10,000			2,168,000
Economic Incentives							
Education							
Economic Incentives							
Data Management							
Policy Planning and Analysis							
Institutional Capacity Building							
Subtotal 3		**2,158,000**		**10,000**			**2,168,000**
Total (1+2+3)	**35,627,000**	**2,327,500**	**15,280,000**	**26,000**		**7,080,000**	**60,349,500**

Table 5. Major sources of expenditures and their total value from 1993-1995 in US $.

Sources	1993	1994	1995	Total
Government	5,000	364,500	49,959,500	50,329,000
Multi & Bilateral	4,029,000	13,334,900	8,222,000	25,585,900
Others	205,000	184,000	2,168,000	2,557,000
Total	4,239,000	13,883,400	60,349,500	78,471,900

Table 6. Percentage of contribution of each source from the total expenditures.

% change	1993	1994	1995
Government	0.11	2.6	82.8
Multi& Bilateral	95	96	13.6
Others	4.8	1.3	3.6
Total	100	100	100

Table 7. Total expenditures and percentage change for 93-95

	1993	1994	1995
Total	4,239,000	13,883,400	60,349,500
% change	0	69	77

Table 8. Major categories of activities and expenditures in 1995 (US $).

Sources	Site or species management	Economic incentives	Education	Data management	Policy Planning & Analysis	Institutional capacity building
Government	32,899,500	10,280,000	3,000,000	189,000		3,600,000
Multi and bilateral	6,180,000			1,660,000	382,000	
Others	2,168,000					
Total	41,247,500	10,280,000	3,000,000	1,840,000	382,000	3,600,000

1.3. The lebanese agricultural sector

1.3.1. Major indicators

The contribution of the Agricultural sector to the GNP has declined from 20% in the 1950s to 10% in the late eighties, to about 8% in 1994. Accordingly the active labor force decreased from 50% of the total active population in the 50s to 20% in the 80s, to about 7.5% in 1994. Women constitutes 39% of the active agricultural force which is characterized by a high illiteracy level (36% in 1995) and is deprived from basic social benefits as compared to other productive sectors.

Although the national reconstruction plan has committed US $360 millions for the rehabilitation of the Agricultural sector over 10 years, the above sum is not proportional to the importance of the sector and to the size of the losses incurred by the sector as a result of the war events. Moreover, the share of the Ministry of Agriculture is steadily declining (2% in 1992 to 0.48% in 1996).

The agricultural trade balance has indicated steady deficits; in 1994, Lebanon imported US $1190 millions worth agricultural products equivalent to 20% of its overall imports.

While agricultural exports valued 108 millions dollars or 20% of its overall exports. Major exports included fruits, vegetables and processed food products.

1.3.2. Agricultural Land

The land available for agriculture is limited because of the variable topography of Lebanon with high mountains and steep valleys, and constitutes 36% of the total area of 10 452 km^2. The actual cultivated area is about 215,000 ha of which 75 000 ha are irrigated.

Land tenure is a major constraint towards the agricultural development in the country, by increasing the cost of agricultural production thus weakening competition for external markets. Recent estimates reveals that 65% of the land holdings are less than two hectares.

1.3.3. Production systems

The diversity of the agroecological zones has contributed to a diversity of agricultural and livestock production systems. Yields and values of various agrobiological products are listed in Table 9. Crop production systems: The total cultivated area in 1994 was about 250,000 ha including fruits, vegetables and field crops.

Field crops

The major field crops include cereals, potatoes, sugarbeets, onions, tobacco and food legumes. Cereals production estimated at 66 000 tons covers about 12% of the self sufficiency. Sugar beet cultivation along with wheat and tobacco has significantly increased since 1991. These crops were subsidized by the government at a cost of US $55 millions in 1995.

Fruits

Fruit crops grown in Lebanon include both temperate zone fruits and subtropical fruits. Citrus, olives, apples, grapes and stone fruits are the main fruit crops accounting for 80% of the total Lebanese fruit production. Olive production is very old including many local varieties and widely spread in all agroecological zones (42000 ha of rainfed plantations). Grape is another old tradition in Lebanon and is mainly located in the plains with various local varieties. Local and exotic varieties of bananas are essentially grown in the southern coast and more recently in greenhouses using tissue culture plants. The total fruit production has tripled during the last three decades and Lebanon is still exporting fruits to the Arab countries.

Vegetables and floriculture

One quarter of the cultivated land is used for vegetable and flower production whether irrigated, rainfed, or protected. Many vegetables as well as flowers are produced under protected environment year round. Some others can withstand the dry and hot conditions especially superior local varieties of tomatoes, watermelon, roses and other fragrance plants.

Livestock production systems

Livestock production includes both traditional extensive and intensive systems. Local breeds of sheep, goat and cattle are reused under extensive conditions and fed on pastures and crop residues. The intensive system is practiced for the production of exotic poultry and dairy cattle. Non conventional species such as quail, rabbit, turkey are being introduced. The Lebanese demand on livestock grows by 4-5% annually while imports represent 80% of the dairy and meat needs.

Bee keeping for honey production is regaining ground, enhanced by the climatic, plant diversity and high demand. Some farmers are producing two crops per year and the quantity of honey produced is steadily increasing. However, Lebanon still import about 60% of its consumption of honey.

1.3.4. Threats to the agrobiodiversity in Lebanon

Major threats to agrobiodiversity include:

1. The chaotic expansion of urban areas into the agricultural lands and forests without any consideration to land zoning and land use planning. Large areas of field crops, subtropical fruits, olives and many other land varieties are gradually disappearing (loss of 20 000 ha of arable land during the last decade)

2. The introduction and adoption of exotic breeds and varieties to replace the local genetic resources that are well adapted to the Lebanese environment.

3. Other threats to agricultural biodiversity come from environmental degradation such as solid and industrial wastes, water pollution, abusive and misuse of agrochemicals, overgrazing of native pastures and natural hazards.

Table 9. Yield of various forms of harvesting of agrobiological production in Lebanon 1994.

Agriculture	Area (ha)	Quantity (tons)	Value (millions US $)
Plant Products			
Field crops	39824	480680	84.92
Fruit trees	126820	1427736	594.45
Vegetables	69003	1298557	363
Total	235647	3206973	**1,042.37**
Animal Products			
Milk			
cow		159877	65.17
sheep		25147	10.79
goat		28914	14.24
Total		213938	90.20
Meat			
beef		7187	8.9
cows		4781	7.9
sheep		2413	4.5
goat		3884	4.5
pork		2782	3.6
chicken		1694	1.8
broilers		41111	50.5
Total		63852	81.7
Eggs		455548	20.95
Honey		609	14.25
Total		456157	35.2
Grand Total			**1,249.47**

1.4. Forestry biodiversity

1.4.1. General Background

Despite its small land size, Lebanon is one of the most famous countries in the middle east with its natural forests. There are various forests with different trees species in Lebanon such as; the "God's Cedars" of Bsharre, Barouk forest, and Qammouaa forest. The most famous species that of significant woodland shares are: Cedars (Cedrus Sp.), Pines (Pinus Sp.), and Firs (Abies Sp.). In addition, the Lebanese forests contain diversified species of aromatic, wild, and medicinal plants. This diversified ecosystem was severely neglected , along with other natural resources during the period of the Lebanese civil war. After the war time, little attention was paid to stop thė damages and restore the forests to their pre-war status.

Given the available data, some studies revealed that the total woodland in Lebanon was decreased by 12.5% during the years of 1968 to 1989. The total woodland in Lebanon in 1968 amounted to 80,000 hectares. This amount represented 8% of the total area of Lebanon. A study conducted by FAO (1989) indicated that the woodland area has decreased to 70,000 ha, a reduction of 10,000 ha over the 21 years. With respect to the major tree species, a reduction of 10%, 12%, and 12% occurred in the areas of Cedars, Pines, and Firs, respectively

(FAO, 1989). The reduction in the forest areas was basically due to the following reasons; unchecked tree cuttings, fires, unlawful grazing and overgrazing, and expansion in mountain urbanization. These factors will be discussed later under threats to forestry biodiversity.

1.4.2. Subsistence

Illegal picking and removal of aromatic and medicinal plants besides the unlawful grazing in the woodland area are the two major components of subsistence in forestry resources. With respect to the removal and picking of aromatic and medicinal plants, some sources in the Ministry of Agriculture estimated the losses in the market value to be around US $12.5 millions. This figure is almost four times the value of the officially exported aromatic and medicinal plants in 1994 (US $3.1 millions). In addition illegal wood cutting represents another source of forestry subsistence. However pertinent data are lacking.

It is estimated that 90 percent of the mountain residents are obtaining their needs of these plants directly from public forests, free of charge. The excessive use and abuse of these plants undoubtfully will have its impact on the sustainability of such species. Bearing in mind that some of them are endemic to Lebanon, the losses becomes even greater. In an attempt to mitigate this problem, the Lebanese MOA has issued two new laws related to aromatic and medicinal plants, in February 1996. The first one forbids the illegal picking and removal of these plants, while the second forbids their exportation.

With respect to unlawful grazing and overgrazing, the available data indicate that almost 4000 farmers use woodland for their sheep and goat grazing. It is estimated that 200,000 heads are grazing on the woodland for two months every year. In some areas, shepherds pay fee for the right to graze on the woodland. The number of the small ruminant flocks for which fees were paid constitute around 40% (almost 80,000 heads) of the total number of the grazing flocks. These flocks utilize about 2,000 hectares during the two month grazing season and generate approximately US $25,000 of revenues. The rest of the shepherds pay no fees for grazing for the 120,000 heads.

Using the above information the subsistence value of grazing (the unpaid ones) can be roughly estimated in proportion to the paid ones. Therefore, the unpaid grazing flocks (120,000 heads) may use 3,000 hectares for grazing and their estimated private value is about US $37,500. It worth-mentioning that the previous estimated value can be considered as the private benefits for the farmers, which is equivalent to the market paid value of grazing. Since farmers do not pay any grazing costs, thus it is considered as losses in the government's revenue. The social costs of subsistence grazing differ and is believed to be higher than the private costs, once the opportunity costs of the different plants that are used for grazing are considered. The potential discrepancies of the two values underscore the need for further detailed studies for the subsistence activities in the Lebanese forests.

1.4.3. Recreation

Sporhunting and park visits are the major related activities to forestry in Lebanon and were included in this study. Concerning sporthunting, data about the number of issued licenses and license revenues were collected and presented next. Data about park visits and forest protection were completely unavailable therefore; a study case was developed (Darwish et al.) and implemented for the only protected national park in Lebanon.

Sporhunting

Detailed data about the wild hunting was not available. However, some figures were estimated by gathering data from some unpublished reports, personal interviews, and newspaper reports. According to the documents of the Lebanese National Council for Wild Hunting (NCWH) 17,000 licenses were issued in 1993. The license fee was set at US $31.25 per year. Therefore, the total license revenue in 1993 was US $531,250. Table 10, represents the revenues obtained from the license fees for the period of 1991-1993. The table figures indicate a continuous increase in the number of hunters and thus in the total revenues. One explanation for the continuous increase of the number of hunters may be due to the increasing stability in Lebanon.

Currently, there are no law enforcement or forest guards to check and monitor the illegal hunting activities, in terms of permissible quantities and types of the hunted animals and birds. In the absence of any law enforcement and hunting regulations, the occurrence of illegal hunting activities usually increase and consequently affect the natural balance of wildlife habitats and ecosystems. That in turn may provide a direct threat to the biodiversity of the wildlife habitats.

Table 10. Total revenues of the issued license for wild hunting in Lebanon, in US $ (1991-1993).

Year	Number of issued license	License fee	Total revenues	Incremental change (%)
1991	6,000	54	323,196	0
1992	16,000	29	467,060	62.5
1993	17,000	29	488,119	5.9

According to the director of NCWH there was 1000 licenses issued in 1974. In the same year, the government hired 11 guards to control the illegal hunting in cooperation with the internal security forces. The result was that in one week period, the number of licenses increased to 15,000. This figure indicate that at least 14,000 hunters were practicing illegal hunting during that week only. Enforcement of hunting regulation will reduce potential degradation to wildlife habitats by limiting the hunters to the allowable types and quantities of the different game species. In addition, such enforcement would be additional source of revenues to the government through the newly issued licenses and fines. These revenues may be reallocated to forest to enhance the services engaged with the protection and management of the forest including hunting. Also, it could be used to breed and release to wilderness new quantities of animals and birds to compensate for the lost quantities due to hunting.

Prior to 1994, the NCWH used to finance its activities through the revenues obtained from the license fees. In 1994, the responsibility of issuing hunting licenses and collecting their revenues was transferred to the Ministry of Interior. Since then, the NCWH started to receive a budget from the country treasury amounting to annually US $ 281,250. This annual budget is the only source of funds available to the NCWH. The budget share allocated to breeding and releasing birds by the council amounts to US $75,000. This share represents 27% of the total funds allocated to the NCWH. The rest of the budget share is used for salaries and administrative costs. Since 1992, the council has succeeded in the breeding and releasing of 30,000 birds, of which 10,000 were partridges and 16,000 were pheasants. Due to the absence

of the inadequate monitoring system, data concerning the types and quantities of the hunted wildlife habitats were not available, and therefore their direct market values could not be estimated.

The Study Case of Bsharre Forest

History and Significant of the Forest

The Forest of "Cedars' of God" of Bsharre represents an interesting case due to a number of reasons. First, it is believed by the local citizens that the forest is the origin of all cedars that spread from mount Taurus to North Africa. Secondly, the cedar tree is considered as a national symbol of heritage represented in the flag and the money. In addition, the Forest of "Cedars of God" has a tremendous spiritual and mythological values. For the Christians, this forest and the mountain where it is located represents the place where God revealed himself to man, that is why it is called "Cedars of God". All of the above factors indicate the importance of this forest to the Lebanese society.

This forest was announced as a protected area in 1920 and is presently the only functioning protected area in Lebanon. A fence was established around the forest shortly after 1920. The fence was 3,220 meters long. But for more than half a century the forest was severely neglected. Some parts of the fence were demolished facilitating the access of goats and wood cutters into the forest. Illegal hunting activities and frequent fire events due to the people's carelessness took place during the same period. All the previous factors plus the absence of forest guards have turned the forest into a small vanishing green spot. The ecosystems of the forestry were severely damage and the trouble years in Lebanon along with negligence of the forest by the local authorities and the media have intensified the severity of the problem.

The rehabilitation of the forest

In 1985, a serious attempt by one NGOs (The Friends of the Cedars' Forest of Bsharre) was made to restore and protect the forest. Two five-year plans were designed and successfully implemented. The first five-year plan (1985-90) objectives were;

1) to protect the forest,
2) to care about the forest's health,
3) To make the forest an eco-museum, and
4) to build international awareness and cooperation with other forestry associations.

The first plan took some rigid measures to restore the forest such as, prohibiting the public to visit and hunt in the forest during the rehabilitation phase (5 years). In addition to that, an educational campaign through the media was made to educate the public about the forest importance. The public behavior was positive. Therefore the first plan did achieve 95% of its objectives. The second plan (1990-95) carried out to elaborate on and further reinforce the objectives of the first plan. In the second plan the public was permitted to visit the forest.

The forest of Cedars' of God occupies an area of 11 ha and is surrounded by a fence of 3050 meters. In 1575, the number of cedars trees in the forest was 26 trees (more than 1000 years old). In 1994, the forest contained 376 cedar trees with some over 1000 years old. In addition, there were 1,645 cedar trees that were less than 100 to 200 years old. Thus, the total

number of tree as of 1994 was 2,021 cedar trees. The above information indicate how precious is this forest considering the natural heritage of Lebanon.

The park management imposed an entry fee for 1993 and 1994. Three levels of entry fees were applied in 1993; US $0.15, US $0.3 and US $0.625, and the number of visitors of each categories were 2,000, 10,800, 28,303 visitors, respectively. The total number of visitors was 41,103 and the total entry fee revenue was US $21,377. In addition, approximately another 20,000 visitors did not pay either because they were from the area or used Illegal entrance. Therefore, the total number of visitors to the forest was approximately 62,000 individuals. In 1994, the entry fees were modified to; US $0.15, US $0.46, and US $0.93. Data about the visitors numbers by fee category were not available, but the total revenue of the entry fees amounted to US $29,656. The total number of the charged visitors have increased to 57,000 visitors. However, in 1995, the entry fees were canceled due to some religious and political considerations.

Table 11 presents the major items of the forest's revenues and costs for the years 1993, 1994, and 1995. The table shows a continuous increase in the forest's net revenues. The net revenues have increased by 580% from 1993 to 1994, and 307% from 94 to 95. Even though, the entry fees were canceled in 1995, the losses in revenues were overwhelmed by a significant increase in the donations both on the domestic and international levels. The magnitude of the donations' increase is a significant indicator for the increase in the public awareness concerning forest protection and preservation. The international donations to this forest were basically from "Agence des Espaces Verts de la région de l'Ile-de- France" a French Public Agency. This organization has started to allocate money for improvement and preservation of Bsharre's forest, since 1994. However, the amount donated for the year 1994 US $28150.2 and for 1995 US $23206.25 appears in the year 1995 since it was delivered in the latter year.

Table 11. Revenues and Costs of the Forest, from 1993-1994, in US $.

Item	1993	1994	1995
I- Revenues			
Entry Fees	19,641	28,248	NA
Donations:			
Domestic	685	296	14,742
International	0.0	0.0	58,038(3)
Others(1)	13,392	10,910	19,675
Total Revenue	**33,718**	**39,454**	**92,455**
II- Costs			
Forest Improvement Costs	2,978	6,927	8,329
Others(2)	28,842	19,595	31,536
Total costs	**31,820**	**26,522**	**39,865**
III- Net Revenue	**1898**	**12,932**	**52,590**

(1) Wood sales prior to 1995, previous balance and interests
(2) Guards, administrative costs, advertisement.
(3) Out of which US $33,177.753 were allocated in 1994, but were received in 1995.

The direct market value (the use value of the forest) was estimated for 1993 and 1994 by entry fees and wood sales generated revenues. A secondary revenue was the volume of sales for the forest advertised booklets. For 1993, the fees revenues were US $19639.6 and the wood sales revenues were US $6949.5 totaling US $26589.1. The revenue generated from the sales of the forest booklets was US $3905, which can be considered as secondary revenue due to the forest existence. Therefore, the total market value of the primary and secondary revenues generated from the forest activities in 1993 were US $30,517. For 1994, the total revenues were; US $28278.2 from entry fees, US $4941.25 from wood sales, and US $3691 from booklet sales amounting to US $36910.5.

In 1995, the fees were canceled and wood sales were prohibited, therefore only gate entry donation may represents market revenues generated from the use of the forest. This amount was US $14750. However, for the direct market value of the forest's stock from wood and natural flora and fauna was difficult to be assigned due to the uniqueness of this forest. For example, how and what value should be assigned on a 1,000 years old cedar tree. Since the fees were canceled and in an attempt to measure the willingness to pay of the public to visit and preserve the forest, a limited study was conducted for this purpose. The approach and the results of this study are presented next.

The study method and results

In this study a survey was conducted for a limited sample of the park visitors. The major objective of this study was to estimate the willingness to pay of the visitors to preserve and protect the forest. A secondary objective was to obtain a sense about the visitors perception for preserving and protecting other similar areas in Lebanon. Due to the lack of time and limited financial resources, the sample size was only 87 visitors. Despite the fact that the sample size was limited, the willingness to pay estimated, in this study, can be considered as an indicator of public willingness to preserve and protect the forest (non-use value). Moreover, the estimated figures were in line with the estimated willingness to pay for similar cases outside Lebanon.

The results revealed that the Lebanese public supports the preservation and protection not only of Bsharre's forest but also of many other natural areas related to biodiversity in Lebanon. This simple study validates the necessity and the importance of comprehensive and detailed studies to measure more adequately private and social costs and benefits of the existing forests, pending financial availability.

Since the entry fee to the forest was canceled and replaced by donation boxes which were at the entry gates, the average donation calculated was about US $1.6 per person donated by 68% of the surveyed sample, while 32% did not offer any donation. The traveling distance to the park varied from 4 km to 200 with average of 120 km. The average traveling costs were estimated to be US $24. The results also revealed that 71% of the sample were frequent visitors, and 29% were first timers. For the regular visitors, the average number of visits per year was 2 visits. Almost 32% of the visitors indicated that the rare tree species of the forest was the main reason for their visit. Others stated that the beautiful sceneries was main the reason (34%), the rest indicated that calm and nature were the main reasons for their visit. Almost 93% indicated that they would like to see other protected areas established in Lebanon. Some of the individuals mentioned specific places that are threatened and needed to be protected to maintain the ecosystems sound and preserved. To mention a few, the Palm

Tree island, Hermel area, Barrouk area, and Naher Ibrahim.

The willingness to pay was estimated from the sample to measure the public willingness to maintain, preserve, and protect the forest. Therefore, the estimated value is the "non-use" value that includes option, existence, and conservation values. The average willingness to pay for the park visitors was US $7.5 per visit to maintain, preserve, and protect the Bsharre's forest. It is believed that this number is not overestimated. Since about 50,000 visitors, in average, visit the park annually, the expected revenues from the fees entry alone could reach US $375,000, if an entry fee were to be applied at the estimated willingness to pay value. This revenue could be used for protection of the forest's ecosystems.

The climatic variability in Lebanon has lead to a rich biodiversity in the Lebanese wild vegetation which includes medicinal and aromatic plants. The various climates permitted the growth of a wide range of plants. However, these important natural resources are either neglected or abused.

They are neglected since little effort has been made towards the study of the importance of these resources in terms of uses, extraction rates and preservation. The studies that have been done until now focused on the plants identification. These studies are important but remain incomplete if they are not supplemented by a scientific and economic study defining the extraction rates and means of preservation of these plants. This would help the decision makers to define accurately the policies concerning the use and preservation of these resources.

The most important remarks concerning the customs reports are:

- The names of the plants are sometimes ambiguous and the quantities traded are not specified by type of plants. This makes the analysis of the figures imprecise and not very relevant for the evaluation. Also, these global reports do not show the importance of each type which makes it unfeasible to estimate future demands of each plants as well as the classification according to economic importance.

- One term of trade states that plants or their parts, fruits or seeds are used in perfumes, in medicine and in controlling pests, fresh or dried, cut or broken or smashed. This would mislead us to the actual quantities traded.

- The exportation value of these plants reached US $2,297,028.7 in 1993 and US $2,976,651.1 in 1994, and US $1,125,000 during the first six months of 1995. These numbers cannot be considered as indicators for the quantities and values of the yearly production of these plants because an important quantity is used by the Lebanese people themselves and this quantity is not defined.

- The importation value is increasing year after year. In 1993 it was US $6,144,552 and became US $9,521,711.68 in 1994 and US $5,500,000 during the first half of 1995. So the import/export ratio is increasing instead of decreasing or at least being stable. As a matter of fact, this ratio was 2.7 in 1993, became 2.9 in 1994 and increased to 4.7 during the first half of 1995. However this ratio is better compared to

that of agricultural products which reached 5.2 in 1994. The increase in this ratio justifies the interest in identifying the plants types and specifications in order to determine the part of the quantities imported that can be produced locally.

- The exported part of these plants should be analyzed to know how this plant can be improved and optimally used. The processing of these plants is very important because it will prevent the exportation of raw material and the importation of this same material as concentrates or other processed form. The processing can also create new job opportunities in the country,. Needless to say that this would also improve the gross national product (GNP).

A suggested study concerning the economic evaluation of the medicinal and aromatic plants potentials in Lebanon would determine the renewable quantities of medicinal and aromatic plants which can be harvested annually without affecting the natural balance, the growth and the sustainability of these plants. In addition, a map would be created showing the geographical distribution of these plants, their density, dates of harvesting and monitoring.

The specific objectives of the study will determine:
- the existing plants in Lebanon
- the quantities that can be extracted each year from each type of plant
- the consumed quantities and the future demand
- the imported quantities
- the exported quantities
- the types that are imported to be used in perfumes industry in order to know if these uantities can be supplied partly or totally from the local sources
- the value of the imported plants
- the value of the exported plants

The methodology to achieve the above is by a survey using a questionnaire that includes all of the above mentioned components.The outcome of the study would be some recommendations concerning how to exploit these resources, the control which includes issuing of a license and monitoring.

1.4.5. Commercial use of forests

The commercial use of Lebanese forests as assessed based upon the following available components: Timber and fuelwood production, honey bees production and pine production.

Timber and fuelwood production

The only available data for the domestic timber production and the associated market values were for the year 1994. These values are summarized in the Table 12.

Table 12. Market values for domestic timber products in Lebanon, in US $ for 1994.

Item	Total Production (Tons)	Total Market Value ($ US)
Charcoal	1,535	455,000
Industrial Wood	147,344	62,200,000
Worked wood	68,419	45,727,000

Source: Chambre de Commerce, Unpublished report

For a country so poor in raw material and with such a small internal market, Lebanon possesses a surprisingly developed wood industry. In 1994 there were about 1,734 industrial establishments related to forestry production. They range from wood products to hard and soft papers. Table 13 shows the newly created industrial establishments and the related activities to forestry production (in addition to the 1,724 already existing ones) in 1995.

Table 13. Newly created industrial establishments related to forestry and their production activities in Lebanon in 1995.

Item	No. of firms	No. of workers	Capital (US $)
Wood products	80	508	10,580,000
Papers	14	162	5,937,500

The total value for wood exportation in 1995 was US $2,674,375. From January to March 1996, 26 new enterprises were created with around 126 employees, a total of US $3,961,875 and a total value of exportation US $318,750.

Honey Bees' Production

A one time questionnaire was developed for the bees' producers in the Bsharre region.

This region contains around 6 honey bees' producers and the honey bees' production is used both for market and self purposes. These producers do not receive any government support, however they receive donations from an NGO (Caritas) which amounts to US $ 2000 per producer per year. The amount of honey sold per year is 7000 kg and the total revenue generated from wax and honey is US $105,000 in addition to 10 kg per producer for self use. It is believed that this revenue would be more or less the same if the beehives were established somewhere else like around fields or gardens. The total number of beehives in the region was 350 and the cost of one beehive is US $100.

Domestic varieties of bees are used for honey production. These varieties should be preserved because they are very well adapted to the Lebanese environment and yield a good production. Some Italian varieties have been experimented but the results were negative. In Bsharre region there is only a summer production of honey and the major source of food for the bees are the wild flowers. During the winter season the beehives are transported to lower elevations in Koura and Zghorta districts. The quality of the honey is positively affected by the abundance of dew. The value of the total honey production in Lebanon in 1995 was estimated at US $14.25 millions (See Table 9).

The importance of the pine stone tree (Pinus pinea) is due to its edible fruit which is consumed in great quantities in Lebanon. It is also an important forestry species in Lebanon especially in sandloam soil. Its wood has many uses especially in carpentry and in fuelwood. In addition the pine tree protects the soil from erosion and degradation.

According to the Green Plan statistics, pine stone covered 8,000 ha in the sixties. Currently this surface is reduced due to the absence of maintenance, the urbanization, the overgrazing, the anarchic cuttings and the fire events. The newly planted areas of pine trees each year, do not compensate the area that is being degraded.

In 1994, an unpublished M.S. thesis revealed that in Lebanon one pine tree produces 40 kgs of cones which give 20% of stone i.e. 8 kg. Out of these 8 kg,20% is edible which equals to 1,6 kg. In the Lebanese pine plantation there are 300 trees per hectare. One hectare of pine trees gives 480 kgs of edible fruit. However, if the pine plantation is well maintained, the production of one hectare of pine could reach 1200 kgs of edible fruit.

In addition the Lebanese fruit in the market is more expensive than the imported one. Its price is between US $ 19 to 26 per kg with an average of US $22.5 per kg which makes the total value US $58,320,000 (5,400 ha with an average of 480 kg/ha).

Based on data availability, Table 14 represents a summary for all the forests production components in Lebanon. The estimated valued were for 1993 or 1994.

Table 14. Summary of the market value of forestry production in Lebanon for 1993 or 1994.

Item	Estimated Market Value (US $1000)	Year
I. Subsistence		
Aromatic & medicinal plants	12,500	1994
Grazing	27.5	1994
II. Recreation		
Sporthunting	531.25	1993
Park visit	29.66	1993
III. Commercial		
Timber and fuelwood	108,382	1994
Grazing	25	1994
Aromatic & medicinal plants	6,1000	1994
Honey	14, 250	1994
Pine fruit	58,320	1994

1.4.6. Threats to biodiversity in the Lebanese forests

There are several factors that can provide major threats to biodiversity of the Lebanese forest. Each one may disturb the ecosystem of the forest and thus destroy, reduce, and deteriorate the existence of the biodiversity in the forests. Some of these threats are listed below.

1. Urban expansion in the mountain areas provides a real threat to the Lebanese forest. Unchecked expansion is not only destroying the trees but also disturbing the ecological system of the areas (plants, animals, birds, etc.).
2. Illegal wood cuttings by local population.
3. Illegal removal and picking of the aromatic, wild, and medicinal plant is another threat that disturbs the ecosystem of the forest.
4. Overgrazing and illegal grazing.
5. Poor management and harvesting policies of the forests.
6. Forest fires due to the public carelessness.

1.5. Marine and fresh water biodiversity

1.5.1. Introduction

Lebanon contains a significant proportion of seashores that extend, from north to south, along 220 kilometers. One might expect, in the presence of such large accessibility to marine water, a well developed fishery industry. However, the fishery industry does not perform as such, given its insignificant contribution to the country's economy. The Lebanese market can bear up to 25,000 tons with an average market value of US $50 millions (Boulos, 1994). But at most 2,500 tons were provided domestically with an average market value of US $5 millions, in 1992 (Boulos, 1994). In other words, the local fishing industry provides only 10% of the local market capacity. The contribution of domestic fish value to the total GDP (US $5.931 billions) in 1992 was 0.084%. Given the vast water areas (marine and fresh water) which are available to Lebanon, it is believed that such a figure underscores the current poor status of the fishery industry.

In 1992, the total number of professional fishermen in Lebanon were 4000 individuals, out of which 2,000 were part-timers. These 4,000 fishermen financially supported about 16,000 persons. Another 2000 individuals worked in related fishing industries (boat repairs and buildings, nets repairs, etc.) and supported approximately 8,000 persons. The 30,000 persons who are living only on the earned income from fishing represent 0.8 % of the total Lebanese population (3.7 millions). This low percentage indicates the current limited capacity of this industry. Table 15 represents the numbers of fishermen and boats distributions at the main Lebanese ports in 1992.

Table 15. Number of fishermen and boats by ports (1992).

Port	Number of fishermen	Number of boats
Tyre (Sour)	750	127
Sidon	850	128
Beirut	550	216
Jounieh	350	94
Jbeil	250	91
Tripoli	850	260
Total	**4,000**	**1,001**

Source: Boulos, 1994.

The total number of fishermen in 1995 reached 4,000 full timers in addition to the 2,000 part timers. The number of boats has also increased to 1,981 boats. It was estimated that the annual average income of a fisherman in Lebanon reaches US $750. This average is about 50% of the average Lebanese income for 1995 which was US $1,500. Again that reflects the poor status of the Lebanese fishermen and thus might shed the light on the insignificant number that are working in this industry. Even with this doubling in the number of fishermen and consequently their dependents, the total number still represents 1.6% of the total population. Job unavailability in cities was among the main reasons that were mentioned by the fishermen explaining why their number has increased despite their hard living conditions.

Statistical data concerning the numbers of boats, fishermen, catchment species, and volumes were hardly available. However, data concerning economic assessment and evaluation for marine biodiversity were totally unavailable. Therefore, in an attempt to fill in this gap, a limited survey was conducted within the framework of this study (Darwish et al., unpublished data). The objectives of this study were; 1) to identify the threats to marine biodiversity, and 2) to estimate the fishermen (professional and recreational) willingness to pay to clean up sea-shores and preserve the marine biodiversity. The results will be discussed in the section V5.

[illegible]

According to the director of the fishery department at MOA, almost 10,000 individuals are practicing sportfishing. However, only 4,000 licenses were issued in 1995. These 4,000 fishermen will be dealt with in the recreational part. The remaining 6,000 individuals were considered in this study to be subsistence fishermen. Based on figures concerning; numbers of fishing trip per individual (72 trips per year), the catchment volume (1.5 kg/trip), and fish average price (US $10), the market value of subsistence fisheries and the catchment amount was roughly estimated. The volume that was caught by the subsistence fishermen was approximately 648 tons with a market value of about US $6.48 millions. These estimated values may not accurately represent the volume and the monetary values of the catchment's species, because of the variability in the amount and price of the species that were caught. In the absence of such detailed information, the estimated figure may help only in recognizing the levels of catchment and its value for the harvested yield for subsistence. In the case study an estimation of the cost of fishing per individual was estimated for the interviewed sample.

I.5.3. Recreation (Sportfishing)

In 1995, 4,000 licenses for surface fishing and 650 licenses for subsurface fishing were issued in Lebanon. The license fees were; US $1.25 for the former and US $3.75 for the latter. Therefore, the total revenue from sportfishing as a recreational activity in 1995 reached US $7,438.

I.5.4. Commercial fishing production

Data concerning the fishing amounts and the total market values for 1995, were collected through personal interview with official from MOA, and are presented in Table 16.

Table 16. Quantities and market values of domestic commercial fish caught in Lebanon in 1995.

Fish types	Quantities (met.ton)	Total Market Value[1] (US $ millions)
Marine water		
I- Non-exotic		
Sardin	1,000	5
Palmida	1,000	5
Others	1,000	5
Sub-total	**3,000**	**15**
II- Exotic		
Mullets	200	3
Sea Breams	400	6
Sea Daces	200	3
Other	200	3
Sub-total	**1,000**	**15**
Total	**4,000**	**30**
Fresh water		
Trout[2]	300	2.1
Grand Total	**4,300**	**32.1**

(1) Average prices were estimated as; US $5/kg for the non-exotic species, and $15/kg for the exotic ones.
(2) The only species that is produced on a commercial scale in fresh water ($7/kg)

The estimated market value of the total harvested fish species for 1995 was about US $32.1 as indicated in Table 16. Therefore, the figure of 1992 was largely underestimated. Nonetheless, the estimated value of 1995 still represents only 0.46 % of the Lebanese GDP (US $7 billions).

The table also indicates an increase in the catchment volume as compared to 1992. This increment represents 37.5% increase in the catchment volume. Since the number of fishermen was almost doubled, this might indicate a reduction in the average volume per fisherman. Personal interviews with the fishermen support the above fact. That in turn implies

that overharvesting of marine biodiversity is taking place. Other reasons that endanger marine biodiversity will be discussed under threats to biodiversity.

Table 17, summarizes the different values of the marine and fresh water biodiversity that were harvested in 1995. From the table, the direct and indirect values of marine production were US $38.6 millions. The fresh water value amounted to only US $2.1 millions.

Table 17. Market value of different components of marine and fresh water productions in Lebanon, 1995.

Item	Estimated Market value (US $)
I- Marine Biodiversity	
Subsistence	6,480,000
Recreational	7,438
Commercial	32,100,000
Total	38,587,438
II- Fresh water Biodiversity	
Commercial	2,100,000
Grand Total	40,687,438

In the complete absence of economics data concerning marine biodiversity, this limited study was conducted to identify potential threats to biodiversity from the public prospective and to estimate their willingness to pay to clean up seashores and to protect marine biodiversity. Two samples were selected and surveyed. The first surveyed sample includes sportfishermen while the second was for professional fishermen. In addition, three interviews with the fishery syndicates' representatives were conducted to fulfill the above mentioned objectives. Due to time and financial limitations, the sample's number was restricted to 38 sportfishermen and 63 professional fishermen, in addition to the three syndicate representatives.

In the previous section the use values (i.e., the value that people place on being able to physically use the species) have been estimated for subsistence, recreation, and commercial uses. The consumptive use value of the product, market prices, and marginal production costs can be used as a basis to calculate the use values. This was the case in the previous sections. However, it should be mentioned that, the estimated use value in this study did not go to an individual species details because of data unavailability. These values were calculated as a lump sum values of the different species.

The Willingness to Pay

The estimation of the willingness to pay to preserve and conserve marine biodiversity is one approach to estimate the non-use value of a certain species or resource. The non-use value is defined as; the value that an individual will place on having opportunity to use the species at some point in the future (option value); or the value that an individual will place on knowing that the species still exist (existence value), or the value placed to pass this species on

to the future generations (conservation value). However, one of the difficulties in estimating the willingness to pay for these mentioned values is in how and what should be asked to an individual and the extend to which the public are informed about the threat to a certain species.

Due to the limited sample, the willingness to pay estimated in this report may only represent the level and the direction of the people willingness to preserve and conserve marine biodiversity, in general and not for a specific species. Therefore, the estimated values can be considered to be representative of the three components of the non-use value. Further studies are needed to explicitly calculate the non-use values for selected or threatened species.

Sportfishing

In this study, a questionnaire was developed and a sample of 38 sportfishermen were randomly selected and interviewed. These sportfishermen were interviewed in five different fishing locations. The data were analyzed and briefly discussed next.

The results indicate that 13% of interviewed persons earn less than US $300 per month, while 34% earn between US $300 and US $500, and 53% earn more than US $500 per month. In addition 68% of the individual stated that the current licence fee US $1.25 is cheap and should be raised. It was estimated that the average annual costs per individual for fishing material was about US $55. The annual average catchment per individual was around 75.6 kg, with a market value of approximately US $756. Therefore, the average net value amounted to US $701.

With regard to whether the fishermen are currently catching the same amount, 52.7% of the sample stated that they used to catch more amount during the last 10 years. That in turn indicates a threats to marine biodiversity, especially when about 55% indicated a decrease or a disappearance of some species used to be caught in the past. In contrast, 36% stated that they are catching a similar amount to the past. However, 90% of those who stated no change used to fish in the north where the pollution problem are less or minimal.

Estimating the willingness to pay for sportfishermen to clean up seashores and preserve marine biodiversity was another objective for the study. The results indicate that 69% are willing to pay more that US $18.75, while 16% were willing to pay US $6.25, while 15% are willing to pay between US $9.4 and US $15.625. This willingness to pay was conditioned by the fact that the seashore will be cleaned up and all threats to biodiversity will be eliminated (more detailed in the threats section). The estimated value indicate the public awareness about the problem and the need to preserve the marine biodiversity.

Professional fishing

The sample size included 63 fishermen. The results indicate that 75% of sample were full timers, while the rest are part-timers. The average monthly income was estimated to be around US $680 for full timers and $565 for part-timers. This results contradict with the estimated annual income of fishermen stated earlier. The licence fee ranges between US $18.75 and US $12.5 depending on the boat size, with an average US $82. Out of the fee US $6.25 go to MOA and the rest goes to the port authority. Asking about the fishermen perception about the license costs; 57.3% indicated that the licence fee is fair while 34% said that it is expensive. Since 4,000 fishermen exist, and given the average license fee, it was estimated that MOA collects around US $25,000 of this revenues, while US $302,500 go to the port authorities.

The willingness to pay for professional fishermen was US $150 per year as an average. It should be mentioned that 33.3 % indicated the unwillingness to pay to clean, preserve, and conserve the marine biodiversity, claiming that this is the job of the government. The study also revealed that the part timers has tendency to pay more that full timers to protect the biodiversity. The results showed that; 33% are willing to pay US $31.25, 26% willing to pay more than US $93.75, the rest 41% are willing to pay between US $62.5 and US $93.75. About the way to collect this increment; 49% would like to pay it as an increase in the annual licence fee, while 51% would rather pay it as a percentage from their daily, monthly or seasonal catchment. The fishermen indicated that their average fish yield has been reduced by 26% during the last 10 years. Overharvesting was the major fact mentioned by fishermen to cause such a reduction.

The era of the war resulted in the overall degradation of many natural and biological resources. Seashores and marine biodiversity were among the ones that were affected significantly. The questionnaires conducted with the fishermen and the officials pointed out the following factors as being the major sources of threats to biodiversity:

1. Waste water dumping into the sea which is practiced all over the Lebanese coastal zone.

2. Garbage dumping into the sea, especially of plastic components which cause severe damage to the fishermen' nets and boats' engines and also increase the death rate of the small fish and fish seeds.

3. Sand dumping into and sand removal from the sea, also increase the losses in the water organisms and their habitats.

4. Spilling of fuel into the sea which cause severe damage to marine organisms.

5. Many construction and industrial factories dump their wastes directly into the sea without any treatment, which cause the death of many fish species.

6. Some water sport activities like water skating and speed boating provide another threat especially that some of them do not respect the law of staying away from the shore by 500 m. This was one of the main complain by fishermen in Beirut and Beirut vicinities.

7. Finally, but most importantly, in the absence of law enforcement many people used to fish with dynamite thus causing severe damage to many species.

The vicious civil war that took place in Lebanon over a period of 17 years, has affected the biodiverity of the biological resources of the country in two ways. First, the data availability about the stock and conditions of the ecosystem components became out dated and need to be updated. Secondly, many of the natural and biological resources have been misused and or abused during the war time. That in turn affected the biodiversity of these resources and ecosystems in the absence of studies concerning the willingness to pay. Limited studies to estimate the willingness to pay to preserve the biodiversity of some biological resources (i.e., forestry and marine biodiversity) were conducted. Despite the fact that these studies are not complete and not comprehensive, the results may shed the light about the public perception to preserve and protect the biodiversity of this system. More comprehensive economic assessment should be conducted to provide significant and reliable numbers to the decision makers along which a sound and prioritized plan could be developed and implemented to preserve and protect the biodiversity of the different ecosystems that exist in Lebanon.

As it has been mentioned through out this report, government policies can play a crucial role in preserving and sustaining the biodiversity of the ecosystems that exist in Lebanon. Faced with a limited budget and a daring plan to reconstruct most of the basic infrastructure in Lebanon, the government financial support is expected to be little.

However, regulation or economic incentives and disincentives could be used as a tool to preserve and sustain the environment of the different ecosystems. For example, enforcing the hunting regulations and hiring park and forest rangers to assist in applying the law could help in bringing in revenues that may be directly reallocated to maintain and preserve the forest and its biological habitats. This revenue can be obtained from the licences fees and imposing from fines on the illegal hunting (i.e., hunters who do not carry licences or violate the regulations). The same could be said about aromatic and medicinal plants. Issuing laws prohibiting their picking and/or exportation should be coupled with law enforcement to apply the laws.

Additional funds should be brought in on the national and international levels. Government and Lebanese NGO's can launch campaigns to inform the Lebanese public and the international forum about the necessity to preserve and maintain the biodiversity of the different ecosystems, especially for the highly threatened species. Lebanon has some endemic species that the rest of the world should be interested in their preservation and protection. Therefore, the willingness to pay by the rest of the world to preserve such species should be underscored through out the government and private campaigns.

In order to formulate the appropriate plan and to set up priorities for what should be preserved and protected first, comprehensive economic assessment and valuations for the selected species should be done. This requires financial assistance from international parties and organizations that are concerned with environmental and biodiversity issues.

1.6.2. Future needs

Three basic areas should be emphasized in order to have a sound and reliable information about the biodiversity in Lebanon. These areas are:

1. The need to update the data concerning the biodiversity in Lebanon. This area should be given the first priority since most of the studies about biodiversity in Lebanon could be traced to the early 1970's. Therefore, updating the data through surveys or research studies is an inevitable step towards a sound policy concerning biodiversity.

2. The need to establish data banks for all the gathered information so that the policy makers can have a complete picture about the different status of the stock and conditions of the biodiversity. In addition, this could allow the updating in data management which facilitates the monitoring and the preservation of the biological resources.

3. The need for a comprehensive economic valuation and assessment for the threatened species and the deteriorated resources is a must. In addition to that, cost benefit analyses for the private and social costs and benefits for the protected areas, forests and alike, is required to help the policy makers in taking the best feasible decision with respect to the preservation and protection of the biodiveristy of the different ecosystems.

1.7. References

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3. Samaha, S. Production fruitière du Pin Pignon au Liban. Mémoire pour le diplôme d'ingénieur Agronome. Université Saint-Esprit-Kaslik 1994-1995.

4. Middle Eastern Statistics, 42 edition. United Kingdom, London 1995.

This chapter considers the capabilities in Lebanon for environmental management including biodiversity management. It focuses on the roles and responsibilities of the various Ministries and organisations in Lebanon whose duties have a bearing on environmental management; and on conflicts of interests and strenghts or weaknesses or resourcing.

2.2. The institutional [illegible]

The conservation and long-lasting use of biological resources require efficient public institutions to cope with this difficult task.

2.2.1 General [illegible]

Responsibility for the management and safeguard of the biodiversity is that of the State, and in particular of the various ministries and public bodies directly or indirectly concerned.

At the legislative level

Parliamentary commission on the environment.

On 18.10.1994, the present Parliament created a special commission on the environment. The supervisory role of this commission should be impossible for the executive power to by-pass. But first of all, the members of this commission should be convinced of the importance of the environment, they should remain neutral when faced with economic pressure groups and electoral interests and they should have the means to efficiently keep watch on the environment.

At the executive level

The Ministry of the Environment.

This Ministry was created by *law no. 216 of 2.4.1993.* Its responsibilities include the conception and promotion of a general policy for the management and protection of the environment, the establishment of conditions for the treatment of sewage water and solid waste, the establishment of conditions for industries and classified establishments, the use of the coast and communal land, hunting, the protection of natural sites, the fight against pollution, the creation of nature reserves, etc.

The law establishing the Ministry of Environment (MOE) is ambiguous and fails to provide a clear basis upon which the MOE can develop its role in the Lebanon or to interact and coordinate activities and responsibilities with other relevant organisations.

The various clauses of the law overlap (eg. solid waste and waste water treatment are the subject of both paragraphs 3 and 4) while there is also confusion between the policy and executing role of the MOE.

There are also overlaps in policy formulation with other organisations (e.g. setting of environmental standards for industry) and many bodies also have executive roles in environmental management.

The Ministry of Agriculture.

This Ministry is responsible for regulating and supervising hunting, fishing, the use of insecticides and chemical fertilisers and the creation of nature reserves, etc.

Related to this Ministry are: the Green Plan, created to further land development (*Order in Council no. 13335 of 10.7.1963*), the Scientific and Agricultural Research Service (*Order in Council no. 16766 of 7.8.1975*) and technical agricultural teaching (*law no. 8/87 of 2.5.1987*). And since its creation by the Ministry of the Interior in 1973, the National Hunting Council has played a role in regulating the hunting of wild birds.

The Ministry of Agriculture is made up of the following departments: the Office of Agricultural Resources, the Service for the Protection of Plants, the Service for the Fight against Disease and for the supervision of insecticides and fertilisers, the Office for Rural Development and Natural Resources, the Forestry and Reforestation Service and, finally, the Fishing and Hunting Service (*Decree no. 5247 of 20.6.1994* established the organisation of this Ministry).

The Ministry of Municipal and Rural Affairs.

Constituted by law no. 197 of 18th February 1993, the aim of this Ministry is to oversee municipal administrations, as well as to further collaboration and coordination between them and the other ministries. The municipalities, in fact, play an essential role in the fight to protect the environment because normally it is the municipalities which have to deal with the numerous everyday problems that citizens must face. However, the ability of these municipalities to act and intervene is limited and sometimes does not even exist. There are many reasons for this and the reasons are due just as much to the lack of funds as to the lack of manpower required for major work and the almost-daily attention that is needed. Nevertheless, the municipalities have an essential role to play in the fight against pollution and the success of any policy depends in part on their ability to answer citizens' needs. [Article 49 of the law on Municipalities (*Order in Council no. 118 of 30.6.1977*) clearly states that the prerogatives of the Municipal Council include the realisation of projects in the fields of improvements, cleanliness, public health, water, road circuits, the creation of recreational areas, repairs and maintenance of sewage works and drains, etc.].

The Ministry of Hydraulic Resources.

This Ministry was created by *law no. 20/6 of 29.3.1966.* It is responsible for problems concerning water services and regulations.

The Ministry of Transport.

This Ministry was created by *law no. 214 of 2.4.1993.* It is responsible for the public maritime domain and territorial waters, as well as the fight against pollution, in particular from hydrocarbons on the coast and at sea.

The Ministry of Public Works.

This Ministry is responsible for regulations and supervision in the field of construction work and urban planning.

The Ministry of Industry and Petrol.

Created by *law no. 9/73 of 31.1.1973*, this Ministry manages and regulates problems concerning industries and classified establishments in the field of petrol and its derivatives.

The Ministry of Higher Education and Culture.

Created by *law no. 215 of 2.4.1993*, this Ministry deals with problems of antiquities and the cultural heritage.

The Council for Development and Reconstruction. (CDR)

This body replaced the Planning Ministry after the war. It deals with major projects and the infrastructure and can, consequently, influence environmental policy. External aid and assistance from international organisations often pass through the CDR which can, therefore, through its choices, encourage the adoption of continued development.

Competition between these different ministries often paralyses the application of the law; for this reason, an inter-ministerial coordination bureau should be created, or the Ministry of the Environment should become a super-ministry.

The National Council for Scientific Research (NCSR).

In 1972, this body conducted a programme of environmental research with partial financial aid from the Ford Foundation. Its main research projects today include: the condition of terrestrial fauna, avifauna, flora, the National Centre for Marine Research, seismology, the National Centre for Protection against Radiation, the National Centre for Renewable Energy, the National Centre for Teledetection, applied to the study of vegetation, ecosystems, quarries, etc.

Although the Lebanese administration is a very centralised administration, the three ministries of Agriculture, Transport and the Interior have administrative services at the level of the *caïmacamat* and the *mouhafazat.*

The local administration has the role of **supervising the application of laws**, granting hunting and fishing permits, watching over the protection of forests, the coast and water, preventing infringements on the public domain and natural resources, and leading the fight against pollution of all kinds.

Decree no. 6349 of 16.3.1961 created in each *mouhafaza* a service for forests, fishing and hunting, which delivers permits and, through its agents in each *caïmacamat,* can report infringements.

The local authorities include, in particular, the President of the Municipality, the Mayor and the Rural Policeman.

Under the law published through the *Order in Council no. 118 of 30.6.1977*, the President of the Municipality is responsible for the protection of the environment, the countryside, antiquities, trees and the fight against pollution (art. 74). In order to execute the necessary measures, he may enlist the municipal police and ask for assistance from public offices.

By virtue of the *law of 27.11.1947,* modified by the laws of *17.2.1948, 21.6.1950* and *30.12.1950,* the Mayor is responsible for passing on to the relevant authorities information on illegal felling of trees, fires and the spread of contagious diseases among plants and trees.

By virtue of the law published through the *statutory order no. 2618 of 24.7.1924* and modified by the law of *7.5.1936,* the Rural Policeman, named by the *caïmacam*, is called on to ensure the protection of forests and plantations, to prevent illegal felling, fires and illegal grazing and has the right to report infringements.

On the ground, apart from a few municipalities such as Zouk Mikhaël and Hammana, the same people have formed the local authorities for the past thirty years and have no interest in the environment, either through ignorance or because of corruption.

It is widely recognised that the public administration of Lebanon is in urgent need of reform and rehabilitation. The wars years took a heavy toll on the physical infrastructure of government, but also seriously weakened the human resources of administration. During the war years the militias governed their separate jurisdictions, taking over the role of government (including levying taxes and charges) but without taking on the responsibilities for more mundane activities like solid waste management. Death, disablement and emigration further eroded public services.

Government salaries are too small to attract professional personnel, and most ministries are dependent on a small group of people recruited on fixed term contracts at middle and senior management levels (in order to offer reasonable remuneration) and many government employees hold jobs outside the government in order to supplement their incomes. The result is understaffing and inappropriately qualified personnel.

In recognition of these profound weaknesses, institutional strengthening represents a significant component of the recovery programme. Some specific measures have already been undertaken, for example to improve the effectiveness of tax collection, and to audit ministry expenditures. It is also hoped that the momentum of professional personnel returning from abroad following the end of the war, will offer technical skills to strengthen the administration.

Law enforcement is an area of general weakness. Responsibilities are unclear, coordination between authorities is poor, the regulations lack of clarity and precision, and where fines and penalties are specified they typically do not provide sufficient deterrent value.

Key Institutions with a Responsability for Environmental Management

Ministry/ Organisation	Waste water	Pollution	Land use and coastal zone management	Forests & agriculture	Solid waste hazardous	Cultural heritage	Industrial pollution	Water resources
Ministry of Environment	x	x	x	x	x	x	x	
Ministry of Agriculture			x	x				
Urban Planning	x		x					
Municipalities	x		x		x			
Mohafaza	x		x		x			
Caza	x		x	x	x			
CDR	x		x		x			x
Roads and Planning			x					
Council of Grand Project	x		x					
Ministry of Transport		x	x					
Department of Antiquities			x	x				
Ministry of Tourism			x			x		
Ministry of Housing	x		x					
Ministry of Hydraulic & Electrical Resources	x							
Ministry of Public Health	x		x		x			x
Ministry of Urban Affairs	x				x			
Ministry of Public Works	x				x			x
Ministry of Industry and Petroleum							x	

Source: Antoun R., 1995.

2.1.5. The private sector (NGO)

The private sector includes Non-Governmental Organisations involved with environmental problems, as well as the educational sector at the university level, and the sectors of industry, agriculture, forestry, the media and religion.

There are many NGOs, but they do not contain many **active elements.**

In spite of a few campaigns led by one organisation or a group of several organisations on topics such as reforestation, the fight against pollution, the opening of the file on the toxic waste imported into Lebanon in 1987, the stocking of hydrocarbons, quarries, and in spite of conferences, study circles and public awareness operations, the efficiency of these organisations remains very limited because **their activities are scarce** and they lack tenacity and a fighting spirit. On the other hand, the fact that many of these organisations flirt with authorities at odds with the environment, and the lack of activities on the ground, together with pressure on the government, make their influence on the population very limited.

With particular reference to the problem of the biodiversity, it should be noted that joint action undertaken by the National Council for Scientific Research (NCSR) and several NGOs made it possible to create three nature reserves at Horch Ehden, the "Iles des Palmiers" and the forest of Barouk.

Faced with the proliferation of these organisations and their lack of collaboration, maturity and experience, the best method would appear to be not to try to group them within the same organisation, but rather to mobilise them each time around a well-defined common project.

At the same time, the major contradiction limiting the efficiency of these organisations is that they are supposed to be apolitical, while any pressure on the powers that be, if it is to bear fruit, must take into consideration the political aspects, especially as economic pressure groups, which are a direct threat to the environment, are closely linked to political circles.

At the level of religious activities, we should point out the importance of sermons and *fatwas* aimed at protecting the environment.

The most important factor, however, is the **very active media**, which seek to arouse public interest and give support to any activity that aims to protect the environment (programmes and articles on the problems of quarries and hydrocarbons, for example).

As far as research is concerned, the NCSR (public body) and its Marine Research Centre in Jounieh, the Lebanese University (public), the American University and Kaslik University are quite active, within the limits of their respective budgets.

At present, there is **a true arousal of interest in environmental problems** in all the private sectors, but these sources of interest need to be able to fuse together in order to put pressure on the public authorities and oblige them to apply the laws that seek to protect the environment.

- Society for Protection of Nature Resources In Lebanon
- Lebanese Committee for Environment and Development
- Greenline
- Ligan Nature Environment
- The Committee for the Protection of the Environment in North Lebanon
- Friends of Nature
- Association for Social and Cultural Development - Nabatiyeh
- Societé de Protection des Animaux - SPA
- Centre from Environmental Development in Hermal
- National Committee for Environmental Activities
- Association foe Environmental Conservation
- Movement de l'homme-Antelias and Beirut
- Man and Environment Society
- Association for Environmental Conservation - Bsharre
- Friends of Cedar Forest
- Society for Protection of Nature - Sh'hym
- Man and Environment Association - Beit Shaar
- Committee for Environmental Protection and Cultural Preservation - Nabatiyeh
- Friends of Ehden Forest Society
- Environment Protectors Party - The South
- Protection of the Environment Committee - Chekka
- Bird Society - Hazmieh
- Environment Sans Limites - Maghdousheh
- Protection and Development of Forest Resources Society
- Scientific Society for Environmental Education and Development - Tripoli
- Environmental Council - Akkar
- Society for Conservation of Nature - Bekaa
- Environmental Committee - Baalbeck
- Rene Moawad Foundation, Centre for Reserach and Education for Democracy - CRED
- Human Rights Society
- Animal Encounter
- Consumer Protection Society
- L'Association Libanaise Pour La Maîtrise De L'Energie (ALME)

Source: Hussein A, 1995.

Introduction

A new branch of law has arisen as a direct extension of Human Rights: **environmental law**, which aims to guarantee that man lives in a healthy environment, where there is respect for the balance between natural phenomena and for biological diversity. This evolution in the law also implies an evolution in intellectual processes, an adaptation of our ways of thinking and our behaviour.

Yet man's right to this environment, when it exists, is constantly in danger of being "hijacked" as it comes up against the short-term financial and economic interests of individuals and groups who covet this natural, free capital, the property of the community and mankind.

This right exists in Lebanon. It is governed by an important series of laws, decrees, decisions and rules going back to Ottoman times. But **this legislation remains fragmented** and divided, with no unifying factor. For this reason, it is ill-adapted to the need for a global approach to the problems of conservation and the protection of the countryside and its natural wealth, fauna, flora and various ecosystems.

The Lebanese natural heritage, which includes natural resources, flora, fauna and their ecosystems, is immensely diverse, but is seriously threatened by irreversible changes and destruction because of the lack of a general law to protect the countryside and, above all, because of the **non-application of existing laws**, even though they leave many gaps and much to be desired.

Problems concerning the environment in general, and the biodiversity in particular, pose a two-fold problem: institutional and legislative.

Although existing legislation on the environment partly answers the problem of the fight against pollution, the prevention of danger, the conservation of the natural and cultural heritage and forests, it does, however, contain **serious gaps concerning the safeguard of the biological diversity,** amounting even to a lack of interest in this relatively new problem.

The protection of sites

TEXT: the *law of 8.7.1939*, modified by the *Order in Council of 14.4.1943*, moved responsibility from the Ministry of Economy to the Ministry of the Interior.

Protected sites include elements of the cultural and natural heritage and can include a group of trees, or even a single tree. This protection, when it concerns natural sites, may directly include the flora and indirectly the fauna.

In 1993, this same responsibility for the protection of sites of touristic, aesthetic, historical, scientific or artistic value was also recognised by the Ministry of the Environment.

The sentence foreseen in the penal code for the destruction of or damage to a protected site can be as much as 3 years' imprisonment (art. 731).

The *decree no. 434 of 28.3.1943* classes as protected sites the Cedars, Deir el-Kamar, the forest of Bologne, the archaeological site of Baalbeck, the lake of Yammouneh and the natural bridge of Nahr el-Laben. Since this decree, no other site has been added to this list.

Obligations of urban development

TEXT: The law established by the *Order in Council no.69 of 9.9.1983* and *no.2/89 of 5.1.1989*, as well as the various regional plans for urban development foresees, through planning, certain public health, general security, aesthetic and environmental obligations.

In addition, this law should protect certain agricultural or natural zones to be conserved, in particular by limiting or prohibiting construction work.

Unfortunately, this law has never been fully applied, as can be seen in the uncontrolled building that is destroying the countryside and agricultural zones.

For those regions which are known for their beautiful countryside, measures should be foreseen to protect and enhance them, even to the point of refusing construction permits. **It is time to work out a bill of law to protect the countryside.**

TEXT: *Statutory order no. 166/LR of 7.11.1933* regulates the protection of antiquities, in particular ancient buildings.

In addition, on 30.10.1990 Lebanon ratified the Paris Convention of 6.11.1972 concerning the protection of the world's cultural and natural heritage.

Under this protocol, the valley of Qannoubine in North Lebanon has been classified, and the valley of Nahr Ibrahim is on the waiting list.

If the protected zones of antiquities are over a certain surface area, such as Byblos or Tyre, or if this protection includes the natural heritage, such as the valley of Qannoubine, the Cedars or Nahr Ibrahim, the site can indirectly include the fauna, the flora and their natural environment. Qannoubine is classified by the statutory order *no. 13 of 22.3.1995.*

In order to bring the statutory order of 7.11.1993 on antiquities up to date, as it is now considered too restrictive, **a bill has been put before the parliament.** It includes in the cultural heritage, those sites, monuments and terrestrial or underwater elements which are of historical, artistic, scientific, aesthetic, ethnological or anthropological value. If this bill is passed, it will open up new possibilities for the protection of the natural heritage.

It should be noted that, thanks to the intervention of UNESCO and the action of the Ministry of Higher Education and Culture, a plan to fill in the sea between Amchit and Byblos was refused, thus safeguarding the coast of this site.

On 16.1.1996, *statutory order no. 2* extended the protected archaeological zone to 300 metres into the sea.

2.2.3 Protection of natural environments

Reserves

Law no. 121 of 9.3.1992 created two natural reserves: the island known as "Isle des Palmiers", facing Tripoli, and the forest of Horch Ehden.

These two reserves are protected by strict, complete rules governing the fauna, flora and their biodiversities, which forbid all harmful, dangerous activities (hunting, fishing, flower picking, the extraction of material, etc.) and which organise visits. There are prohibitive sentences of up to 3 years in prison.

The two reserves are managed by a commission of seven people, named by the Ministry of the Environment for a period of three years.

Statutory orders of the Ministry of Agriculture for the creation of six nature reserves:
- *N 1/166 of 22.12.91:* reserve of Saissouk (AKKAR), managed by a committee of six members.
- *N127 of 23.10.91:* reserve of Maasser El-Chouf and Barouk, including three cedar forests.
- *N1/71 of 13.5.92:* reserve of Kfarzabad (Bekaa).
- *N1/21 of 12.2.92:* reserve of Kherbet-Selm (South of Bint-Jbeil).
- *N1/152 of 15.10.92:* reserve of Hbéline (region of Jbeil).

All these reserves are managed by the forestry service of the Ministry of Agriculture. Controlled breeding and animal runs for species of wild animals that are to be reintroduced into their environment are planned, together with plant nurseries and plantations of endemic wild trees and fruit trees.

A new reserve was created by the Ministry of the Environment under the statutory order n 1/14 of 6.10.95 at Karme Chbat (Akkar), managed by a committee of six members.

These reserves are protected by the same rules as those provided under the penal code and the forest code, and are consequently less severe and prohibitive than those provided for under *law no. 121.*

- *Statutory order no.129 of 23.10.1991:* the maritime reserve of Batroun, managed by the Oceanographic Institute of Batroun. This reserve includes the coast and territorial waters near this coast, without further precision. An aquarium and a centre for research and study in the fields of the environment, aquatic species, birds and water pollution are planned. This statutory law makes no mention of regulations concerning the reserve.

There is also the reserve of Bintaël (region of Jbeil), created in the 1980s and inaugurated on 23rd May 1987 under a rent contract signed by the Ministry of State and the Environment and the domanial authorities. It is managed by the Association of the Bintaël

Nature Reserve which is a private association. This reserve does not have an adequate legal framework, detailed regulations or efficient means of legal protection.

It is essential to establish a general law on nature reserves and to include in it the national parks in order to unify the rulings on Reserves and Parks, to introduce prohibitive sentences and to facilitate the creation of reserves and parks by decrees or statutory orders passed by the relevant authorities.

The importance of national parks is that they combine the conservation of the natural heritage with the reception of the public.

Protection of forests and farmland

The protection of forests goes back to the Roman Emporor Adrian (117-138), whose inscriptions are found on the peaks of Lebanon.

TEXTS: forest code 149 of 7.1.1949
modified by *law no.3/68 of 16.1.1967*
Order in Council no.141 of 31.12.1977
Order in Council no.43 of 17.6.1983
Order in Council no.85 of 7.9.1991.

This code is **very modern in its provisions for the protection of trees, but insufficient for the protection of the biodiversity.**

This code states that the rules for exploitation must guarantee the perennial nature of forests (art. 11). It requires authorisation for cutting (art. 12). It makes it necessary to obtain authorisation for grazing, the extraction of stone, sand, earth, grass, plants, natural manure, seeds, fruits and the gathering of forest produce. It makes it obligatory to obtain a permit to sell wood and to clear land. The authorisation can be refused for various reasons concerning the conservation of the earth, the protection of the land, sources, the coast, public health and the safeguard of classified tourist sites.

Cutting down resinous plants is forbidden. They can only be pruned with permission and against a certificate for the reforestation of a surface area of 2,000m2 for every 50 trees of the same species to be pruned (art. 93).

Measures are provided under the *law of 9.11.1951* to protect the land, encourage reforestation and guard against the grazing of goats.

Order in Council no.31 of 18.1.1995 makes it compulsory to fight against contagious agricultural diseases and harmful insects.

The penal code provides punishment for those found responsible for fires, the extraction of grasses, earth, stones, sand or any other matter of public ownership (art. 764-765), just as it condemns those who do not take the measures necessary to prevent or stop the spread of contagious diseases of plants or forests (art. 605).

The *law of 9.11.1951* gave the Ministry of Agriculture the power to take all necessary measures to protect the land, together with its reforestation and protection from grazing.

The law promulgated by *decree no. 16766 of 7.8.1957*, by which the Green Plan for land development was created, as well as the Service for Scientific Agricultural Research (INRA), has brought about the reforestation of large areas of cedars and other trees and the protection of existing trees.

Protection of the coast and the sea

Decree no. 144 of 10.6.1925 considers the sea, as far as the limit of high waters, as well as the bed and the substratum of the territorial sea, i.e. a width of 12 miles from the coast, as an inalienable, indefeasible public maritime domain.

The Order in Council no. 4810 of 24.6.1966 was passed to regulate urban development on the coast. Under this Order in Council, only industrial or touristic exploitation of public interest can appropriate any part of the coast, and on condition that it does not disturb the continuity of the coast.

Articles 733, 735 and 736 of the penal code forbid any encroachment upon the public domain, subject to a sentence of two years' imprisonment.

Law no. 14 of 20.8.1990 of the Ministry of Finance declares null and void any occupation of the coast not covered by a legally obtained decree.

Decree no. 3899 of 6.8.1993 forbids the extraction of sand or of any other matter from the public maritime domain without the permission of the Ministry of Transport or of the Council of Ministers. Article 764 of the penal code punishes any law-breaker.

In addition, all laws on the subject of pollution also protect the sea.

Lebanon has ratified almost all the international conventions on the protection of the sea (in 1954, in 1962, at Brussels in 1969, Barcelona in 1976, London in 1973, Madrid and Geneva in 1982).

2.2.4. Protection of the flora and fauna

Hunting regulations

TEXT: *law of 18.6.1952*
modified by the *Order in Council no. 137 of 12.6.1959*
law no. 1/70 of 19.1.1971
law no. 4/80 of 7.4.1980
law no. 5/85 of 10.8.1985
law no. 14 of 20.8.1990.

Statutory order no. 297/1 of 31.8.1965 made a classified list of protected game birds and birds.

The *law of 18.6.1952* regulated the conditions for hunting, demanded hunting permits (art. 81), decided on the opening and closing dates of the hunting season (art. 84), forbade the use of nets, traps, glue and hunting during snowy periods etc. (art. 86), protected nests, eggs

and young birds (art. 88). It also forbade the importation or use of instruments that reproduce bird calls (*Decree no. 2/B of 21.5.1993).*

Communiqué no. 335/3 of 26.3.1985 listed all useful birds, almost all of which are migratory birds, and which it is forbidden to hunt.

Order in Council no.64/1 of 16.3.1993 forbade hunting between 15th March and 15th September. This decision was not based on a scientific study.

Statutory order no. 1/7 of 12.1.1994 forbade hunting for three years from 1.1.1995.

Statutory order no. 1/110 of 29.6.95 was adopted under pressure from the arms trade lobby and reintroduced hunting between 15th September and 30th January (from 1995) of each year and for 12 species of birds. This decision was not based on any scientific study.

Law no. 8337 of 6.4.1974 gave the National Hunting Council, created by *Decree no. 191 of 21.8.1973* taken by the Ministry of the Interior, responsibility for making a list of wild animals and birds that can be hunted and for deciding on the dates of opening and closure of the hunting season. The role of this council is to take the measures necessary to breed birds and animals for hunting and then to release them into the wild. This practice will have harmful consequences and disrupt the genetic biodiversity.

The statutory order that forbade hunting was efficiently applied by the army and had begun to have beneficial effects as birds that were thought to have disappeared for ever began to reappear.

Hunting should again be forbidden until a normal ecological situation has been re-established. At the same time, hunting laws must be studied carefully, lists of protected birds and animals must be brought up to date and the delivery of hunting permits should be studied seriously in order to make the law more credible and efficient.

Fishing regulations

TEXT: The law published by *statutory order no. 1104 of 14.11.1921*, modified by *Order in Council no. 138 of 16.9.1983.* This law forbids fishing in ports, the use of products that anaesthetize or poison fish or which pollute the water, and the use of explosives in fishing. It also forbids factories to let their waste flow into the sea.

Law published by *Decree* *no. 2775 of 28.9.1929* and modified by:
statutory order *no. 2981 of 22.1.1930*
no.4 of 10.1.1939
no.86 of 3.3.1939
no.67 of 3.4.1939
Decree no. 6054 of 25.5.1946
law of 18.2.1947
law of 3.5.1954
law of 25.5.1962
law 110/66 of 14.2.1966
law 89 of 7.9.1991.

This law laid down the rules for the supervision of fishing, regulated the tools of fishing, protected the grasses and eggs, set down the norms for the fish that could be fished, forbade explosives and products that anaesthetized fish, etc.

The *statutory orders no. 1/62 of 16.3.1953 and no. 229/1 of 13.10.1993* laid down the conditions for the fishing of sardines and the use of nets.

Statutory order no. 347 of 11.12.1972 forbade underwater fishing with oxygen bottles or night-time underwater fishing with lights.

The *law of 18.6.1948,* modified by *law no. 1/84 of 13.6.1984* and *law no. 14/50 of 20.8.1990*, which regulated sponge fishing. *Statutory order no. 63/11 of 16.3.1993* forbade sponge fishing for five years.

Statutory order no. 95 of 9.5.1939 and the *law of 19.11.1947,* modified by *law no. 14/90 of 20.8.1990* and by *Decree no. 11882 of 3.6.1948,* regulated river and freshwater fishing.

Fishing resources have been depleted by the massive use of illegal methods of fishing. In addition to the need to protect the reproduction of these resources, there is also the need to conserve biological wealth, which implies that the laws should be revised and the various aquatic flora and fauna should be taken into account. Although the terrestrial and marine fauna is relatively well protected, the flora is hardly mentioned in conservation laws.

2.2.5. Protection of waters

TEXT: *Statutory order no. 144 of 10.6.1925* concerning the public domain and *Decree no. 320 of 26.5.1926* on the protection and use of public waters, modified by *Decree no. 680 of 5.9.1990*, declaring all water (lakes, sources, rivers, underground water, waterfalls, riverbanks, etc.) to be public property and regulating its protection and use.

They make it an offence to pull up or cut grasses, trees, shrubs, to extract earth, stones or sand from land close to the banks of sources, lakes, lagoons or rivers, or to undertake any activity which would have an effect on the quantity or quality of the water. These prohibitions also figure in the penal code (articles 740, 745, 747, 748 and 764).

Decree no. 14438 of 2.5.1970 regulates the digging of wells and requires a declaration for a depth of less than 150m. and a permit for one of more than 150m.

Law no. 10276 of 7.10.1962 provides for protected zones around sources. Certain statutory orders have already marked out the protected zones around certain sources.

The **legislation concerning water, most of which is old,** was conceived to manage and protect water, quantitively and qualitatively, in relation to the needs of man, but did not provide for its protection as a natural environment, rich in aquatic biodiversity, although Lebanon has large aquatic zones, such as the Ammiq marsh in the Bekaa, a humid zone of exceptional interest which is in danger of disappearing for good.

Nevertheless, if this legislation had been applied, it would have brought indirect benefits, even if limited, for the protection of the aquatic biodiversity.

It is time Lebanon modernised its legislation on water, water seen as the natural environment of this rich biological aquatic diversity. It is time Lebanon became a member of the RAMSAR Convention of 2.2.1971 for the protection and rational management of aquatic biodiversities. Finally, the country should foresee laws to protect its cavernicolous heritage and its underground biological wealth in view of its numerous natural caves.

2.2.6. Protection of [illegible]

TEXT: *Law no. 974,* executed by *Decree no. 8735 of 23.8.1974,* protects the environment from pollution caused by solid and liquid waste, especially from sewage water and septic tanks. It obliges industrial establishments to purify their water before disposing of it. The law bans the use of bottomless wells for sewage water and requires existing wells of this type to be closed; offences are punishable by two years' imprisonment. It contains a whole series of measures concerned with public health.

Order in Council no. 2761 of 1932 and article 748 of the penal code had already set out the same prohibitions and the same sentences for offences concerning water.

The *law no. 64 of 12.8.1988* made, for the first time, pollution by dangerous substances a crime punishable by hard labour, or even by the death penalty. This type of pollution includes changes in the environment, damage to man, the flora or fauna, the air and water. The dangerous substances are listed in a decree which is an appendix to the law and can be updated at any time.

On the subject of pollution by chemical products, we can refer, as far as insecticides, fungicides and chemical fertilisers are concerned, to the following laws and decrees:

- *decree no. 10659 of 21.9.1970*
- *law no. 11/78 of 24.4.1978*
-*Order in Council no. 71 of 1983*

These laws and decrees regulate the importation, production, sale, and use of these products with the aim of protecting the countryside and public health.

A special commission of the Ministry of Agriculture supervises the application of these conditions as stated in the legislation. In particular, it is forbidden to import products that are banned in their country of origin.

Unfortunately, **these laws are still not applied**. The excessive and uncontrolled use of these products is due to the inefficiency or corruption of the control services.

2.2.7. Rules concerning classified installations, hydrocarbons and quarries

Classified installations

TEXT: The legislative decree *no. 21/L of 22.7.1932* lays down the regulations concerning dangerous, insalubrious or unsuitable establishments.

It is completed by *decree no. 1119/C of 4.11.1936* which sets the conditions to be applied and by *decree no. 1120 of 4.11.1936* which classes industries. It was completed by *decree no. 2009 of 22.8.1959*, modified by *decree no. 7558 of 8.9.1961.*

Stocking petrolium products

TEXT: The stocking of petrolium products is regulated by *decree no. 5509 of 11.8.1994.*

This decree lays down the anti-pollution safety norms.

Quarries

TEXT: 5616 of 6.9.1994

This text regulates the exploitation of quarries, makes them subject to the opinion of a national commission on quarries and requires a preliminary study of the impact on the environment and natural resources. A map of protected regions and sites was drawn by a consultant for the UNDP and annexed to the text.

In view of the risks that these industries and quarries may constitute regarding the destruction of the countryside and the natural environment, as well as the risk of pollution that they might engender, first of all, and without delay, the current legislation must be applied and, at the same time, the code on urban development, the legislation of classified installations and rural development must be modernised. It is also essential to **impose a study of the impact** of these factors. In this way, it will be possible to control the activities and usage of space that could be harmful to the environment, and to the biological diversity.

2.2.8. Land laws and property rights

In Lebanon, the ownership of land is divided between *mulk* property and *amirié* property.

Mulk property is property that is owned totally. It is generally situated inside towns and includes all the lands of the ex-government of Mount Lebanon.

Amirié property is property that belongs essentially to the State, but which individuals can have the right to use.

Amirié property cannot be transformed into *waqf*; the right to use property can be won or lost by five years of usage or non-usage, and in the basement the owner only has the right to the building materials.

In reality, the differences between these two types of ownership are lessened by the fact that there is no administrative organisation of the loss of the right of usage, and because

the regulations concerning mines, quarries, antiquities and treasure make no distinction between the two types of ownership.

The right to communal property belongs to the State and the right of use to a collectivity. As for public property, it is either the property of the State or the property of the municipalities.

There are also *waqf* properties which are full ownership properties; they are used by religious groups, families or both.

The *waqf* is an endowment deed which immobilises a property in order to distribute its revenue to a charitable, public or family cause. In Morocco, there are *waqf* for the protection and maintenance of storks. Under the law of 10.3.1947, family or combined *waqf* can be dissolved under certain conditions.

Contrary to French law, where the right of ownership implies the right of usage, to the point of abuse of the object or even the destruction of the object, Lebanese property law is limited in its intentions, which are the right to use, dispose of or exploit the object, within the limits of the existing laws and regulations.

Moreover, the theory behind the *amirié* property is that the owner is considered as the manager of a common heritage and responsible for its management.

By joining together these two notions of ownership, we should be able to find a balance between the private interest of the owner, which is to exploit the resources of his property, and the general interest (of the nation, of mankind), which is to conserve the integrity of this common capital which bears the genetic resources of the future.

2.2.9. Application of the legislation

Law no. 89 of 7.9.1991 multiplies by 100 the fines foreseen by pre-1983 legislation and post-1983 legislation by 80.

If present legislation were applied, many environmental problems (the protection of biodiversities, the fauna and the flora, the conservation of the coast and natural sites, the protection of water from pollution) which have a direct influence on the biodiversity would be solved. The measures to be taken to guard against this type of problem do not require a special budget, just the simple application of the law.

The reasons for the non-application of the law are numerous and varied:

1. The war in Lebanon disrupted the political and administrative institutions and opened the way to infringements on the law.
2. The commercial spirit, the search for development at any price and the lack of any concept of lasting development overcame any opposition from the law and encouraged chaotic short-term development, setting aside environmental problems that required the kind of long-term policies that did not interest those in power.
3. The frantic need to consume, wastage, outright individualism and the lack of any public spirit have encouraged the kind of behaviour that is destroying the

environment which is considered to be a free capital to be appropriated by the most astute and the one who gets there first.

Under Lebanese law, international conventions have priority over the dispositions of national law (article 2 of the code on civil procedure).

-UNESCO Convention of 21.11.1972 for the protection of the world's cultural and natural heritage (Lebanon adhered by virtue of *law no. 30/82 of 14.9.1982*).

-Paris Convention of 6.11.1972 for the protection of the world's cultural and natural heritage (Lebanon adhered by virtue of *law no. 19 of 30.10.1990*).

-The two international conventions on the protection of the ozone layer, the Vienna Agreement of 1985 and the Montreal Protocol of 1987 (Lebanon adhered by virtue of *law no. 253 of 22.7.1993*).

-The International Convention of Rio de Janeiro of 5.6.1992 on climate changes (Lebanon adhered by virtue of *law no. 359 of 1.8.1994*).

-Convention on Biodiversity signed at Rio de Janeiro on 5.6.1992 (Lebanon adhered by virtue of *law no. 360 of 1.8.1994*).

The application of the Paris and UNESCO conventions is a matter for the Ministry of Higher Education and Culture. The application of the remaining conventions is the concern of the Ministries of the Environment and Agriculture.

Lebanon adhered to the Arab Centre for Studies on Arid Regions and Land (research on water, land, ecology, fauna and flora) by virtue of law no. 27/71 of 12.3.1971.

An agreement was reached between Lebanon and the International Development Research Centre with the aim of creating in Lebanon a Centre for Agricultural Research in Arid Regions, by virtue of the law passed by legislative decree no. 124 of 30.6.1977.

Lebanon adhered to the creation of the World Fund for Agricultural Development (*Order in Council no. 150 of 31.1.1977*) and the creation of the Arab Agricultural Development Organisation (*law no. 11 83 of 28.5.1983*).

Lebanon adhered to the Mediterranean Basin Centre for Higher Agricultural Studies (*law no. 171 of 22.12.1992*).

The application of these conventions is the concern of the Ministry of Agriculture.

-International convention on the protection of the sea from pollution by hydrocarbons. The final document was adopted at the London Congress on 3.4.1966, after modifications to the 1954 Convention (Lebanon adhered by virtue of *law no. 66/67 of 26.11.1966*).

-International convention on intervention at sea in the case of accidents at sea that risk polluting the sea with hydrocarbons, concluded in Brussels on 29.11.1969 (Lebanon adhered by virtue of the law passed by *decree no. 9226 of 12.10.1974*).

-Convention on the protection of the Mediterranean from pollution, and two protocols added in appendix (Lebanon adhered by virtue of a law passed by *Legislative decree no. 126 of 30.6.1977*).

-International convention of 1973 to prevent the pollution of the sea by hydrocarbons, and 1978 protocol (Lebanon adhered by virtue of *law no. 13/83 of 28.5.1983*).

-Barcelona Convention for the protection of the sea (16.2.1976) and the Vienna Protocol for the protection from pollution from the land (17.5.1980) and that of Geneva on protected zones (3.4.1982), (Lebanon adhered by virtue of *law no. 292 of 22.2.1994*).

-Convention on sea law adopted by the United Nations, and appendices (Lebanon adhered by virtue of *law no. 295 of 22.2.1994*).

The application of these conventions is the responsibility of the Ministry of Petrol and the Ministry of Transport.

The lack of a national report or plan of action is due to the disintegration of political and administrative institutions during the war; only a few laws and regulations, mostly on the subject of sea pollution, have been put into practice.

Apart from this, the Ministry of Higher Education and Culture has begun to classify certain sites of the cultural and natural heritage, such as the valleys of Qadicha and Nahr Ibrahim.

It is to be hoped that with the return of peace to the country, a plan of action will be proposed and applied. At present, commissions have been set up to establish an environmental code that will certainly take these conventions into consideration.

2.4. Prospects

Faced with legislation that answers, even though imperfectly, the need to safeguard the environment, but which remains inefficient because it is not applied as a result of the lack of competent, honest institutions, what should we do?

2.4.1. A political choice

The State must make the protection of the environment, including the biological diversity, a political choice which must be clearly registered in the Constitution and demonstrated through appropriate, efficient legislation.

If environmental law is often inefficient, it is because it comes up against the prevailing legal norms which favour the appropriation, transformation and even the destruction of the countryside. For this reason, the environmental norm must be strengthened constitutionally **by declaring the protection of the environment to be of general interest.**

For example, article 225 of the Brasilian Constitution of 5.10.1988 states that **"everybody has the right to an ecologically balanced environment, as something that is common to the people and as an element that is essential for a healthy quality of life"**.

This will not be difficult since the Lebanese Constitution recognises, in its preamble, the Declaration of Human Rights. Environmental rights would be the legal instrument for the protection of the natural environment, which is necessary for our health and quality of life, the basic values of human rights.

At the same time, in any future environmental code, it is essential that the leading principle be accepted as the fact that the protection of the environment is of public interest.

In French law, article 1 of the law of 10.7.1976 on the protection of the countryside states that *"the protection of natural species and the countryside, the maintenance of the ecological balances in which they participate, and the protection of natural resources from all the causes of degradation that threaten them are of interest to the general public"*.

2.4.2. Inventory of figures

The aim of environmental law is to establish a balanced relationship between man and the countryside, and thus to protect the countryside and its resources, which must be shared equally between present and future generations, to fight against pollution, to conserve our heritage, especially our biological heritage, and to improve the situation and quality of life. Consequently, it is essential to begin by making a list of elements and problems.

This inventory should include a detailed map showing:

1. types of ownership: public, domanial and private.
2. the distribution of zones: agricultural, range, forest, industrial and urban.
3. the distribution of water.
4. the distribution of natural resources, in particular biological, and the map of these resources.

5. the map of quarries, land concessions, illegally occupied land, illegally exploited resources.

In addition, a list should be made of the difficulties that lie in the path of the safeguard, protection or recovery of those natural and biological resources that are fast disappearing.

2.4.3. An environmental code

Rather than reform present legislation on the environment, which is fragmentary and incomplete, it would be better, in view of the importance of the subject, to work out an environmental code integrating certain intangible principles, such as:

1. Declare the countryside and its resources to be a national heritage.

2. Consider the owner to be the manager with the right to exploit his property, but also the duty to safeguard this capital, the property of present and future generations.

3. Adopt the principle, **polluter, predator-payer.** Tax and compensation mechanisms must be worked out, norms must be established for pollution and protection, and these new norms must be imposed on already-existing installations.

4. An **impact study** must be conducted to determine the impact on the environment of industries, classified establishments, development plans, large complexes, etc. An impact study must be imposed, not only as a prior condition to any form of development, but it must also be conducted throughout the course of the development, so that the impact study becomes an instrument for both prevention and correction.

5. Civil and administrative courts must have **the right to suspend activities likely to harm the environment**, because otherwise, with the slowness of legal procedures, there is a great risk of decisions being taken too late.

6. Strengthen **citizens' control** by requiring that decisions be advertised and transparent, by lifting the secrecy of administrative files and by facilitating appeals by individuals and associations for the defence of the environment. A bill giving the right of appeal to associations for the defence of the environment has already been submitted to parliament for approval.

7. In legal texts, **exceptions and dispensations should be avoided** and the discretionary power of the minister and the administration should be limited because this power weakens the administration when faced with political and economic pressure and opens the way to violations of public ecological order.

8. The State should guarantee everybody the right to live in a well-balanced, healthy environment. This implies the protection of the countryside and its ecological balances, and the rational exploitation of natural resources, without harming their

natural ability to regenerate. At the same time, the citizen's right, and even his duty, to defend these values for himself and for future generations, must be recognised.

The French law of 10.7.1976 places the countryside at the same level in the hierarchy of values as other recognised needs: *"the fauna and flora are a national biological heritage"* (art. 5). Thus, protection of the natural heritage becomes a legal obligation which can be set against any public or private action.

At present, the Ministry of the Environment is preparing an environmental code under the direction of the Institute of Environmental Law of Lyons, which clearly lays down the specific nature of the Lebanese case. We hope that the preparation of this code will take into consideration the above principles.

This plan for an environmental code has just been presented to the Council of Ministers by the Ministry of the Environment. It includes the following principles:

1. The right of man to his environment.
2. Prevention.
3. Precautions.
4. Polluter - payer (taxes, norms, backdating).
5. Information and participation of citizens.
6. Correction and return to original condition following offences against the environment.
7. Public ecological order and coordination between Ministers, public establishments and municipalities.
8. Impact study on the environment.

A National Environment Council attached to the Office of the Prime Minister and a Green Police Force are also planned.

To complete environmental legislation, the code should include a series of laws relative to the various sectors. As far as the field in which we are particularly interested is concerned, it is essential to establish a **law to protect animal and vegetable species**, with an appendix listing the animal and vegetable species, their habitats and the degree of protection which they have been allotted.

Protection should also be sought for migratory birds, regulations should be adopted on the introduction of animal and vegetable species which might constitute a potential danger for endemic flora and fauna.

Institutions and legislation in the field of the environment should take the protection of the biodiversity into consideration: **the safeguard of zones rich in biodiversity** and particularly fragile or in danger.

Finally, the safeguard of the biodiversity should become a parameter in any land development and impact study.

Since **ecological mistakes** can have more dangerous effects than any other mistakes and they are evidence of socially harmful behaviour, it is essential that they be punishable by law. In order to make the protection of the countryside more efficient and punishments more restricting, the penal code should include the offences of destruction, degradation or pollution of the environment, or any other act against the countryside. This would bring these offences within the mechanism of the courts, thus making prosecutions faster and therefore more efficient.

At the same time, the objectivity of penal responsibility should be increased, amnesty should be refused to those found guilty of ecological offences and the penal responsibility of corporate bodies should be recognised.

The management, protection and conservation of the biodiversity requires the **creation of a national body of experts** and representatives of ministries concerned by the problem of biological resources.

Among its other responsibilities, this body would participate in the establishment of a general policy of **continuous development**, which would take into account as its parameters not only economic and social aspects, but also the biological diversity. It would be able to demand emergency measures to protect threatened ecosystems and the creation of nature reserves and national parks whenever it deemed necessary.

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

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الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
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