

**CONSERVATION OF FORESTS AND
BIOLOGICAL DIVERSITY IN LEBANON**

FAA 118/119 REPORT

Prepared for

USAID/Lebanon

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Prepared by

ECODIT ●



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EXECUTIVE SUMMARY

During the 1997-2002 period, the impact of the USAID program on forests and biodiversity appears to have been essentially neutral overall. The following activities may have had a mix of positive and adverse impacts on forests and biodiversity: Agricultural or access roads; Tree planting and tree nurseries; Drainage canals and lakes; Solid waste dynamic composting; Wastewater treatment; and Dairy cows (USDA funding). While it is not likely that any of these activities had significant adverse impacts on forests and biodiversity, some may have had localized adverse impacts that could be mitigated. Implementing EA requirements would ensure that potential adverse impacts are identified in advance (during the planning and design stages) and adequate measures are taken to mitigate such impacts. Implementing EA also would be in compliance with the EA regulation of USAID (22 CFR 216) as well as the EIA draft decree prepared by MoE.

Also, although some of the PVOs operating in Lebanon are generally familiar with EA requirements, all these PVOs and their partners (NGOs, municipalities) would benefit from participating in a dedicated training program on the EA procedures and requirements of USAID and Ministry of Environment, as well as techniques to identify potential adverse environmental impacts and possible mitigation measures. Because other USAID missions have already offered similar training courses to partner PVOs (e.g., USAID/West Bank & Gaza), USAID could leverage those training resources, with some adaptation to the Lebanese context, to offer EA training courses to the PVOs, contractors and their partners implementing the USAID/Lebanon program.

Based on the analysis of the status of forests and biodiversity in Lebanon and the institutional and legal framework for forest and biodiversity conservation in Lebanon, the highest-priority recommendations for forest and biodiversity conservation in Lebanon are to:

1. Develop a protected area system that includes a representative sample of all significant habitats and ecosystems;
2. Strengthen the science base necessary to support conservation efforts; and
3. Develop and implement cost-effective reforestation programs based on the promotion of natural regeneration.

In addition to the above priority recommendations, the report has identified a number of other stand-alone recommendations to conserve forests and biodiversity in Lebanon:

1. Train municipalities and NGOs in managing public lands and protected areas;
2. Develop ecotourism as a tool to conserve biodiversity;
3. Promote awareness of the Convention on Biological Diversity;
4. Integrate biodiversity conservation into the economic sectors;
5. Develop a strategy for linking forest patches and other natural habitats;
6. Develop picnic grounds;
7. Document local (indigenous) knowledge and ensure its transfer to future generations;
8. Provide basic agricultural services to encourage farmers to conserve agro-biodiversity; and
9. Empower local farming communities.

USAID/Lebanon could implement the above recommendations under one or the other of its three strategic objectives for the period 2002-2005. For example, under the “Expanded Economic Opportunities” SO, USAID could support one or more of the following:

1. Local community participation in ecotourism and cultural tourism;
2. Development of privately run, for profit, plant nurseries;
3. Provision of basic agricultural services to farmers in biodiversity hotspots; and
4. Strengthening of local environmental consulting firms.

To promote effective governance and democracy, USAID/Lebanon could support workshops, training programs, technical assistance and similar activities to strengthen the administrative capacity of NGOs and municipal governments. Assistance could include programs to improve the capacity of NGOs and municipal governments in the design and implementation of sustainable reforestation and ecosystem restoration projects/programs, the management of protected areas and rangelands, accounting, ensuring financial sustainability, developing proposals, reporting, project monitoring, etc. USAID/Lebanon could implement all of the three priority recommendations under its SO to improve environmental practices.

LIST OF ACRONYMS

<i>AUB</i>	American University of Beirut
<i>ACSAD</i>	Arab Center for the Study of Arid Zones and Dry Lands
<i>CBD</i>	Convention on Biological Diversity
<i>CI</i>	Conservation International
<i>FFEM</i>	Fond Français pour l'Environnement Mondiale
<i>GEF</i>	Global Environment Facility
<i>GoL</i>	Government of Lebanon
<i>ICARDA</i>	International Center for Agricultural Research in Dry Areas
<i>ICRISAT</i>	International Crops Research Institute for the Semi-Arid Tropics
<i>IPGRI</i>	International Plant Genetic Resources Institute
<i>IUCN</i>	World Conservation Union
<i>MoA</i>	Ministry of Agriculture
<i>MoE</i>	Ministry of Environment
<i>SEPASAL</i>	Survey of Economic Plants for Arid and Semi-Arid Lands
<i>UNDP</i>	United Nations Development Programme
<i>WWF</i>	World Wide Fund for Nature

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1. INTRODUCTION

1.1 Purpose

The purposes of this forest and biological diversity assessment are to comply with the requirements of Sections 118 and 119 of the Foreign Assistance Act (FAA, see *Appendix A*) and to identify opportunities for USAID to ensure that its ongoing and future programs are sensitive to biodiversity concerns and complement those activities of other donors, NGOs and the GoL designed to conserve forests and biological diversity. Section 119(d) of the FAA requires that all USAID country level operating unit strategic plans include a summary of (1) the actions necessary to conserve biological diversity, and (2) the extent to which the actions proposed meet the identified needs. Section 118(e) requires that for countries that have any part of their territory within the tropics the strategic plan shall also include a summary of (1) the actions necessary to achieve conservation and sustainable management of tropical forests and (2) the extent to which the actions proposed meet the identified needs. Since no part of Lebanon falls within the tropics - there have been no tropical forests in Lebanon since the Pliocene, Section 118 does not apply to Lebanon. Nevertheless since forests are an important habitat for biodiversity, this report will address the status of forests in Lebanon.

1.2 Background /USAID Strategy for Lebanon

In 1997, USAID put in place a five-year strategy for Lebanon worth a total of US\$60 million. This strategy aimed at revitalizing and expanding economic opportunities in rural area, promoting democracy and good governance, and improving environmental practices. Over time, several other activities were added in response to emerging needs, such as a WTO accession program to encourage trade and investment; an industry-cluster program to identify and promote productive sectors for investment; a water resources management program to make agriculture more productive; and a landmine action program to increase awareness on suspected minefields and assist survivors in productive enterprises.

As its 1997-2002 strategy is coming to a close, USAID is preparing a new strategy for the period 2003-2005. USAID's intention over these next three years is to build on its successes, and meld elements of the existing strategy into one that will target value-added and growth-oriented sectors, and promotes economic and political governance in ways that will enhance Lebanon's competitiveness as a regional and global player. Similar to the 1997-2002 strategy, this new strategy includes three major components:

1. Expanded economic opportunities;
2. Governance and democracy; and
3. Improved environmental practices.

USAID intends to provide approximately US\$35 million per year over the next three years.

On May 24, 2002, USAID contracted ECODIT, through the Water IQC held by DAI, to conduct an environmental program assessment and this Forest and Biodiversity Conservation Assessment to assist the Mission in preparing the third strategic objective on improving environmental practices and to identify opportunities to contribute to the conservation of biological diversity in Lebanon.

1.3 Methodology

A three-member team with strong prior experience with Lebanon's environmental situation and international experience with programs to conserve forests and biodiversity contributed to this Forest and Biological Diversity Assessment (see team composition in *Appendix B* and Scope of Work in *Appendix C*). The team reviewed the most recent reports and documents on forests and biodiversity in Lebanon, including the Lebanon 2001 State of the Environment Report.¹ Members of the team met with four US PVOs that have worked with USAID on its Community Cluster Program since 1997 (YMCA, CHF, Mercy Corps and Pontifical Mission), as well as with a selection of government officials and senior professionals (e.g., Ministry of Environment, American University of Beirut). *Appendix D* provides a list of meetings and contacts, and *Appendix E* contains select meeting and field notes.

The team also conducted several field visits with the PVOs to a sample of USAID-funded environmental projects across the country and to the Al Shouf and Horsh Ehden Cedar Reserves. Projects visited include solid waste and wastewater treatment facilities, tree planting projects, biogas fermentation tanks, drainage canals, one olive mill, hill lakes, and a slaughterhouse. While the team was already familiar with USAID's environmental program, the field visits provided an opportunity to meet some of the beneficiaries, including the local municipalities, NGOs and individuals, and to discuss some of the successes and difficulties related to the projects.

1.4 Report Organization

This report is organized in five chapters and several appendices as follows:

1. Introduction (this chapter);
2. Status of Forests and Biodiversity;
3. Institutional and Legal Framework for Forest and Biodiversity Conservation;
4. Recommendations for Biodiversity and Forest Conservation; and
5. Programming opportunities for USAID/Lebanon.

Chapter 4 describes the actions necessary to conserve forests and biodiversity in Lebanon. Chapter 5 discusses the potential impacts of recent/ongoing and proposed USAID/Lebanon program activities on forests and biodiversity and possible mitigation measures, and suggests programming opportunities for USAID/Lebanon to address, directly or indirectly, forest and biodiversity conservation needs.

¹ MoE/ECODIT, 2002

2. STATUS OF FORESTS AND BIODIVERSITY

This chapter provides an overview of forests and biodiversity in Lebanon. It describes Lebanon's five geomorphological regions, major landscapes, ecosystems and plant communities, including Lebanon's six major forest types. The chapter concludes with an overview of major causes of the loss of Lebanon's forests and biodiversity and the threats facing them.

2.1 Overview of Lebanon

Lebanon, a narrow strip of territory approximately 160 miles long and 20 to 50 miles wide, is a mountainous country located on the eastern shore of the Mediterranean Sea. It has a narrow coastal plain that disappears in some places. The snow-capped Mount Lebanon range rises from the coastal plain and is separated from the Anti-Lebanon Range to the east by the fertile Bekaa Valley. The mountains are rugged and are mostly made up of Jurassic and Cretaceous limestone and sandstone.

Karst formations, which cover two thirds of Lebanon's surface area, may be important habitats for Lebanon's biodiversity, as they are elsewhere in the Mediterranean area. However, there are insufficient data on the flora and fauna of Lebanese karst features such as sinkholes, underground streams and caves to determine whether such features are important habitats for endemic species. Karst formations are found mostly on Mount Lebanon between 300 and 1,800 m above sea level. Cedar, fir, and juniper forests are found on karst soils and once covered a much greater area of these soils.

The country consists of five geomorphological regions:

1. **The coastal zone**, including the shoreline and continental shelf, the coastal plain, and the foothills of Mount Lebanon rises to 250 meters;
2. **The Mount Lebanon range** (or chain), including middle-and high-elevation zones, rises from Akkar in the north and extends south to the hills of Jabal Amel. The highest peak is Qornet el-Sawda (3,087 meters or 9,409 feet) and Mount Sannine (2,624 meters or 7,998 feet) is the second highest peak in the region;
3. **The Bekaa valley**, a fertile land corridor separating the Mount Lebanon and Anti-Lebanon ranges, is drained to the north by the Aassi River and to the South by the Litani River. The central part of the valley was occupied by lakes and seasonally-flooded marshes until it was drained for agriculture during the 19th century. The only large natural wetland that survived conversion is the Ammiq swamp, a small remnant swamp along the Litani River in the Bekaa Valley;
4. **The Anti-Lebanon chain**, which extends across the Lebanese-Syrian borders along the eastern part of the country and includes, at its Southern terminus, Jabal el Cheikh (Mt. Hermon, 2,814 meters or 8,577 feet), which distributes rainfall and snowmelt into at least three main watersheds across Lebanon, Syria and Israel; and
5. **South Lebanon**, an elevated plateau that extends a short distance inland from the western shores of South Lebanon to the Mount Hermon foothills in the East. Seasonal streams flowing from east to west into the Mediterranean Sea intersect this region.

The climate is Mediterranean with hot, non-rainy (humid on the coast, dry inland) summers and warm, moist winters. The average annual rainfall at Beirut is 920 mm, falling mostly between mid-October and early May when Mediterranean depressions are frequent.

Monthly average temperatures on the coast range from 13° Celsius in January to 27° Celsius in July. Temperatures occasionally drop to near 0 degrees Celsius in Beirut during winter but rarely drop below freezing and soar to the high thirties in the summer. Inland, the Bekaa valley is much drier, and winters are cooler than on the coast, with frequent frost and snow. In general, precipitation decreases from west to east, the Bekaa valley having an average annual rainfall of only about 380 mm. The wettest areas are the higher-elevation western slopes of the Mount Lebanon Chain (up to 1,750 mm of rain, including up to 3 meters of snow on average). The driest areas are the northern sections of the Bekaa valley (less than 250 mm of rain).

The population of Lebanon, estimated at 3,800,000, is unevenly distributed with about 67 percent clustered in the narrow coastal zone of the country.² These coastal settlements have contributed to the loss and degradation of the Lebanese shorelines and coastal plains leading to the destruction of marine resources and important habitats. The spatial distribution of the population has major implications for the environment, both in terms of demand for land resources and for environmental services.

The biological diversity of the Mediterranean Eco-region, of which Lebanon is a part, has been more influenced by humans than that of any of the other 24 eco-regions selected as biodiversity hotspots by Conservation International (CI). Human's influence in the region dates back 8,000 years when the first significant deforestation began. Since that time landscapes have been as much influenced by humans as by nature. Despite the fact that more species have become extinct in the Mediterranean hotspot than any other hotspot, 13,000 of the 25,000 vascular plant species in the region are endemic. Two hundred and fifty (1 percent) of these endemics are found in the "mini-hotspot" made up of Lebanon and Israel.³

Throughout the region, humans have converted forests, especially deciduous forests, to agricultural lands, evergreen woodlands, and maquis, a "hard-leaved shrubland dominated by Juniperus, Myrtus, Olea, Phillyrea, Pistacia, Quercus, and other evergreens,"⁴ which now covers more than half of the region. The rapid population growth and mechanized agriculture of the current century accelerated the deforestation that had been going on for centuries and also destroyed biodiversity-friendly forms of land use developed during the Middle Ages. The region's vegetation has also been much influenced by the regular burning of grass and shrub. As a result of such anthropogenic interventions, there is little "pristine" vegetation in the region, no more than 1 to 2 percent. The region's vegetation, and Lebanon's as well, is best described as "human-modified."⁵ It is surprising that, despite the long history of man's intervention, the region is so rich in biodiversity.

² CDR/ECODIT-IAURIF, 1997, p. 75

³ Mittermeier, et al., 2000, pp. 38, 256-261

⁴ Mittermeier, et al., 2000, p. 256

⁵ Mittermeier, et al., 2000, p. 261

2.2 Major Landscape, Ecosystems and Communities

Lebanon's landscape is a mosaic of patches or remnants of ancient forests from more favorable ecological and climatic conditions and reflects the influence of man over many centuries.⁶ Lebanon's uplands "were once covered with stately cedars (*Cedrus libani*) whose height, strength, and utility became legendary throughout the Old World. Felling of the trees started as early as 3,000 BC, when the Phoenicians began a lucrative trade in cedar wood with the Egyptian Pharaohs and King Solomon, among others. Now the Lebanon highlands have lost most of their trees and the cedar is a threatened species."⁷ The mosaic also includes over-grazed grasslands, agricultural lands, urban sprawl along the coast, and two woody vegetation types much influenced by man: *maquis* (brushwood) and *guarrigue* (a degraded form of maquis found on shallow soils with rock outcrops).

2.2.1 Forest Types

While very little forest remains, Lebanon's remaining forests can be classified into six forest types, three of which are relic patches of vegetation which once covered a much more extensive area.

Cedar, Fir and Juniper forests

These three forest types are found together as mixed evergreen forests in some parts of the country, but pure, or nearly pure, stands of each are also found. Both cedar (*Cedrus libani*) and fir (*Abies cilicica*) are generally found between 1,300 and 2,000 meters. Junipers (*Juniperus excelsa* and *Juniperus oxycedrus*) are found growing with fir and cedar starting at about 1,500 meters. Occasionally, between 2,000 meters and the timberline (about 2400 meters), pure stands of junipers are found becoming increasingly scrubby as altitude increases.

The remaining cedar forests, which once covered the mountainous Oro-mediterranean zone (see Vegetation Zones, Section 2.2.2), are now found only as mosaic patches, occupying approximately 2,200 hectares on the western slopes of the Mount Lebanon chain. These forests are located on the western slopes of the Mount Lebanon range, in the following localities from north to south: Qamou'a, Dinnieh, Bsharre, Ehden, Sweisse, Hadeth-tannourine, Jaj, Bmohray, Ain-Zhalta, Barouk and Maasser al-Shouf.⁸

Mixed forests of fir and cedar are found in Qamou'a, and in Ehden, its southernmost limit, where it grows at a lower density mixed with cedar and other tree species. Sparse Grecian Juniper forests, covering an area of 9,000 ha,⁹ grow in patches on the eastern slopes of the Mount Lebanon chain and in the Caza of Hermel. All these forests have suffered from deforestation and severely eroded soils since biblical times leading to severe deterioration in their natural habitats and invasion by degraded guarrigue.¹⁰

⁶ Quézel, 1985 & Heywood, 1995

⁷ Mittermeier, et al., 2000, p. 261

⁸ Chouchani, et al., 1974

⁹ Baltaxe, 1965

¹⁰ METAP, 1995

Pine forests

Stone pine (*Pinus pinea*) forests occupy an area of 17,000 ha. with nearly half of this managed for the production of pine nuts. These forests are found at altitudes ranging from 800 m. to 1500 m. above seal level, on the sandy soils of Metn and Jezzine on the western slopes of the Mount Lebanon chain. The area covered by these forests has decreased primarily as a result of war, forest fires, and urban development. The other pine forests types - Calabrian pine (*Pinus brutia*) and Aleppo pine (*Pinus halepensis*) - grow between 500 m. and 1,300/1,500 m. on the western slopes of the Mount Lebanon chain. Calabrian pine forests occupy a large area in the North, while Aleppo pines cover an area of 400-500 ha in the southern part of the country in the Cazas of Marjaoun and Hasbaya.¹¹

Oak forests

The kermes oak (*Quercus calliprinos*) forests cover 10 percent (40,000 ha) of the land area, and their dominance in the lower altitude of the western slopes of the Mount Lebanon range is an indicator of habitat degradation. The oak coppices found on the eastern slopes of Mount Lebanon extend in a very discontinuous manner in the low elevation zone between Yammouneh and Hermel and on the slopes of Jabal Barouk/Niha. On the western slopes of the Anti-Lebanon chain, only a few diminutive oak stands persist, mainly east of Baalbeck, Masnaa and around Rachaya.¹² In the South, a few degraded and overgrazed oak coppices can be found on the hills of Jabal Amel. These forests have been subject to severe cutting for charcoal production and to overgrazing, which has led to their deterioration and their replacement by highly degraded garrigue.

Additionally, sporadic trees of Turkey oak (*Q. cerris*) are found in Qamou'a and Ehden, Cedar Oak (*Q. cedrorum*) and Lebanon oak (*Q. libani*) in Ehden, pennatifid oak (*Q. pinnatifida*) in Ehden, Hadeth-Tannourine and Bsharre, and brant's oak (*Q. brantii* ssp. *look*) in Ain Zhalta and Barouk. Cyprus oak (*Q. infectoria*) is found in cedar and fir forests.

Evergreen Cypress

The only remaining forest patch of cypress (*Cupressus sempervirens*) is found in Akkar on hard limestone. Other species in this patch include Mediterranean buckhorn, Kermes oak (*Q. infectoria* var. *boissieri*), and the oriental strawberry tree (*Arbutus andrachne*). The mesic nature of this patch is indicated by the presence in this association of Maple (*Acer* spp), whitethorn (*Crataegus monogyna*), false senna (*Coronilla emeroides*), hop-hornbeam (*Ostrya carpinifolia*) and others.¹³ In the Northern part of the Mount Lebanon chain, sporadic cypress tree populations are found in Calabrian pine forests, in Karm-Sadet and Aito villages.¹⁴

¹¹ MoA/UNEP, 1996

¹² METAP, 1995

¹³ Zohary, 1973

¹⁴ Chouchani, et al., 1974

2.2.2 Vegetation Zones

Lebanon's major climatic zones are the Mediterranean zone and the pre-steppe zone. These two Mediterranean climate zones are further sub-divided into ten bio-climatic regimes and 22 vegetation associations.¹⁵

The western slopes of the Mediterranean Mountains are differentiated into five altitudinal zones: Thermo-Mediterranean (0-500 m altitude), Eu-Mediterranean (500-1,000 m), Supra-Mediterranean (1,000-1,500 m), Mountainous Mediterranean (1,500-2,000 m) and Oro-Mediterranean zones (above 2,000 m). The lower zones (Thermo-Mediterranean, Eu-Mediterranean, Supra-Mediterranean) are covered by a belt of evergreen maquis and garrigue, while the higher zones are covered by deciduous forest climax (Mountainous Mediterranean) and dwarf thorny vegetation characterizing the alpine and sub-alpine zones (Oro-Mediterranean).¹⁶

Thermo-Mediterranean Zone (0-500 m)

At sea level, this zone includes a coastal strip harboring plant communities reflecting two habitats: the sandy and rocky beaches. The sandy beach plant communities are made up of many characteristic species such as tamarisk (*Tamarix tetrandra*), sea medik (*Medicago marina*), sea daffodil (*Pancratium maritimum*), coast spurge (*Euphorbia paralias*), shaggy birds (*Lotus villosus*), kalli cyperus (*Cyperus kali*), etc. Rocky beach communities include rock samphire (*Crithmum maritimum*), stonecorp catchfly (*Silene sedoides*), Golden samphire (*Inula crithmoides*), sieber's sea-lavender (*Limonium sieberi*), etc.¹⁷

An upper vegetation zone, characterized by an evergreen garrigue, has been seriously degraded by the overexploitation of shorelines, urban expansion and pollution. Carob (*Ceratonia siliqua*) and pistachio (*Pistacia palaestina*) trees grow in this zone. These plant communities are well developed in the south of Lebanon, while in the north the Carob tree becomes rare and is replaced by myrtle (*Myrtus communis*), hairy thorny-broom (*Calycotome villosa*), spanish broom (*Spartium junceum*), sumac (*Rhus coriaria*), etc.¹⁸

Eu-Mediterranean Zone (500-1,000m)

Maquis vegetation, harboring mainly the Kermes oak and pistachio, was the dominant plant community in this zone. These forests have been seriously degraded, and the climax oak maquis has disappeared and been replaced by a degraded garrigue.¹⁹ Single trees and shrubs of this formation are encountered also at much greater altitudes, such as the Kermes oak (*Quercus calliprinos*) noted at 1,500 m.²⁰

Supra-Mediterranean Zone (1,000-1,500 m)

This zone, found above the evergreen maquis vegetation, is characterized by a deciduous forest climax. In this zone, the vegetation cover is denser as the human population density is lower and major settlements are more recent. The dominant tree species in this zone are Kermes oak, Calabrian pine maquis and stone pine. In many areas, these forests which really belong primarily to the evergreen lower zone, penetrate into the middle zone of the mountains as high as

¹⁵ Talhouk, et al., 2001

¹⁶ MoA/UNEP, 1996

¹⁷ Chouchani, 1979

¹⁸ Zohary, 1971

¹⁹ METAP, 1995

²⁰ Zohary, 1971 & personal observation

or even higher than 1,500 m. At this altitude, stands of *Q. infectoria* var. *boissieri* and *Q. cerris* which are moisture-demanding species, were destroyed by humans and lost their ability to regenerate because of the deterioration of soil conditions following forest clearing. Stone pine forests are limited to the Metn and Jezzine areas.²¹

Mountainous Mediterranean Zone (1,500-2,000 m)

Above 1,500 meters, a coniferous forest climax usually replaces the deciduous forest. Relic forests of Cedar, Cilician fir and Grecian juniper can still be found in this zone. Plant communities encountered also include Cedar Oak (*Q. cedrorum*) in Ehden and Qammou'a, Cyprus Oak (*Q. infectoria*) and Kermes Oak, Calabrian pine, hop hornbeam (*Ostrya carpinifolia*), fan-leaved service tree (*Sorbus flabellifolia*), Lebanon buckthorn (*Rhamnus libanotica*), and olive-like Daphne (*Daphne oleoides*).²²

Oro-Mediterranean Zone (above 2,000 m)

On the high summits dominating the Mount Lebanon chain, the leading plant community is a xerophytic vegetation comprising a formation of cushion-like dwarf thorn shrubs such as Lebanon prickly-thrift (*Acantholimon libanoticum*), makmel garlic (*Allium makmeliana*), angular milk-vetch (*Astragalus angustifolia*), hoary vetch (*Vicia canescens*), stumpy spurge (*Euphorbia caudiculosa*). Due to the isolation effect, many endemic species are found in this alpine zone.²³

The dominant formation on the steppic and desiccated Anti-Lebanon foothills is a degraded garrigue used for grazing. Much of the area is barren or covered by poor overgrazed rangeland. Higher up, in the pre-steppic vegetation zone - between 1,000 and 1,500 m, the vegetation is mainly heavily grazed forestlands of kermes oak. Kermes oak mixed with Cyprus oak dominate the supra-Mediterranean zone. This vegetation shifts higher up to sporadic Grecian juniper trees mixed with dwarf thorny shrubs. On the upper Western Slopes of the Anti-Lebanon chain, pre-steppic vegetation similar to that found on the eastern slopes of the Mount Lebanon chain is found.²⁴

2.2.3 *Riparian vegetation and wetlands*

The riparian vegetation also changes with altitude. In many areas riparian vegetation covers river slopes. It is highly diverse and constitutes a fragile ecosystem that plays a major role in watershed protection and erosion control. Near sea level, the riverbank vegetation cover includes oriental plane tree (*Platanus orientalis*), oleander (*Nerium oleander*), St John's wort (*Hypericum spp.*), laurel (*Laurus nobilis*), small-flowered pancratium (*Pancratium parviflorum*), officinal chaste tree (*Vitex agnus-castus*), and white willow (*Salix alba*). At higher altitudes, the vegetation cover includes alder (*Alnus spp.*) and Lebanese willow (*Salix libani*).²⁵

Lebanon's few swamps and wetlands, principally in Ammiq and Anjar, are important habitats for migratory birds. Dominant vegetation in these ecosystems includes Syrian ash (*Fraxinus syriaca*), Lebanese willow, southern reed (*Typha australis*), water iris (*Iris pseudocarus*), and many other species.²⁶

²¹ Chouchani, 1979

²² MoA/UNEP, 1996 & Chouchani, et al., 1974

²³ METAP, 1995

²⁴ Idem

²⁵ MoA/UNEP, 1996

²⁶ idem

2.3 Forest Cover and Biological Diversity

In 1965, it was estimated that Lebanon had slightly over 130,000 hectares covered by forest, almost equally divided between dense and degraded forest (see Table 1). Estimates in 1995 showed little change: 135,000 ha or only 12.8 percent of the country's surface area. Current "guesstimates" of forest cover vary from as low as 4 percent to as high as 13 percent, depending on what is considered "forest". The Ministry of Agriculture reported in 1996 that forests cover 6.7 percent of the country's surface area.²⁷

Table 1
Estimated dense and degraded forest areas (1965)

Forest	Dense Forests (Hectares)	Degraded Forests (Hectares)	% Dense Forests	% Degraded Forests	% of Total
Cedar and fir	3,831	276	5.6	0.4	3.1
Juniper	7,843	24,568	11.6	37.3	24.3
Pinus pinea	6,997	1803	10.3	2.7	6.6
Pinus brutia	6,486	764	9.6	1.3	5.4
Oak	39,170	30,666	58.5	46.5	52.4
Mixed forests	3,006	7,826	4.4	11.8	8.2
Total	67,333	65,903	100%	100%	100%

Source: Baltaxe, 1965

As noted in Table 1, Lebanon is included in the Mediterranean eco-region hotspot identified by Conservation International.²⁸ The World Wide Fund for Nature (WWF) has also included the Mediterranean region in its "Global 200" priorities for biodiversity conservation. Of the 25 eco-regions on CI's list, the Mediterranean ranks 3rd in vascular plant diversity (number of species) and endemism, 17th in bird diversity and 14th in bird endemism, 11th in mammal diversity and 13th in mammal endemism, 14th in reptile diversity and 10th in reptile endemism, and 15th in amphibian diversity and 16th in amphibian endemism.²⁹ Within this very large eco-region, the small, and poorly studied, country of Lebanon is estimated to have at least 9,119 fauna and flora species.³⁰ Further biological exploration of the country, especially the mountaintops, karst areas, and other isolated areas, is likely to identify many additional species. The high biodiversity is due to the country's topography, past climatic changes, geomorphology, diverse microclimates, its location at a continental crossroads, and the long history of man's presence.

Species that are considered threatened in Lebanon include five species of vascular plants - 0.4 percent of the total flora, six mammals, seven birds, one reptile and one invertebrate species.³¹

2.3.1 Flora

The Lebanese flora includes at least 4,633 species.³² Despite the centuries of deforestation and the resulting extremely low forest cover, the forests and other habitats still harbor high species richness. Additionally, the percentage of endemic plant species in Lebanon,

²⁷ MoE/ECODIT, 2002

²⁸ Mittermeier, et al., 2000

²⁹ MoA/UNEP, 1996

³⁰ MoA/UNEP, 1996

³¹ IUCN Red Book, 2000

³² MoA/UNEP, 1996

estimated at 12 percent, is considered high when compared to other Mediterranean countries with similar histories of human activity.³³

The highest peaks dominating the Mount Lebanon chain, Qornet es Sawda (3,087 m) and Jabal Makmel (3,070 m) are known to harbor a high percentage of endemism.³⁴ The high summits dominating the two mountain ranges (Slenfe, Qamou'a, Qornet es-Sawda, Ehden, Sannine and Mt. Hermon) are considered to be reservoirs for endemic species; one hundred species specific to Mount Hermon and the Anti-Lebanon Range have been counted.³⁵ Further explorations in these areas and other areas likely to harbor large numbers of endemic species, such as Karst formations, are very likely to greatly increase the number of endemic vascular plant species currently estimated for the Lebanon - Israel mini-hotspot.

Additionally, the Lebanese mountains are characterized by the presence of a considerable number of northern species that may be regarded as relics of glaciations during the Pleistocene. These species include plants such as hop hornbeam, maple, rhododendron, manna ash, rusty foxglove and many others. These plant species can still be found, growing sporadically in the remaining forest patches. A fairly large number of forest trees reach their southernmost distributional limits (in the northern hemisphere) in Lebanon's mountains. These species include the Juniper, Cedar, Fir, Lebanese oak, Turkey oak, as well as other species classified under the service tree (*Sorbus*) and Maple (*Acer*) genera.³⁶

Lebanon's agro-biodiversity is also a valuable global resource. A regional agro-biodiversity project based at ICRISAT is working with Lebanon and other countries in the region to identify and conserve wild races of important agricultural plants such as wheat and fruit trees. SEPASAL has estimated that 212 species of plants with economic potential as medicinal plants or edible crops are found in Lebanon.³⁷

2.3.2 Fauna

There are 4,486 known fauna species in Lebanon, of which nearly half are terrestrial.³⁸

Vertebrates

A recent survey estimated that over 300 bird species are found in Lebanon. A relatively small number of them (100) nests in Lebanon. The estimates of species rarely seen in Lebanon are approximately 25 percent of all species observed. Several factors explain this phenomenon: bio-geographical situation, climate, rain spread over several months of the year, impact of urban development, hunting, deforestation, and reduced habitats. In spring and autumn, millions of songbirds, game birds and soaring birds migrate through Lebanon. Migrating songbirds include thrush, doves, quail, finches, swallow, etc. Soaring birds include birds of prey, storks, pelicans, white storks, honey buzzard, Levant sparrow hawk, and the lesser-spotted eagle.³⁹

Fifty mammal species are believed to have once been found or to be currently found in Lebanon. These include 19 species that are now extinct in Lebanon and five that are threatened

³³ Davis, et al., 1994

³⁴ Zohary, 1973 & Medail, et al., 1997

³⁵ Medail & Quézel, 1997

³⁶ Zohary, 1971

³⁷ MoE/ECODIT, 2002

³⁸ MoA/UNEP, 1996

³⁹ MoA/UNEP, 1996

with extinction. Both carnivore and herbivore species are threatened with total extinction, while rodents and insect eaters are on the increase. According to the national biological diversity assessment of fauna species, the Syrian brown bear (*Ursus arctos syriacus*), African leopard (*Panthera pardus nimr*), Persian lynx, deer, Arabian gazelle (*Gazella gazelle arabic*) and golden hamster (*Mesocricetus auratus brandti*) have become extinct in Lebanon; while the wolf (*Canis lupus pallipes*), wildcat (*Felis silvestris tristrami*), and mongoose are close to extinction. Shrews (*Crocidura* spp.) and bats (*Eptesicus* spp.) are rare, and populations of the hyrax (*Procavia capensis syriaca*), squirrel (*Sciurus anomalous syriacus*), black rate, fox (*Vulpus vulpus palaestina*), black tailed dormouse (*Eliomys melanurus*), field-mouse, gray hamster, jird (*Meriones tristrami*), snow vole (*Microtus nivalis hermonis*) and Levant vole (*Microtus guentheri guentheri*), jackal (*Canis aureus syriacus*), mole rat, brown rat, and the two endemic species - greater mouse-eared bat and Lebanese common knothole - are greatly diminishing.⁴⁰

Forty-eight species of reptiles and only five species of amphibians are known to exist in Lebanon.⁴¹

The National Center for Marine Sciences has inventoried 218 marine fish from 140 genera. An additional 25 species are confirmed to exist in Lebanese freshwater systems. Zooplankton account for the largest share of marine faunal diversity with more than 747 species recorded. Other families of marine organisms include cephalopods, reptiles and mammals.⁴²

2.3.2 Invertebrates

Few surveys of invertebrates have been done. Estimates include: terrestrial mollusks - 124 species, arachnids -242 species and insects - 842 species including 268 homoptera, 212 lepidoptera, 116 coleoptera, 149 hymenoptera, 16 Diptera, 16 Orthoptera, and 63 Apterygota.⁴³

2.4 Causes of the Loss of Forests and Biodiversity

The root causes of loss of biodiversity and other forms of natural resource degradation in Lebanon, as in other parts of the world, include:

1. Inequitable access to economic opportunity;
2. Unsustainable population growth and natural resource consumption;
3. Failure of national accounting systems to value the environment and its resources;
4. Deficiencies in knowledge and its application; and
5. Lack of integration of conservation and sustainable use of biodiversity and related natural resources in legislation, policies and programs (legal and institutional systems that promote unsustainable exploitation).

Each of these causes must be addressed if efforts to conserve forests and biodiversity are to succeed. Population growth and inequity are problems that must be addressed throughout society. Any program designed to conserve forests or biodiversity should recognize these principal causes of natural resource degradation and address them. In particular, underprivileged segments of the population must be the principal beneficiaries of such programs. However, if the

⁴⁰ Idem

⁴¹ Idem

⁴² Idem

⁴³ Idem

impact of these causes is to be significantly reduced, actions outside the natural resource sector will be more important than those within the sector. Among other things, educational and employment opportunities must be expanded.

The other causes of natural resource degradation should be addressed within the sector by strengthening educational and research institutions that deal with the natural resource sector and by improving policies so that the national accounts do reflect the cost of natural resource degradation as well as the benefits of improved natural resource management and by integrating natural resource management concerns into other sectors of the economy and public policy.

2.5 Threats to Forests and Biodiversity

Most, if not all, of the threats to forests and biodiversity are derived in some way from the causes discussed briefly above. The threats to forests and biodiversity in Lebanon include:

1. Conversion of natural habitats, such as forests, coastal zones and coastal wetlands, to urban, industrial and/or agricultural uses. Among 206 plant species listed as threatened, urbanization accounts for over 60 percent of the threats;⁴⁴
2. Concentration of population growth in the coastal zone - while this practice reduces pressure on upland forests and other ecosystems, it has led to severe degradation of coastal ecosystems;
3. Widespread and excessive use of pesticides and other agro-chemicals;
4. Harvesting of forest products, both fuel wood and timber and non-timber forest products such as aromatic plants. For example, wild ornamental plants (and cut flowers such as the narcissus) are being harvested at liberty and perhaps at rates exceeding their rate of natural regeneration;⁴⁵
5. Overgrazing which destroys natural regeneration and compacts soils;
6. Uncontrolled hunting - especially of migratory birds - in the coastal zone hunting is believed to be responsible for reducing the breeding population of passerines to about 10 species (see Box 1 on hunting "malpractices" in Lebanon);
7. Private ownership of beaches and shore properties coupled with an abusive interpretation of the law establishing the maritime public domain and defining its lawful uses. A growing number of man-made embankments and the deterioration of the coastline have destroyed several important biocenoses (biotic communities);⁴⁶
8. Forest fires - while the area burned annually appears small, it becomes large when seen from the perspective of the percentage of remaining forest which is burned - at 1,200 hectares per year this is almost 1 percent of the area covered by dense or degraded forest;
9. Introduction of invasive species;
10. Over fishing and use of nets that catch species such as turtles as well as the target species;

⁴⁴ MoE/ECODIT, 2002, p. 148

⁴⁵ MoE/ECODIT, 2002, p. 150

⁴⁶ MoE/ECODIT, 2002, p. 160

11. Quarrying, which leads to deforestation, destruction of natural habitats, landslides and gully erosion;
12. Tourism that is not carefully managed to minimize negative impacts on natural ecosystems; and
13. Air and water pollution.

Many of the threats listed above involve the loss of forest cover. Loss of cover means loss of habitat for biodiversity but it also means watershed degradation - which, in turn, leads to floods and droughts, soil erosion, and landslides that can result in the loss of human lives and the destruction of expensive infrastructure.

The impact of human activities often leads to unforeseen consequences. For example, the hunting of wood thrushes is believed to have interfered with regeneration of *Juniperus excelsa*. Wood thrushes feed on the fruits of this Juniper and the seeds are scarified with an acid treatment as they pass through the bird's gut. Thus the birds distribute the seeds and facilitate their germination.

Box 1

Hunting “Malpractices” in Lebanon

Most hunters have no training in, or familiarity with, basic gun safety, game recognition, sportsmanship, or environmental stewardship. Their practices have penalized the minority of hunters who are ecologically minded and given them a bad image. Many hunters trespass on protected areas and on private properties against owners' wills and have no respect for minimum setback distances (safety, nuisance). They shoot at the smallest, non-game birds, and often begin shooting before sunrise and continue after sunset. Shooting from the car is not uncommon.

Although bird raptors (“jawareh”) are protected by international law, many hunters in Lebanon consider them fair game, shooting at migrating Vultures, Eagles, Buzzards, Harriers, Hawks and Falcons. Storks (“laklak”), Pelicans (“bajaa”) and Cranes (“kerke”) are also the targets of some shooting, although the pressure on them seems to have subsided in recent years. An increasing number of hunters use illegal tricks and devices to catch birds or lure them within shooting range, such as:

- Sticky rods (limes) to catch small birds;
- Blinds and live decoys to attract and shoot/catch partridges (Chukar) and the Golden Finch;
- Recorded tapes played on loudspeakers to attract and shoot songbirds such as Thrushes, Larks, Buntings, Finches, and Quails;
- High-powered light projectors to attract birds migrating at night such as thrush or to shoot roosting birds; and
- Mist nets, tranquilizers, and poison.

Hundreds of thousands (about 10 millions) of migratory birds are hunted each year over Lebanon, including small birds such as ortolans, chaffinches, and larks. Many hunters bag up to three or four hundred such birds on a heavy migration day (the concept of bag limits is totally foreign!). For example, on September 16, 2001, tens of thousands of quails were hunted throughout Lebanon, after being lured to the fields by song recordings during their night migration. Many hunters shot 100-200 birds on that day.

Protected by the Bonn convention, the Ortolan Bunting is the subject of a tug of war between Lebanese conservationists, who want to protect it, and hunters, who want it to be included on the official list of bird games in Lebanon.

Source: MoE/ECODIT, 2002, p. 159

3. INSTITUTIONAL AND LEGAL FRAMEWORK FOR FOREST & BIODIVERSITY CONSERVATION

This chapter provides an overview of Lebanon's legal and institutional framework for forest and biodiversity conservation. It also provides a summary of past and on-going donor projects related to forests and biodiversity.

3.1 Convention on Biological Diversity (CBD)

In recognition of the importance of biodiversity (see Box 2), 150 states including Lebanon signed the Global Convention on Biological Diversity (CBD) at the June 1992 UN Conference on Environment and Development in Rio de Janeiro. Lebanon later ratified the convention in December 1994.

Box 2 **Importance of Biological Diversity**

“The earth's genes, species, and ecosystems are the product of over 3 billion years of evolution and are the basis of the survival of our own species. Biological diversity - the measure of the variation in genes, species and ecosystems – is valuable because future practical uses and values are unpredictable, because variety is inherently interesting and more attractive and because our understanding of ecosystems is insufficient to be certain of the impact of removing any component.”

Source: MoE/IUCN, 1999

Following the signature and ratification of the Convention, the GoL prepared in 1996 the “Biological Diversity of Lebanon” report (MoA/UNEP, 1996), which is the most comprehensive assessment of biological diversity in Lebanon to date. With grant funding from GEF/UNEP, 33 scientists reviewed and compiled existing data on species nationwide. However, several aspects of the study are the source of continued debate among scientists: number and distribution of outstanding species (i.e., threatened, endangered and other species of economic importance), trends in Lebanon's flora and fauna. Such discrepancies will persist as long as field studies are not carried out to update information on Lebanon's flora and fauna. The lack of qualified taxonomists, ecologists and other biological specialists is a major constraint to effective field research and the conservation of forests and biodiversity (see Box 3 for a discussion of the scientific base in Lebanon).

Under Article six of the CBD, the GoL is required to develop and implement a national strategy and an action plan for the conservation and sustainable use of biological diversity. It should also “integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programs and policies.” Furthermore, under Article 26, Lebanon should present to the Conference of Parties regular reports on measures taken to implement the provisions of the convention.

Box 3 An Overview of Lebanon's Scientific Base

Lebanon's flora and fauna were written over a hundred years ago and have not been revised or updated since. The number and range of species endemic to Lebanon and its immediate neighbors is not known. The experts with whom we met admit that the numbers for total species and endemic species reported in the "Biological Diversity in Lebanon" national reports are only estimates. There is little information on Lebanon's karst heritage and biodiversity, although it is widely recognized that such features are often centers of endemism in other countries. The mountain peaks are suspected of harboring endemic species not known to science, but there is no systematic exploration of such areas. There is insufficient information about the ecology of Lebanon's principal species or its forests to properly manage either the species or the forests. Natural resource managers attempt to "reintroduce" species thought to have been native to Lebanon without sufficient evidence to support these suspicions and, worse yet, without sufficient knowledge of the habitat requirements of the "reintroduced" species to be sure that it can survive without doing serious damage to protected ecosystems. An ecotourism industry will need to provide tourists with information on the ecology of Lebanon's protected areas as well as guidebooks to wild flowers, trees, insects, butterflies, etc.

Lebanon does not have the trained ecologists, taxonomists, other field biologists, natural resource economists, and natural resource managers it needs to carry out the research needed for it to develop and maintain a viable system of protected area. Unfortunately, at this time, the demand for these specialties is not sufficient to motivate Lebanese university students to prepare themselves for careers where they will contribute to the conservation of Lebanon's forests and biodiversity. The problem is that Lebanon needs these professionals now, but even if Lebanon's university system now offered curricula designed to prepare students for careers in natural resource management, it would take years to, for example, prepare an individual who could lead the effort to update the flora of Lebanon, oversee a national herbarium, or maintain a website devoted to the flora of Lebanon.

In November 1998, with the collaboration of the UNDP and GEF, the MoE developed a national strategy and action plan for biodiversity conservation. This strategy adopted or established the following nine goals:

1. Protect Lebanon's terrestrial biodiversity from degradation and ascertain their availability for environmental and economic benefits;
2. Conserve freshwater biodiversity through the sustainable management and wise use of freshwater resources;
3. Protect Lebanon's coastal and marine biodiversity and develop these resources in a sustainable way;
4. Protect Lebanon's agricultural biodiversity from degradation, and secure its availability while maximizing both environmental and economic benefits;
5. Conserve biodiversity under natural conditions and establish a balanced ecosystem where plants and animals evolve naturally;
6. Conserve Biodiversity *ex-situ* and utilizing existing capacities;
7. Protect natural ecosystems from invasive species;
8. Share global responsibilities in the use, conservation and management of biodiversity; and
9. Share knowledge, costs and benefits with individuals and communities.

The Action Plan included specific recommendations to achieve these goals in the short, medium and long terms.

3.2 Institutional Framework

Conservation of forests and biodiversity is currently a responsibility shared by two ministries:

1. Ministry of Agriculture (MoA), which is a relatively senior government administration with more than 40 years of experience in forest management and a staff of several hundred; and
2. Ministry of Environment (MoE), which is the youngest ministry in the Republic of Lebanon (established in 1993) and with a combined workforce of 62 employees and project staff.

Law 216/93 established MoE and defined its mandate and functions. Several organizational decrees followed creating some confusion about the Ministry's current mandate and functions. Therefore, the GoL has drafted a decree, expected to be promulgated soon, that would reorganize the MoE into seven departments, including a department for natural resources. This department would be responsible for overseeing the management of nature reserves and conserving biodiversity.

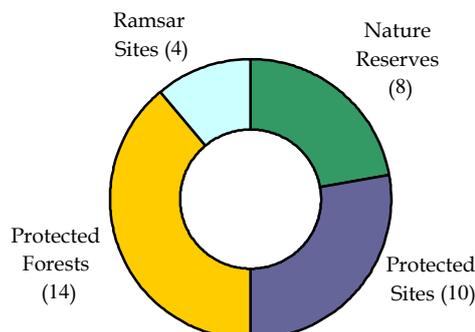
The Ministry of Agriculture's Directorate of Rural Development and Natural Resources is responsible for managing Lebanon's forests. The Directorate currently employs 221 forest guards and operates 31 forest stations across the country. Forest guards are responsible for enforcing forest protection laws and regulations, such as the National Forest Code (Law 558/96).

While not directly responsible (or mandated) for conserving forests, the Lebanese Air Force has in recent years been assuming a growing role in combating forest fires. Between 1999 and 2002, the Lebanese Army acquired 15 fire-fighting "buckets" which are mounted on helicopters. The buckets are filled in the sea or inland water bodies (Qaroun lake) and can be released anywhere in the country within 30 minutes of notification. Airborne fire fighting has proven instrumental in containing forest fires when they are reported early, but less effective when the blaze has time to spread. There is also concern over the use of saltwater to fight fires. The fire-fighting unit of the Lebanese Air Force maintains direct contact with regional army stations, the civil defense, and the MoA's forest stations.

3.3 Legal and Regulatory Framework

Lebanon hosts eight nature reserves (established by law), 10 protected sites (established by Ministerial decision), 14 protected forests (established by MoA), and four Ramsar Sites (wetlands) of International Significance (see Figure 1). Some sites appear in more than one category. For example, Palm Islands and Tyre Coast are both Ramsar Sites and legally protected Nature Reserves. The cedars of Tannourine were declared "Protected Forest" in 1996 and "Nature Reserve" in 1999. Lebanon also boasts five world heritage sites as well as areas protected by private initiatives.

Figure 1
Number of Nature Reserves and Other Protected Sites in Lebanon



Note: Chart does not include World Heritage Sites or sites protected thanks to private initiatives.

Source: MoE/ECODIT, 2002

3.3.1 Nature reserves

Between 1992 and 1999, a total of seven nature reserves were established by law, covering about 207 km² or 2 percent of the Lebanese territory (see Table 2). This achievement was the result of the concerted efforts of dedicated individuals, local NGOs, local governments, and the MoE. In addition, MoE proclaimed the reserve of Karm Chbat under a ministerial decision.

Table 2
The Eight Nature Reserves of Lebanon: Legal Basis, Approximate Area and Elevation Zone

<i>Nature Reserve</i>	<i>Law</i>	<i>Date</i>	<i>Approximate Area (km²)</i>	<i>Elevation Zone (meters)</i>
Horsh Ehden Nature Reserve	121	9/3/1992	17	1,200-1,900
Palm Island Nature Reserve (marine basin)	121	9/3/1992	5	Sea level
Shouf Cedars Nature Reserve	532	24/7/1996	160	900-2,000
Tyre Coastal Nature Reserve	708	5/11/1998	4	Sea level
Bentael Nature Reserve	11	20/2/1999	2	250-800
Yammouni Nature Reserve	10	20/2/1999	17.5	1,400-2,000
Tannourine Cedars Nature Reserve	9	20/2/1999	1.5	1,300-1,800
Karm Chbat (MoE Decision 14/1)	NA	6/10/1995	NA	NA

NA: Not Available

Source: MoE/ECODIT, 2002 (areas and elevation zones provided by Greenline Association using GIS)

Legislative gaps

Whilst the legal framework for the establishment of these reserves was the founding block for conservation management, the laws fall short of providing an effective management perspective that promotes sustainable development and viable economic activities that are compatible with the conservation of natural areas. Specifically, Articles 2, 3, 4 and 5 of the laws establishing the reserves prohibit the exploitation of all wood and non-wood forest products, as well as camping and grazing.

Enforcement of these strict conservation measures has generated mixed results. Whereas enforcement has led to a notable increase in the natural regeneration of several plant species (including cedars) in the Al Shouf Cedars and Horsh Ehden Nature Reserves, it has also partially alienated local communities. These forest systems supported viable economic activities that were interrupted when the reserves were proclaimed. Many villagers used to harvest medicinal and aromatic plants, sometimes with an innate understanding of and attention to nature's carrying capacity requirements. The management team and municipality of the Al Shouf Cedars Nature Reserve have filed several lawsuits against shepherds who have trespassed the reserve boundary.

While such stiff regulation was necessary to protect the reserves at a time when hunting, grazing and felling were practiced liberally, today's concern is finding income generating activities (such as harvesting plants, ecotourism, controlled grazing, and bee farming) that are compatible with the conservation of natural areas. Such activities could generate much needed income for local communities and support park management activities. Sustainable economic activities could provide valuable additions to MoE's contributions (see Table 3 for an overview of MoE donations).

Table 3
MoE Contribution to the Management of Lebanon's Nature Reserves
(in million LBP)

<i>Reserve</i>	<i>Year</i>					<i>Total</i>
	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>	
Chouf Cedars	51	60	55	55	80	301
Horsh Ehden	20	40	45	45	65	215
Palm Islands	20	40	45	45	65	215
Bentäel	-	-	-	25	65	90
Tyre Coast	-	-	-	25	65	90
Tannourine Cedars	-	-	-	25	80	105
Yammouneh	-	-	-	-	-	-
TOTAL	91	140	145	220	420	1,016

Source: MoE/ECODIT, 2002

MoE is aware of the limitations and gaps of the current laws establishing protected areas and has prepared a draft framework law for the establishment and management of nature reserves in Lebanon. The parliament is currently reviewing the draft law, whose approval is imminent. Under this framework law:

1. Nature reserves would be established to protect important ecosystems or landscapes;
2. Nature reserves may be established on public as well as private lands;
3. Nature reserves would be established by a decree defining the boundaries of the "strict protection area" and the "sustainable development region";
4. In the event that large portions of the proposed reserve are privately owned, the MoE must acquire express approval from the landlords of three fourths of the total private land;

5. Management guidelines for both the “strict protection area” as well as the “sustainable development region” would need to be developed by decree pursuant to the law; and
6. Management of “sustainable development regions” should balance conservation and economic issues.

Other provisions under the framework law include the appointment of follow-up committees, the preparation of five-year management plans, and the delegation of the management functions to either the public or private sector institutions, to be designated by the Minister of Environment.

3.3.3 Protected forests

Rapid deforestation of Lebanon’s already greatly reduced forest areas has prompted the GoL to enact more stringent forest legislation. The Forest Code (Law 85 of 12/9/1991), amended by Parliament in 1996 (Law 558 of 24/7/96), stipulates that all cedar, fir, cypress, juniper forests and “other forests” in Lebanon are protected *de facto*. Moreover, at least 15 forests were declared protected explicitly by ministerial decisions (MoA) under the amended Forest Code, as listed in Table 4. Unfortunately the Ministry of Agriculture seems currently unable to effectively monitor recreational and economic activities or natural catastrophes within the protected forests.

Table 4
Forests Protected by Ministerial Decision under the Forest Code (558/1996)

Decision	Date	Region	Description				
			Cedar	Fir	Juniper	Cypress	Other
499/1	14/10/96	Tannourine/Hadath el Jebbeh, Jajj and Arz el Rab (Bsharre)	X				
587/1	30/12/96	Swayse (Hermel)	X	X	X	X	
588/1	30/12/96	Aamouah (Akkar)	X	X	X	X	Pine
589/1	30/12/96	Karm Chbat (Akkar)	X	X	X		
591/1	30/12/96	Bazbina (Akkar)	X	X	X	X	
592/1	30/12/96	Knat (Knat)	X	X	X		Oak
10/1	17/1/97	Qaryet el Sfina (Akkar)	X				Oak
11/1	17/1/97	Merbine (Wadi Jhannam)	X	X	X		
8/1	17/1/97	Ain el Houkaylat/kornet el kif (Dinniyeh)	X	X	X		Oak
9/1	17/1/97	Jurd el Njas/jabal el Arbaiin (Dinniyeh)	X	X	X	X	
174/1	25/3/97	Chbaa (Hbaline)	X	X	X	X	Pine
3/1	8/12/97	Bkassine (Jezzine)					Pine

Source: MoE/ECODIT, 2002

3.3.4 Protected Sites

In 1998, the Ministry of Environment declared five rivers (Dog, Beirut, El Aassi, Aarkah, and Awali), one valley (Damour), two mountaintops (Makmel and Qornet el Sawda), and the Shouf region as protected sites (Ministerial decisions 97/1, 130/1, 189/1, 188/1, 187/1, 131/1, 129/1, and 122/1). According to these decisions, MoE will develop, in coordination with the Directorate General for Urban Planning, permitting standards for the construction and operation of any facility around these sites and within a 500-meter buffer zone. Enforcement remains a problem as MoE requires the assistance of the *Mohafez* (regional governmental representative) to enforce environmental legislation and there appears to be some contradiction between the decisions and other legal instruments. Meanwhile, MoA has declared other natural sites protected

by ministerial decision including Hbaline, in the caza of Byblos (152/1, 1992) and Kfarzebid (71/1, 1992).

3.3.5 Ramsar wetland sites

The Convention on Wetlands, signed in Ramsar (Iran, 1971), is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation of wetlands and their resources. There are presently 125 Contracting Parties to the Convention, with 1,078 wetland sites (totalling 82 million hectares), four of which are located in Lebanon: Ammiq Estate (year 2000), Ras el Chaq'aa (2000), Tyre Coastal Nature Reserve (2000) and Palm Islands (2001). All sites except Ammiq Estate are marine wetlands. Being included in the Ramsar List of Wetlands of International Importance increases the chances that these four sites will benefit from international funding for conservation management. All sites except Ras el Chaq'aa currently benefit from international funding: The Palm Islands is one of three beneficiaries under a five-year GEF/UNDP conservation project (1996-2001), and Ammiq Estate and Tyre Coastal Nature Reserve are jointly targeted under a FFEM cooperation framework (2001-2004).

3.3.6 World Heritage Sites

Lebanon is a signatory of the Paris Convention (1972) that calls for the protection of the world's cultural and natural heritage. Of the 690 sites on UNESCO's World Heritage List, five are in Lebanon. These are Tyre, Baalbek, Byblos, Anjar and the Qadisha Valley (see Table 5). To be inscribed on the World Heritage List, candidate sites must meet at least one of several "cultural" and/or "natural" selection criteria. The criteria applicable to the five sites in Lebanon are multiple. Several initiatives are underway to add the valley of Nahr Ibrahim to the list - a picturesque valley where forest and biodiversity abound, just 40 km north of Beirut.

Table 5
List of World Heritage Sites in Lebanon

<i>Site</i>	<i>Date</i>	<i>Criteria</i>	<i>Description</i>
Baalbek	1984	Cultural	Originally a Phoenician city, it retained its religious function in Roman times when the sanctuary of Heliopolitan Jupiter drew thousands of pilgrims. With its colossal structures, Baalbek is one of the most impressive examples of Imperial Roman architecture at its apogee.
Anjar	1984	Cultural	The ruins of Anjar, a city founded by Caliph Walid I at the beginning of the 8 th century, has a very methodical layout, reminiscent of the palace-cities of ancient times. It is a unique testimony to Omayyad city-planning
Tyre	1984	Cultural	According to legend, the purple dye was invented in Tyre. It was a great Phoenician city that ruled the seas and founded prosperous colonies such as Cadiz and Carthage. Its historical role declined at the end of the Crusades. It conserves important archaeological remains, mainly from Roman times.
Byblos	1984	Cultural	Byblos is the site of the multi-layered ruins of one of the most ancient cities of Lebanon, closely tied to the legends and history of the Mediterranean region for many thousands of years. Byblos is directly associated with the history of the diffusion of the Phoenician alphabet.
Wadi Qadisha	1998	Cultural & Natural	The Qadisha valley is one of the most important early Christian monastic settlements in the world, and its monasteries, many of great age, are positioned dramatically in a rugged landscape. Nearby are the relic cedar forests highly prized for the construction of great religious buildings in Antiquity.

Legend : 'C' for Cultural heritage criteria and 'N' for Natural heritage criteria.

Source: <http://www.unesco.org/whc/sites>

Although only the Qadisha site is important for its biodiversity, all the sites are important for their tourism potential and both cultural and ecological tourism could complement one another as important economic resources. Wadi Qadisha is located near a relic cedar stand (*Cedars of the Lord*) and each of the other sites is within a one-hour drive (or less) of one of Lebanon's seven nature reserves.

3.3.7 Private initiatives

The Ammiq swamp (880 m)

This semi-permanent freshwater marsh measures roughly 240 ha during the rainy season. It lies on one of the most important bird migratory routes between Europe and Africa. The marshes were originally much larger, covering several thousand hectares, but were gradually reduced to their present size following the construction of drainage canals and artesian wells. Most of the area is inundated in the winter, but in summer only two small areas of open water remain. The marshes fall within a 2,400-hectare private estate. The fields around the marshes are edged with reeds and bramble bushes. In June 2001, a grant was concluded between the GoL and the "Fond Français pour l'Environnement Mondiale" to design and implement an integrated management program at the site.

"La Reserve" de Afqa (1,500-1,800 m)

A private entrepreneur has rented this three-million m² land (over a period of 17 years) to offer camping and other recreational activities (hiking, horseback riding, caving, mountain biking, etc.). The facility receives more than 4,000 visitors every year and has a come a long way in promoting environmentally friendly tourism. La Reserve is located at higher elevations in the caza of Jbeil, atop the famous Afqa source of Abraham River (*Nahr Ibrahim*). The site includes habitats of a large number of plant species and trees, including the cypress and the juniper, and offers breathtaking views overlooking the Nahr Ibrahim valley. A drive across a recently constructed road stretch takes you above the tree line and across the mountain peak, before descending to the East into the Bekaa plain.

3.4 Conservation Projects

Since Lebanon ratified the Convention on Biological Diversity, the GoL has secured approximately US\$4.9 million in grant support for implementing biodiversity-related projects (see *Appendix H*). Major donors include GEF/UNDP, FFEM and Kew Gardens in the UK. Lebanon has benefited from an additional US\$4.8 million to support forest management related projects. Other grants related to forests and biodiversity include programs on desertification (US\$ 285,000) and coastal management (US\$1.4 million).

4. RECOMMENDATIONS FOR FOREST & BIODIVERSITY CONSERVATION

At the time that most of the world was becoming aware of the growing threats to global biodiversity and its value, Lebanon was occupied with a civil war. Since the war ended, the country has focused on reconstruction, reconciliation and the development of public institutions. The country has also been trying to catch up with all the time lost not protecting its environmental and natural resources. Thus, despite the fact that Lebanon has well prepared human resources and strong educational institutions, it has lagged behind other nations in ensuring that one of its most precious assets, its biological diversity, is preserved for the use and enjoyment of future generations.

This chapter presents a selection of recommended actions for Lebanon to conserve its forests and biodiversity, drawing on a range of conservation measures now being carried out around the world as relevant and applicable to Lebanon. While many of these recommendations are intertwined, we have grouped all recommendations into three priority recommendations (Section 4.1) plus a pool of other stand-alone recommendations (Section 4.2).

4.1 Priority Recommendations

Based on the analysis of the status of forests and biodiversity in Lebanon (Chapter 2) and the institutional and legal framework for forest and biodiversity conservation (Chapter 3), the highest priorities for forest and biodiversity conservation in Lebanon appear as follows:

1. Develop a protected area system that includes a representative sample of all significant habitats and ecosystems;
2. Strengthen the science base necessary to support conservation efforts; and
3. Develop and implement cost-effective reforestation programs based on the promotion of natural regeneration.

4.1.1 *Develop a protected area system that includes a representative sample of all significant habitats and ecosystems*

Ideally, developing the science base would be a priority, but if Lebanon spends years addressing this weakness, many endemic species might become extinct in the meantime and the species and economic opportunities would be lost forever. Thus Lebanon should proceed as rapidly as possible to establish a network of protected areas that includes all of Lebanon's remaining forests, wetlands (marine and freshwater), high mountaintops, and all undeveloped beaches and waterfront areas, as well as any other habitats, such as karst features and isolated river valleys, suspected of harboring important elements of Lebanon's biodiversity. A multi-disciplinary group of national and international experts on Lebanon's biodiversity should be convened to select areas to be included in the system and to elaborate guidelines for the management of protected areas that draws upon relevant international and national experience and adapts this experience to the Lebanese situation. This team of experts would develop a list of research priorities needed to develop the information necessary for the continued development of the protected area system - including the addition of new areas to the system as well as the removal of any areas found to be unnecessary for the conservation of forests or biodiversity.

4.1.2 *Strengthen the science base necessary to support conservation efforts*

Lebanon needs a variety of taxonomists, forest, wetlands, marine and alpine ecologists, natural resource economists and other specialists to identify the species and habitats in need of protection, develop management plans for protected areas, evaluate and develop the economic potential of protected areas and their buffer zones, ensure that local communities participate fully in, and benefit from, conservation efforts, and to prepare the economic studies which will demonstrate the costs of environmental degradation as well as the benefits of conservation to political leaders and the general public.

We suggest that Lebanon initiate and sustain a process to update the science base for biodiversity and forestry conservation by convening a multi-disciplinary group of national and international experts on Lebanon's biodiversity to suggest priorities for species and habitat protection as well as for research and education needed to support protection efforts. This panel should also be asked provide guidelines for establishing the institutional arrangements necessary to develop and maintain the science base for conservation and to prepare Lebanese scientists and resource managers to lead the process.

Lebanese education and research institutions could take an immediate step toward improving institutional arrangements by forming collaborative arrangements to share information among themselves and to work together on important research projects (see Box 4). While Lebanon is preparing its own biologists, resource managers, and natural resource economists, Lebanese universities could invite visiting faculty to teach key subjects and participate in research projects. The GoL, donors, international NGOs, and the Lebanese private sector (the tourism industry, for example) could support such efforts as well providing funding for research grants, the establishment of field research facilities, study tours and exchange programs for students and young professionals, attendance at international symposia and courses, and workshops or retreats for young scientists and resource managers to share and reflect upon their experiences and the lessons they have learned.

Box 4

Establishing Collaborative Relationships with Local & International Research Institutions

One approach to developing the science base is to establish collaborative relationships with research and educational institutions in the more developed world; examples of such relationships include the Organization for Tropical Studies in Costa Rica, Merck and INBIO in Costa Rica; Smithsonian Institution in Panama; the St. Louis Botanical Garden in Panama; Kew Gardens in former British colonies and elsewhere including Lebanon; Princeton University in Peru's amazon basin; the University of Connecticut and New Mexico State University in Paraguay; the University of Aarhus (Denmark), the New York Botanical Garden, the St. Louis Botanical Garden and Ecuador's Catholic University in Ecuador; etc. We recommend that Lebanese research and educational institutions seek opportunities to develop similar relationships first among themselves and then with institutions abroad - especially countries in Mediterranean type climatic zones.

One immediate opportunity for donor support would be to continue the development of a national herbarium and online flora of Lebanon at AUB. These projects, begun by Dr. Musselman, a visiting professor from Old Dominion University in Virginia, will contribute to updating the flora of Lebanon and will be important tools for other researchers studying the flora and/or ecosystems of Lebanon and other countries in the region. These tools are needed to identify species and habitats in need of protection, support studies of the ecology of important

ecosystems to improve their management and evaluate the impact of human activities such as ecotourism, these resources, develop brochures for use by visitors to protected areas, develop field guides to the trees and wild flowers of Lebanon, etc.

4.1.3 Develop and implement a cost-effective reforestation program based on the promotion of natural regeneration

Starting in the 1960s Lebanon and international donors, most notably the Food and Agriculture Organization of the United Nations (FAO) have supported “large-scale” reforestation programs that have achieved limited success in reestablishing forest cover on Lebanon’s barren over-grazed hillsides. Even if they had been more successful, it is difficult to imagine where the funds would come from to reforest all of the barren hills or even to protect important watersheds. In general Lebanon’s hillsides are eroded, and its mountain soils too shallow to support forests everywhere.

Probably the most promising approach to reforestation would be one that promotes natural regeneration of forests on the most promising sites - sites with adequate soil and moisture to sustain tree growth. This process might start with the planting of a sufficient number of trees to protect these sites from further erosion and maintain their hydrologic properties. Direct seeding, either by hand or by air, is another alternative for both the initial establishment of trees on favorable sites and for the expansion of existing forests.

Before this approach is initiated on anything more than a very local scale, research would be needed on the site requirements of the individual species to be planted. Also more needs to be known about the germination requirements of the seeds as well as how these seeds are disseminated in nature. Any attempt to promote natural regeneration must mimic nature as much as possible.

Once enough is known about the site and germination requirements of the selected species, seed trees can be selected, local residents can be “recruited” to collect seeds, and nurseries can be established (in communities, at schools, on farms, etc.) close to the planting site. Alternatively, technical assistance can be provided to individuals interested in growing tree seedlings for sale as ornamentals, trees for reforestation projects, or Christmas tree plantations. Seedlings from these nurseries would then be planted at sites selected because soil and moisture conditions favor tree growth.

In areas where direct seeding is tested, the nursery step would be skipped and seeds from select seed trees would be disseminated at the site, probably by hand, but for larger areas aerial seeding might be attempted. Some site preparation might be necessary for direct seeding. Once these first trees have reached seed bearing age, it would probably be necessary to do some site preparation in the surrounding area to promote seed dissemination and germination and seedling establishment. It might be necessary to introduce fauna responsible for seed dissemination if such fauna are not already present.

This is obviously a long-term process, but it is more likely to succeed than planting seedlings on badly eroded slopes and is much less costly on a per hectare basis. For those reasons, assisted natural regeneration will produce measurable results faster than the approach taken in the 1960s.

4.2 Other Recommendations

In addition to the priority recommendations described in Section 4.1, we have identified a number of other stand-alone recommendations to conserve forests and biodiversity in Lebanon:

1. Train municipalities and NGOs in the management of public lands and protected areas;
2. Develop ecotourism as a tool to conserve biodiversity;
3. Promote awareness of the Convention on Biological Diversity;
4. Integrate biodiversity conservation into the economic sectors;
5. Develop a strategy for linking forest patches and other natural habitats;
6. Develop picnic grounds;
7. Document local (indigenous) knowledge and ensure its transfer to future generations;
8. Provide basic agricultural services to encourage farmers to conserve agro-biodiversity; and
9. Empower local farming communities.

4.2.1 *Train municipalities and NGOs in the management of public lands & protected areas*

Management of protected areas by local populations (municipalities, NGOs, cooperatives, and other community based organizations) has been found to be one of the most successful approaches to the management of such lands in many areas of the world, yet one of the people we interviewed remarked that this approach had failed in Lebanon so far.⁴⁷ Nevertheless, we believe that the alternatives to major involvement of local populations in managing protected areas -- especially when they have been accustomed to using the area for grazing, extraction of fuel-wood, harvesting of non-timber forest products, etc.-- are so unlikely to succeed that the experience in Lebanon with local management of public lands should be carefully evaluated and compared with models used in other countries.

One of the key elements in these models is that most of them involve the participation of international NGOs or consulting firms in providing technical assistance and training to the community as a whole, as well as the persons selected for management roles --as professionals and para-professionals. In some cases national government agencies and/or strong national NGOs also play a role.

The GoL could request donor assistance in evaluating its experience with local management of public lands and in developing alternative models for testing in Lebanon. This same donor, or another, would need to make a grant to an international NGO or contract a consulting firm (international or local with access to international expertise) - or alternatively make arrangements for an NGO and a firm to work together - to provide training and technical assistance to test one or more models for the development of the economic potential of natural areas and their buffer zones in Lebanon. Activities should probably be carried out in and around Al Shouf, Horsh Ehden, Palm Islands, and at least one protected area that has not benefited from donor funding (UNDP/GEF) to date.

⁴⁷ *Pers. Comm.* Mr. Faisal Abu Izzeddin (see meeting notes)

4.2.2 *Develop ecotourism as a tool to conserve biodiversity*

Ecotourism is a promising tool in the global fight to conserve biodiversity. Like most tools it must be used with care. The global supply of ecotourism sites may now exceed demand -- conservationists interested in ecotourism to help support the conservation of biological diversity should study their markets carefully and develop products for their principal markets. Lebanon may want to concentrate on national and regional tourism initially, including the Lebanese diaspora around the world, and combine ecotourism with cultural tourism.

Once the infrastructure for tourism is developed it must be carefully maintained and upgraded or the tourists will go elsewhere. Care must be taken in designing ecotourism attractions in protected areas to ensure that tourists do not damage the area and do not become a threat to the site's biodiversity. As mentioned above, a good science base is one of the keys to success in ecotourism. Ecotourists want information on the ecology of the habitats they visit and the species they see. They want guides to the flora, trees, butterflies, birds, etc. They may also be interested in the history of the area. The science base will also be important for the development of self-guiding trails and the brochures for such trails. Because many tourists will feel more comfortable with a guide to the area, guides must be trained to point out flora and fauna of interest. Guides should know the common and scientific names of the flora and fauna. They should know of areas where they are most likely to see flora and fauna of interest. They should recognize and be able to mimic the calls of birds and other fauna. They should be well trained in the natural history of the area.

The GoL, donors, and the private sector (especially the tourism industry) can support the development of an ecotourism industry in Lebanon by providing technical assistance and training to the Ministry of Tourism and to tour operators. It might be appropriate to assist an NGO in becoming involved in tourism to ensure that some of the benefits of tourism go to local communities. A donor might sponsor one or more workshops on tourism, perhaps to help local planners to prepare a tourism development plan, and invite international tour operators and an international ecotourism expert to participate. Such workshops should be preceded by an opportunity for the international operators and expert to visit some of the ecotourism attractions. Since the operators are not likely to have much time available, the workshop should be structured so that they can have their input early leaving the local planners to work with the expert after their departure.

Donors might also provide assistance in developing ecotourism attractions in and near protected areas and ensuring that local populations benefit to the maximum extent possible. It must be remembered that the major beneficiaries of ecotourism are *a priori* international and national tour operators, not the local communities. With care, the benefits to local communities can be increased. There are many types of ecotourists; those who stay in first class hotels in the capital city and visit natural areas on day trips and the backpackers who spend most of their time in rural areas are opposite extremes. While those who stay in first class hotels may bring more benefit to the national economy, the backpackers may bring more economic benefits to the rural areas.

One unique opportunity for ecotourism development in Lebanon would be to link together existing old trails to form a trail that passes through natural and historical sites. Inns and restaurants might be developed along the trail to cater to long distance-hikers, day hikers and motorists.

Lebanese organizations interested in ecotourism should become members of the international ecotourism society headquartered in Vermont and might be interested in enrolling in

an ecotourism ListServe which is based in Quito, Ecuador. Interested persons can enroll by sending an e-mail to ron@planeta.com or can visit the organization's website at <http://www.planeta.com>. In October this organization will sponsor an online conference on NGOs and Nonprofits in Tourism and Conservation. Organizations or individuals interested in participating can enroll by visiting http://www.planeta.com/ecotravel/tour/tourism_conservation.html. The organization sponsors several online discussions of ecotourism related subjects every year.

4.2.3 Promote awareness of the Convention on Biological Diversity

The GoL ratified the Convention on Biological Diversity (CBD) in 1994 (Law 360/94) and prepared a National Biodiversity Strategy and Action Plan (NBSAP) in 1996, but has done very little to implement the provisions of these documents or to ensure that the agencies that ought to be responsible for their implementation are aware of these responsibilities. The GoL has yet to establish the institutional and legal structure necessary to conserve biodiversity.

Awareness campaigns are needed to ensure that the provisions of both the Convention and NBSAP are disseminated among different institutions (governmental, private, public, academic) and at the grass-roots level to integrate biodiversity conservation in the consciousness of the Lebanese people. An environmental education program should be developed targeting different audiences: government officials, private sector leaders, municipal governments, NGOs, urban dwellers, residents of rural areas, etc. Workshops and field trips should be held for government officials and others. Guides, flyers, TV and radio programs should be produced for the general public. School science programs should include the study of biodiversity and the international agreements and national strategies/plans that support its conservation. Nature reserves should include, at their visitor centers, exhibits on biodiversity conservation addressing both the legal framework and the scientific basis for conservation.

4.2.4 Integrate biodiversity conservation into the economic sectors

Lebanon's biodiversity strategy calls for Lebanon to integrate biodiversity concerns into its plans for other economic sectors; forestry, agriculture and fisheries, tourism, education, environment, and financial planning. Other sectors that should be added to this list include government and private sector agencies responsible for road construction, urban development, industrial development, coastal zone development, etc. So far no progress has been made toward this goal.

To begin to implement its biodiversity strategy, the government needs first to promote awareness of the CBD throughout the government and then to require ministries and other government agencies dealing with the different economic sectors to prepare plans which integrate biodiversity concerns into their normal planning processes. The government also needs to assist the private sector to recognize the importance of conserving biodiversity as it plans for and implements its activities. Ministries and other agencies responsible for overseeing activities in sectors that can impact on biodiversity will need assistance in preparing plans which address biodiversity conservation. The MOE, as the agency with overall responsibility for the implementation of the biodiversity strategy, should produce a document with guidelines on how to integrate and hold workshops (with field trips) for high-level officials and members of the private sector. Donors and NGOs as well as private sector organizations (the Chamber of Commerce, for example) should support, and actively participate in, this process. The legislature and municipalities should also be included in this process.

4.2.5 *Develop a strategy for linking forest patches and other natural habitats*

Lebanon's forest remnants are small patches of green scattered about the country, especially in North Lebanon, and forests now cover only 5-7 percent of the total surface area of the country. Since much of the remaining forest is in small widely dispersed patches, the habitat for larger mammals, birds, and even smaller mammals who depend upon larger populations for their genetic diversity no longer exists.

In order to maintain genetic diversity within its flora and fauna and to provide minimal habitat for some of its more wide ranging species, Lebanon needs to prepare and implement a strategy for creating "greenways" to link patches of natural habitat in such a way that the remnants of Lebanon's flora and fauna can expand into a range which more closely matches their natural range and maintain their genetic diversity. These greenways or lines of connection are important because isolated green islands (habitat patches) experience higher extinction rates than larger, more continuous, habitats. Similar strategies are being followed elsewhere in the world where habitat fragmentation has become a problem - one notable example is the "Paseo pantera" (Jaguar path) in Central America which links segments of jaguar habitat together in hopes of maintaining a viable population of jaguars along the Caribbean coast of Central America. The "Paseo pantera" also links many other habitats including habitats for bird species that migrate seasonally up and down mountains.

Since baseline references are needed to measure the impact of these green corridors, continuous research on the flora and fauna in both the corridors and the patches will be needed. Any strategy for developing corridors should include a supporting research and monitoring plan. The results of this research will be used as a tool to evaluate the success of the strategy and make adjustments to the strategy as needed.

4.2.6 *Develop picnic grounds*

One of the best ways to develop a conservation ethic among the general public is to provide opportunities for outdoor recreation and environmental education in a natural setting. Traditionally Lebanese from urban areas have sought opportunities for outdoor recreation on weekends. One of the persons we interviewed recalled that years ago the olive groves near Beirut were filled with picnickers on weekends, but lamented that now that the olive groves have been broken into smaller units and have been invaded by urban sprawl, this is no longer a common practice. The more affluent retreat to their villas in the mountains in the summer months, but there are few opportunities for outdoor recreation in a natural setting for the average citizen. Today, picnickers usually target riverbanks, isolated trees in open lands, and pine forests, often leaving non-degradable litter behind. Many picnic goers also smoke the traditional water pipe which constitutes a significant fire hazard.

If efforts to conserve Lebanon's biodiversity are to succeed, a conservation ethic must be created in the majority of Lebanese citizens. Providing opportunities for outdoor recreation in natural settings will be an important step toward developing this ethic, especially if it revives an old tradition. Natural areas in and around Beirut and other large urban areas should be protected from further urban encroachment and developed into picnic areas and nature education centers. Additional picnic areas should be developed in or adjacent to nature reserves. Of course, if this effort is to succeed, the picnic areas must be well maintained and clean of litter. Emphasis should be on educating users to clean up after themselves and leave nature as they find it. To do this it might be necessary to hold regular education programs for picnickers, post unobtrusive signs, and hire personnel to remind those who litter of their responsibilities as guests in the picnic area.

4.2.7 Document local (indigenous) knowledge and ensure its transfer to future generations

One of the keys to conserving biological diversity is to discover non-destructive economic uses for local flora and fauna. One approach to finding such uses is to study how people in rural areas, especially indigenous peoples, use their flora and fauna. Over the centuries rural people have discovered agricultural, medicinal and other uses for local flora and fauna and passed this information down from generation to generation. As rural to urban migration increases, much of this information is lost. In the interest of preserving this precious knowledge as well as conserving biodiversity, it is important to document the information and identify and conserve such “economic” species.

Participatory research to document this knowledge should be initiated as soon possible. Support for graduate students and dissertation research could help preserve important information as well as interest students in an important and interesting line of research (the American University of Beirut has over the years secured several grants from international donors – International Development Research Center, Kew Gardens - to support ethnobotanic research). Care should be taken to ensure that the principal benefits of any commercial application of this knowledge go to indigenous peoples to whom the knowledge belongs.

4.2.8 Provide basic agricultural services to encourage farmers to conserve agro-biodiversity

Farmers in three rural communities in the Bekaa region (Arsal, Nabha, and Ham/Maaraboun) have been asked to participate in an effort to conserve agro-biodiversity. The project aims to assist farmers increase their yields and valorize natural races that are more resistant to the natural variations in climate, soil conditions, and other risk factors. The Project, however, does not have the resources to provide participating farmers with basic agricultural services. According to the Project Manager,⁴⁸ farmers in these target regions (and elsewhere in Lebanon) would be more willing to conserve agro-biodiversity if they had better access to agricultural supplies and equipment, their access to markets were improved, or irrigation became available for at least some of their crops.

Agro-biodiversity also includes an important array of local varieties of fruit trees. These are being replaced by higher yielding imported varieties or horticultural varieties and the genetic diversity of many species is being lost as a result. Since many fruit trees are also beautiful flowering trees (e.g., cherries, almonds), even low yielding or less attractive or tasty varieties of fruits make attractive ornamental trees for landscaping. Using wild fruit trees in ornamental landscaping would not only provide fruits for home growers but also would contribute to the conservation of the genetic diversity of these species.

The GoL, donors, and NGOs could contribute to the success of the Agro-biodiversity Project by working to provide basic agricultural services and other services often lacking in these communities, such as access to potable water, wastewater treatment, and solid waste disposal.

4.2.9 Empower local farming communities

Developers and researchers regularly visit rural communities to collect data but rarely share this information with the subjects of their research. Often the information could be of value to the community in initiating their own development activities. Researchers and developers interested in the conservation of biodiversity and/or forests should share their information with local communities and assist them in planning conservation and/or development activities.

⁴⁸ Pers. Comm.. Ms. Wafa Khoury (see meeting notes)

5. PROGRAMMING OPPORTUNITIES FOR USAID/LEBANON

This chapter examines some of the potential impacts and mitigation measures of USAID-funded projects on forests and biodiversity. It also identifies programming opportunities for USAID/Lebanon support for the conservation of biodiversity and forests.

5.1 Potential Impacts of the USAID/Lebanon Program on Forests and Biodiversity

The USAID program for 1997-2002 included the same basic three components that are included in the draft 2002-2005 Strategy:

1. Expanded Economic Opportunities;
2. More Effective Governance and Democracy; and
3. Improved Environmental Practices.

Each of these components has the potential to contribute to the conservation of forests and biodiversity in Lebanon. Each component also has the potential to generate adverse impacts on forests and biodiversity as well as other valuable natural resources such as soil and water.

During the 1997-2002 period, the impact of the USAID program on forests and biodiversity appears to have been essentially neutral overall. The following activities may have had a mix of positive and adverse impacts on forests and biodiversity:

1. Agricultural or access roads;
2. Tree planting and tree nurseries;
3. Drainage canals and lakes;
4. Solid waste dynamic composting;
5. Wastewater treatment; and
6. Dairy cows (USDA funding).

While it is not likely that any of these activities had significant adverse impacts on forests and biodiversity, some may have had localized adverse impacts that could be mitigated. Table 6 summarizes some of the potential adverse impacts PVO projects in Lebanon and possible measures to mitigate those impacts.

5.1.1 *Agricultural or access roads*

The agricultural/access roads program may have potential adverse impacts on forests and biodiversity. Typically, PVOs have left it to the local landowners to decide on the exact routing of the agricultural/access road to be built and to implement basic excavation and leveling works; PVOs then intervene to lay the base course of the agricultural or access road. While this approach lets local landowners negotiate the best routing among themselves, it may not produce the optimal routing from an environmental perspective (e.g., avoiding wooded areas or high-slope areas prone to erosion). Also, excavation contractors need guidance and specific requirements on best practices for building a road.

Table 6
Potential Adverse Environmental Impacts and Possible Mitigation Measures a/

<i>Potential Adverse Impacts</i>	<i>Possible Mitigation Measures</i>
Agricultural and access roads	
<ul style="list-style-type: none"> ▪ Soil erosion and sediments in streams due to improperly sited, designed, or built roads ▪ Soil erosion could restrict plant regeneration/growth, often favoring invasive species ▪ Sediments in streams could impacts on aquatic habitats ▪ Roads could fragment natural habitats and serve as a vehicle for urban sprawl 	<ul style="list-style-type: none"> ▪ PVOs must play a pro-active, oversight role in siting, design, and construction to ensure proper formulation and implementation of the necessary mitigation measures
Tree planting and tree nurseries	
<ul style="list-style-type: none"> ▪ Creation of artificial ecosystems may favor some species over others ▪ Uncontrolled imports of seeds and seedlings could introduce diseases, insects and genetic materials not native to Lebanon ▪ Distributing seedlings without follow-up on care and management raises doubts about the effectiveness of agro-forestry or reforestation schemes 	<ul style="list-style-type: none"> ▪ Seedlings planted n Lebanon should be grown in nurseries in Lebanon from seeds collected in Lebanon (except for certified imported seed, rootstocks or grafting material) ▪ Favor reforestation through the promotion of natural regeneration (e.g., planting of patches of native tree species to serve as seed sources in the long run)
Drainage and lakes	
<ul style="list-style-type: none"> ▪ Potential impacts of improperly sited lakes (e.g., uprooting of rate trees at high elevations) ▪ Draining of wetlands/marches endanger biodiversity ▪ Large drainage projects could result in water loss by evaporation, poor ditch maintenance could cause weed growth and mosquitoes 	<ul style="list-style-type: none"> ▪ Site hill lakes to reduce adverse impacts ▪ Require feasibility study and full EA for the drainage and lake projects in the Marjayoun/Khiyam plain
Solid waste dynamic composting	
<ul style="list-style-type: none"> ▪ Quality of compost suspect (presence of foreign objects), risk of contaminating soils with invasive species (due to residual seeds in the compost) ▪ Access roads to remote dynamic composting facilities through high-slope and pristine forest areas ▪ Partially treated sewage disturb aquatic ecosystems 	<ul style="list-style-type: none"> ▪ If possible, put in place source separation programs ▪ Establish strict compost quality monitoring requirements ▪ Include facility siting and access roads as part of compulsory EIA
Wastewater treatment	
<ul style="list-style-type: none"> ▪ Partially treated effluents could introduce imbalances of nutrient levels to streams and disturbances to aquatic ecosystems ▪ Soil erosion and sediment impacts associated with access roads and sewage collectors to treatment facility 	<ul style="list-style-type: none"> ▪ Build awareness and capacity of local communities to operate and maintain the treatment plants ▪ Include facility siting and access roads in compulsory EIAs to be prepared for these types of projects
Dairy cow program (USDA funding)	
<ul style="list-style-type: none"> ▪ Soil compaction and grazing impact plant regeneration & biodiversity in the long term 	<ul style="list-style-type: none"> ▪ Ensure that all farmers receiving pure bred dairy cattle have the means and training needed to care for these animals

a/ Implementing EA requirements, as stipulated by CFR 216 and the Ministry of Environment's draft EIA procedures, would ensure that potential adverse impacts are identified and appropriate measures to mitigate those impacts are formulated as part of project planning and design

Improperly sited, designed or built roads could cause soil erosion and generate sediments in streams. Soil erosion could restrict plant regeneration and growth, often favoring invasive species (weeds), while excessive sediments in streams could impact on aquatic habitats, favoring the growth of some species at the expense of others. In addition, excessive or poorly planned agricultural/access roads could contribute to fragmenting natural habitats and endangering certain species. Many agricultural roads built under the program have intruded on pristine landscapes (e.g., South Lebanon, Hermel). By providing easy and uncontrolled access to hunters, amateurs of "off-road," picnic goers, and "mid-night dumpers," such roads pose significant risks of degrading biodiversity and polluting water resources. Finally, under the private land ownership rights and construction laws prevailing in Lebanon, landowners are free to build along these so-called agricultural roads, which end up serving as the vehicle for urban sprawl in the mid to long terms.

Possible mitigation measure. At a minimum, PVOs must play a pro-active, oversight role in the siting, design and construction of agricultural or access roads to ensure proper formulation and implementation of the necessary mitigation measures in all stages

5.1.2 Tree planting and tree nurseries

Tree planting may have adverse impacts on biodiversity to the extent that the creation of artificial ecosystems may favor some species over others. Moreover, some tree planting activities may be importing seeds or seedlings with little or no concern that diseases, insects or genetic materials not native to Lebanon may be introduced in the process. There are too many examples around the world of the impacts on natural ecosystems of introducing exotic diseases and insects. The accidental introduction of chestnut blight and Dutch elm disease on forests in the eastern United States provides two notable examples. Also, some NGOs appear to be distributing seedlings with no follow-up on the care and management of the seedlings, which raises doubts about the effectiveness of agro-forestry or reforestation schemes using those seedlings.

Possible mitigation measures. Seedlings planted in Lebanon should be grown in nurseries in Lebanon -preferably private sector and on-farm nurseries (NGOs could provide technical assistance for the establishment of such nurseries)- from seeds collected in Lebanon. Certified imported seed, rootstocks or grafting material might be used for fruits, nuts, and ornamental species, which are known not to be invasive species. Finally, reforestation through the promotion of natural regeneration (e.g., planting of patches of native tree species to serve as seed sources in the long run) would be more likely to result in ecosystems that closely resemble original natural ecosystems.

5.1.3 Drainage and lakes

Although the team is not aware of any adverse impacts of the drainage or lakes programs, such activities can have adverse impacts on forests and biodiversity (e.g., uprooting rare trees at high elevations), as well as other natural resources, if they are not sited, planned and implemented carefully. Considering the greatly diminished area of wetlands in Lebanon, great care should be taken in selecting drainage projects to ensure that these activities would not have adverse impacts on important wetland habitats. Large drainage projects, such as in the Marjayoun/Khiyam plain, could have potential adverse impacts associated with water loss through evaporation, disposal of excavation materials, import of basalt stone to line the canal sides, poor ditch maintenance, growth of reeds and weeds that could slow drainage, stagnant waters and mosquito proliferation, waste dumping into the ditches, etc.

Possible mitigation measures. Site hill lakes to reduce and eventually eliminate potential adverse impacts on forests and biodiversity. Require feasibility study and full EA for the project to drain portions of the Marjayoun/Khiyam plain and build a water storage lake at the southern tip of the plain.

5.1.4 *Solid waste dynamic composting*

Dynamic composting facilities in the solid waste management program may be producing compost that is improperly cured and contains foreign objects such as plastics and glass. Due to the high content of foreign objects, this compost might be used as a soil conditioner in land reclamation projects (as opposed to agricultural lands). The compost might contain seeds of invasive plants that could survive the three-day curing process in the dynamic composting drums, where temperatures do not exceed 60 degrees Celsius. Use of such compost in land reclamation could pollute soils and pose a threat to biodiversity by introducing invasive plants. In the absence of source separation or more effective segregation of commingled waste at the inlet (waste unloading platform), dynamic composting is unlikely to result in better quality compost. Also, some composting plants were sited in remote areas and necessitated building special access roads through high-slope and pristine forest areas.

Possible mitigation measures. If possible, put in place source separation programs wherever composting plants are built. At a minimum, ensure more effective segregation of commingled waste. In all cases, establish strict compost quality monitoring requirements. Finally, include facility siting and access roads in compulsory EIAs to be prepared for these types of projects.

5.1.5 *Wastewater treatment*

Some wastewater treatment plants appear to be treating the wastewater only partially, either due to inadequate operation and maintenance or because sewage inflows have vastly exceeded the plant's design capacity (unanticipated connections to the network). Partially treated effluents could lead to imbalances of nutrient levels in streams and, hence, to manmade disturbances to aquatic ecosystems. Also, many wastewater treatment plants are typically built at the lowest possible locations and as far as possible from inhabited areas. As a result, they tend to be located at the bottom of a steep ravine (Kaws Akkar) or at quite some distance from the village (Kobeyate). Building access roads and installing sewage collectors leading to those facilities could have soil erosion and sediment impacts similar to those of building agricultural and access roads.

Possible mitigation measures. Build awareness and capacity of local communities to operate and maintain the treatment plants. Include facility siting and access roads in compulsory EIAs to be prepared for these types of projects.

5.1.6 *Dairy cows (USDA funding)*

The team met with two persons who suggested that the dairy cow program might have had adverse impacts on the environment. If this program has had negative impacts, it seems most likely that they would have been on soil and water due to soil compaction, rather than on forests or biodiversity. However, soil compaction and grazing could restrict the regeneration and growth of forests and other plants as well as soil microorganisms. Any impact on plant regeneration and growth could, in turn, impact upon animal species.

Possible mitigation measures. Ensure that all farmers receiving purebred dairy cattle have the means and training needed to care for these animals.

One constraint to ensuring that the programs discussed here do not have adverse impacts on biodiversity is the lack of adequate information on the status of Lebanon's biodiversity. What species are endemic and/or endangered, where are they located, and what are their preferred habitats? What habitats are not already included in Lebanon's system of protected areas but should be added to ensure that Lebanon's valuable biodiversity is preserved for future generations? The following section includes several program suggestions that would contribute to resolving this data limitation.

5.2 Programming Opportunities for USAID/Lebanon

Each of USAID/Lebanon's three strategic objectives offers opportunities for contributing to the conservation of biodiversity and forests in Lebanon. While presenting opportunities according to the three strategic objectives is practical, however, this separation remains artificial. Experiences around the world have demonstrated repeatedly that efforts to conserve natural resources --especially forests and their associated natural resources (biodiversity, soil, water, and climate)-- are likely to fail if they do not provide economic benefits to those populations that need to change their behaviors if conservation programs are to succeed. These populations must also be involved in the planning and implementation of these programs. Thus, successful conservation programs must provide expanded economic opportunities and must involve more effective government and democracy, especially at the local level and through collaboration between local community groups and local/national governments. Since other donors, the government and NGOs are already active in a variety of biodiversity-related programs/projects, USAID should be able to target specific activities that would contribute to the success of ongoing efforts.

The interventions listed below are drawn from the overall recommendations discussed in Chapter 4, and are based on the assumption that USAID would prefer to concentrate its efforts on working through PVOs/NGOs, AUB, and LAU. While all of the interventions described in Chapter 4 are important to the conservation of forests and biodiversity, the most critical activities are those that contribute to the development of the science base, development of the economic potential of protected areas and their buffer zones, and improved capacity of local governments and NGOs to design and implement conservation projects that emphasize participation.

While it may be possible, and perhaps desirable at this stage, to contribute to the conservation of biodiversity and forests without working directly with the national government, we would like to suggest that USAID consider sponsoring, perhaps through the NGOs and universities, field visits, workshops, seminars and other activities designed to share the experiences of USAID's partners with one another and with appropriate national and municipal government institutions.

5.2.1 Implementing Environmental Assessment Requirements

As explained in Section 5.1, several projects implemented under the USAID program have the potential to cause adverse impacts on forests and biodiversity, not to mention other impacts on human health and the environment. Implementing EA requirements would ensure that potential adverse impacts are identified in advance (during the planning and design stages) and adequate measures are taken to mitigate such impacts. Implementing EA also would be in compliance with the EA regulation of USAID (22 CFR 216) as well as the EIA draft decree prepared by MoE.

Clearly, however, not all projects (or activities) implemented under the USAID program would need to be subject to a full EA. As envisioned by 22 CFR 216 (and by MoE's draft decree), individual grants/contracts or groups of similar grants/contracts would be screened using specific evaluation procedures (Initial Environmental Examination or IEE). Such a screening would group individual projects (or activities) funded under each grant/contract into four possible categories, requiring different actions, as summarized in Table 7.

Table 7
Screening USAID Projects and Programs Based on EIA Requirement

<i>Screening finding</i>	<i>Decision</i>	<i>USAID terms</i>
Project has significant adverse environmental impacts	Do full EA or redesign project	Positive determination
Project has no significant adverse environmental impact	Project has passed environmental review	Negative determination
With adequate mitigation and monitoring, project has no significant environmental impact	By adding mitigation to project design, project passes environmental review	Negative determination with conditions
Not enough information to evaluate impacts	Must finalize IEE before USAID funds can be spent	Deferral

Source: 22CFR216

As illustrated in the above table, only certain types of "high-risk" projects, as listed in 22 CFR 216, would be subject to a full EA. Other projects are either "low risk" (also listed in 22 CFR 216) and pass the environmental review automatically, or are neither low-risk nor high-risk activities (i.e., not listed in 22 CFR 216) but pass environmental review subject to implementing specific mitigation measures. Such mitigation measures are generally identified in the IEE and grantees/contractors need to make sure that they are incorporated in project design and implemented.

Although some of the PVOs operating in Lebanon are generally familiar with EA requirements, all these PVOs and their partners (NGOs, municipalities) would benefit from participating in a dedicated training program on the EA procedures and requirements of USAID and MoE, as well as EA techniques. Because other USAID missions have already offered similar training courses to partner PVOs (e.g., USAID/West Bank & Gaza), USAID/Lebanon could leverage those training resources, with some adaptation to the Lebanese context, to offer EA training courses to the PVOs, contractors and their partners implementing the USAID program in Lebanon.

5.2.2 *Expanded Economic Opportunities*

The most important overall theme in this program area is the development of the economic potential of protected areas and their buffer zones. Specifically, USAID could support one or more of the following:

1. Local community participation in ecotourism and cultural tourism;
2. Development of privately run, for profit, plant nurseries;
3. Provision of basic agricultural services to farmers in biodiversity hotspots; and
4. Strengthening of local environmental consulting firms.

USAID could assist local communities in taking advantage of the economic opportunities offered by ecotourism. Ecotourism and cultural tourism activities could include the development of inns and restaurants, development of trails within and between protected areas, training of guides, development of brochures and guides for visitors (including self guiding trails), and the publication of illustrated guidebooks on wild flowers, birds, trees, insects, etc.

USAID could provide technical assistance for the establishment of privately run, for profit, plant nurseries. USAID has already supported a tree nursery in North Lebanon (Zgharta), which is producing approximately 20,000 seedlings per year (forestry seedlings and fruit trees). USAID-supported nurseries could diversify their products by providing ornamental plants, aromatic plants, medicinal herbs, and wild fruit trees. Such nurseries could potentially support the management of protected areas and alleviate the pressure on the biodiversity within the reserves.

USAID could support the provision of basic agricultural extension services to encourage farmers to conserve agrobiodiversity. For example, USAID could request one or more of its PVO partners to extend their agricultural services to the agricultural communities participating in the “Conservation and Sustainable Use of Dryland Agrobiodiversity” (Aarsal, Ham & Maaraboun, and Nabha). Improved agricultural infrastructure in these regions (e.g., hill lakes) would result in increased participation and improved conservation of agro-biodiversity.

USAID could continue to support the work of local and US environmental consulting firms by continuing to use such firms to support development, implementation and monitoring of its environmental activities. Where possible and necessary, USAID should assist Lebanese firms to access environmental professionals with relevant experience in other parts of the world to ensure that Lebanon benefits from lessons learned elsewhere.

5.2.3 *More Effective Governance and Democracy*

To promote effective governance and democracy, USAID/Lebanon could support workshops, training programs, technical assistance and similar activities to strengthen the administrative capacity of NGOs and municipal governments. Assistance could include programs to improve the capacity of NGOs and municipal governments in the design and implementation of sustainable reforestation and ecosystem restoration projects/programs, accounting, developing proposals, reporting, project monitoring, etc.

In particular, USAID could provide technical assistance and training for NGOs and local governments to develop proposals to support on-going management services in Lebanon’s nature reserves (e.g., Palm Islands, Horsh Ehden, and Al Shouf): technical know-how, financial sustainability, community participation. Assistance could also be provided to groups interested in

the development of other designated protected areas. USAID could provide training for municipalities on the management of municipal lands, including rangelands. Such training could include formal training programs and facilitated workshops for municipalities to exchange experiences in managing lands.

5.2.4 *Improved Environmental Practices*

Under its strategic objective to improve environmental practices, USAID could seize on the programming opportunities offered by the three priority recommendations formulated in Section 4.1:

1. Develop a protected area system that includes a representative sample of all significant habitats and ecosystems;
2. Strengthen the science base necessary to support conservation efforts; and
3. Develop and implement cost-effective reforestation programs based on the promotion of natural regeneration.

Also, other programming opportunities are offered by the “Other recommendations” formulated under Section 4.2 of this report. In particular, under the environmental strategic objective, USAID could seize on those other opportunities that are directly related to the priority recommendations above, such as:

1. Develop a strategy for linking forest patches and other natural habitats;
2. Promote awareness of the Convention on Biological Diversity; and
3. Develop picnic grounds.

System of protected areas. In addition to expanding the science base, USAID could assist the GoL and Lebanese NGOs to develop a system of protected areas with appropriate levels of protection and development. Such a system would include wilderness areas, national parks, ecological reserves, national monuments, marine reserves, national seashores, wildlife reserves, national forests, national trails, etc. USAID, working through NGOs and/consulting firms could provide technical assistance and sponsor workshops for NGOs and national and municipal governments to design a protected area system appropriate to protect important habitats for biodiversity in Lebanon. Such a system would also protect important cultural and historical sites. See Section 4.1.1 for more detail on this topic.

Science base. USAID could support the expansion of the science base needed to develop and implement conservation programs. An expanded science base would also facilitate Lebanon’s capacities to assess the economic potential of natural areas and their buffer zones, develop public and political support for efforts to conserve biodiversity, determine the status of biodiversity in Lebanon, update existing management plans or develop new ones for newly established protected areas, etc. Section 4.1.2 describes in detail the team’s recommendation to expand Lebanon’s scientific base. The following list summarize those activities that USAID could potentially support:

1. Development of a national herbarium at AUB;
2. Development of an online flora of Lebanon based at AUB;
3. Collaborative arrangements between Lebanese universities and research institutions and similar institutions in the U.S. and elsewhere (especially institutions with experience in Mediterranean climates);
4. Study tours and exchange programs for students and young professionals;

5. Assistance to Lebanese Universities in developing taxonomy and ecology programs;
6. Documentation of indigenous knowledge; and
7. Development of guides on wild flowers, birds, butterflies, insects, and trees.

Reforestation through natural regeneration. USAID could work with NGOs, local community groups and research institutions to develop and test reforestation programs that emphasize natural/assisted regeneration, as a way to establish green corridors between Lebanon's protected areas and relic forests. See Section 4.1.3 for more detail on this recommendation.

Habitat corridors. USAID could provide support for NGOs and local communities to develop a system of corridors between existing protected areas and forest patches. Such corridors would provide habitat for species needing more space than is included in Lebanon's protected areas and for species that migrate locally. USAID has already supported many tree planting operations. See Section 4.2.5 for more on this topic.

Environmental education. USAID could ensure that the USAID-funded environmental education programs (e.g., YMCA teacher kit) address forest and biodiversity issues and increase public awareness of Lebanon's obligations under the Convention on Biological Diversity. USAID could also provide support for NGOs to develop environmental education programs in the protected areas. Initially such programs should concentrate on schools and the general public in the area surrounding the protected areas, but the programs should be expanded to include all visitors to the reserves.

Picnic grounds. USAID could assist NGOs and municipalities to develop picnic grounds in and near protected areas as well as in areas easily accessible from the larger cities. Education programs could be developed so that visits to such picnic grounds would increase public awareness to environmental concerns such as the conservation of forests and biodiversity while at the same time providing a healthy outdoor recreational experience. NGOs could also experiment with methods to promote trash free outdoor recreational areas. See Section 4.2.6 for more on this topic.

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APPENDIX A**SECTIONS 118 AND 119 OF THE FOREIGN ASSISTANCE ACT**Foreign Assistance Act, Part I, Section 118 - Tropical Forests

(a) Importance of Forests and Tree Cover.--In enacting section 103(b)(3) of this Act the Congress recognized the importance of forests and tree cover to the developing countries. The Congress is particularly concerned about the continuing and accelerating alteration, destruction, and loss of tropical forests in developing countries, which pose a serious threat to development and the environment. Tropical forest destruction and loss--

(1) result in shortages of wood, especially wood for fuel; loss of biologically productive wetlands; siltation of lakes, reservoirs, and irrigation systems; floods; destruction of indigenous peoples; extinction of plant and animal species; reduced capacity for food production; and loss of genetic resources; and

(2) can result in desertification and destabilization of the earth's climate. Properly managed tropical forests provide a sustained flow of resources essential to the economic growth of developing countries, as well as genetic resources of value to developed and developing countries alike.

(b) Priorities.--The concerns expressed in subsection (a) and the recommendations of the United States Interagency Task Force on Tropical Forests shall be given high priority by the President--

(1) in formulating and carrying out programs and policies with respect to developing countries, including those relating to bilateral and multilateral assistance and those relating to private sector activities; and

(2) in seeking opportunities to coordinate public and private development and investment activities which affect forests in developing countries.

(c) Assistance to Developing Countries.--In providing assistance to developing countries, the President shall do the following:

(1) Place a high priority on conservation and sustainable management of tropical forests.

(2) To the fullest extent feasible, engage in dialogues and exchanges of information with recipient countries--

(A) which stress the importance of conserving and sustainably managing forest resources for the long-term economic benefit of those countries, as well as the irreversible losses associated with forest destruction, and

(B) which identify and focus on policies of those countries which directly or indirectly contribute to deforestation.

(3) To the fullest extent feasible, support projects and activities--

- (A) which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and
- (B) which help developing countries identify and implement alternatives to colonizing forested areas.
- (4) To the fullest extent feasible, support training programs, educational efforts, and the establishment or strengthening of institutions which increase the capacity of developing countries to formulate forest policies, engage in relevant land-use planning, and otherwise improve the management of their forests.
- (5) To the fullest extent feasible, help end destructive slash-and-burn agriculture by supporting stable and productive farming practices in areas already cleared or degraded and on lands which inevitably will be settled, with special emphasis on demonstrating the feasibility of agroforestry and other techniques which use technologies and methods suited to the local environment and traditional agricultural techniques and feature close consultation with and involvement of local people.
- (6) To the fullest extent feasible, help conserve forests which have not yet been degraded, by helping to increase production on lands already cleared or degraded through support of reforestation, fuelwood, and other sustainable forestry projects and practices, making sure that local people are involved at all stages of project design and implementation.
- (7) To the fullest extent feasible, support projects and other activities to conserve forested watersheds and rehabilitate those which have been deforested, making sure that local people are involved at all stages of project design and implementation.
- (8) To the fullest extent feasible, support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing, including reforestation, soil conservation, and other activities to rehabilitate degraded forest lands.
- (9) To the fullest extent feasible, support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation, including research in agroforestry, sustainable management of natural forests, small-scale farms and gardens, small-scale animal husbandry, wider application of adopted traditional practices, and suitable crops and crop combinations.
- (10) To the fullest extent feasible, conserve biological diversity in forest areas by--
- (A) supporting and cooperating with United States Government agencies, other donors (both bilateral and multilateral), and other appropriate governmental, intergovernmental, and nongovernmental organizations in efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis;
- (B) whenever appropriate, making the establishment of protected areas a condition of support for activities involving forest clearance of degradation; and

(C) helping developing countries identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas.

(11) To the fullest extent feasible, engage in efforts to increase the awareness of United States Government agencies and other donors, both bilateral and multilateral, of the immediate and long-term value of tropical forests.

(12) To the fullest extent feasible, utilize the resources and abilities of all relevant United States Government agencies.

(13) Require that any program or project under this chapter significantly affecting tropical forests (including projects involving the planting of exotic plant species)--

(A) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land, and

(B) take full account of the environmental impacts of the proposed activities on biological diversity, as provided for in the environmental procedures of the Agency for International Development.

(14) Deny assistance under this chapter for--

(A) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner which minimizes forest destruction and that the proposed activity will produce positive economic benefits and sustainable forest management systems; and

(B) actions which significantly degrade national parks or similar protected areas which contain tropical forests or introduce exotic plants or animals into such areas.

(15) Deny assistance under this chapter for the following activities unless an environmental assessment indicates that the proposed activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development:

(A) Activities which would result in the conversion of forest lands to the rearing of livestock.

(B) The construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undegraded forest lands.

(C) The colonization of forest lands.

(D) The construction of dams or other water control structures which flood relatively undegraded forest lands.

(d) PVOs and Other Nongovernmental Organizations.--Whenever feasible, the President shall accomplish the objectives of this section through projects managed by private and voluntary

organizations or international, regional, or national nongovernmental organizations which are active in the region or country where the project is located.

(e) Country Analysis Requirements.--Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of-

(1) the actions necessary in that country to achieve conservation and sustainable management of tropical forests, and

(2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

(f) Annual Report.--Each annual report required by section 634(a) of this Act shall include a report on the implementation of this section.

Foreign Assistance Act, Part I, Section 119 - Endangered Species

(a) The Congress finds the survival of many animal and plant species is endangered by overhunting, by the presence of toxic chemicals in water, air and soil, and by the destruction of habitats. The Congress further finds that the extinction of animal and plant species is an irreparable loss with potentially serious environmental and economic consequences for developing and developed countries alike. Accordingly, the preservation of animal and plant species through the regulation of the hunting and trade in endangered species, through limitations on the pollution of natural ecosystems, and through the protection of wildlife habitats should be an important objective of the United States development assistance.

[75] 22 U.S.C. 2151q. Sec. 119, pars. (a) and (b) were added by sec. 702 of the International Environment Protection Act of 1983 (title VII of the Department of State Authorization Act, Fiscal Years 1984 and 1985, Public Law 98-164; 97 Stat. 1045).

(b) [75] In order to preserve biological diversity, the President is authorized to furnish assistance under this part, notwithstanding section 660, [76] to assist countries in protecting and maintaining wildlife habitats and in developing sound wildlife management and plant conservation programs. Special efforts should be made to establish and maintain wildlife sanctuaries, reserves, and parks; to enact and enforce anti-poaching measures; and to identify, study, and catalog animal and plant species, especially in tropical environments.

[76] Section 533(d)(4)(A) of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1990 (Public Law 101-167; 103 Stat. 1227), added ``notwithstanding section 660" at this point.

(c) \77\ Funding Level.--For fiscal year 1987, not less than \$2,500,000 of the funds available to carry out this part (excluding funds made available to carry out section 104(c)(2), relating to the Child Survival Fund) shall be allocated for assistance pursuant to subsection (b) for activities which were not funded prior to fiscal year 1987. In addition, the Agency for International Development shall, to the fullest extent possible, continue and increase assistance pursuant to subsection (b) for activities for which assistance was provided in fiscal years prior to fiscal year 1987.

\77\ Pars. (c) through (h) were added by sec. 302 of Public Law 99- 529 (100 Stat. 3017).

(d) \77\ Country Analysis Requirements.--Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of-

- (1) the actions necessary in that country to conserve biological diversity, and
- (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

(e) \77\ Local Involvement.--To the fullest extent possible, projects supported under this section shall include close consultation with and involvement of local people at all stages of design and implementation.

(f) \77\ PVOs and Other Nongovernmental Organizations.-- Whenever feasible, the objectives of this section shall be accomplished through projects managed by appropriate private and voluntary organizations, or international, regional, or national nongovernmental organizations, which are active in the region or country where the project is located.

- (1) \77\ Actions by AID.--The Administrator of the Agency for International Development shall-(1) cooperate with appropriate international organizations, both governmental and nongovernmental;
- (2) look to the World Conservation Strategy as an overall guide for actions to conserve biological diversity;
- (3) engage in dialogues and exchanges of information with recipient countries which stress the importance of conserving biological diversity for the long-term economic benefit of those countries and which identify and focus on policies of those countries which directly or indirectly contribute to loss of biological diversity;
- (4) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity;
- (5) whenever possible, enter into long-term agreements in which the recipient country agrees to protect ecosystems or other wildlife habitats recommended for protection by relevant governmental or nongovernmental organizations or as a result of activities undertaken pursuant to paragraph

- (6), and the United States agrees to provide, subject to obtaining the necessary appropriations, additional assistance necessary for the establishment and maintenance of such protected areas;
- (6) support, as necessary and in cooperation with the appropriate governmental and nongovernmental organizations, efforts to identify and survey ecosystems in recipient countries worthy of protection;
- (7) cooperate with and support the relevant efforts of other agencies of the United States Government, including the United States Fish and Wildlife Service, the National Park Service, the Forest Service, and the Peace Corps;
- (8) review the Agency's environmental regulations and revise them as necessary to ensure that ongoing and proposed actions by the Agency do not inadvertently endanger wildlife species or their critical habitats, harm protected areas, or have other adverse impacts on biological diversity (and shall report to the Congress within a year after the date of enactment of this paragraph on the actions taken pursuant to this paragraph);
- (9) ensure that environmental profiles sponsored by the Agency include information needed for conservation of biological diversity; and
- (10) deny any direct or indirect assistance under this chapter for actions which significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas.
- (h) \77\ Annual Reports.**--Each annual report required by section 634(a) of this Act shall include, in a separate volume, a report on the implementation of this section.

APPENDIX B**TEAM COMPOSITION**

Mr. Robert Mowbray	Natural Resource Management Specialist (US)
Ms. Elsa Sattout	Natural Resource Management Specialist (local)
Mr. Karim El-Jisr	Environmental Management Specialist (local)

APPENDIX C

SCOPE OF WORK

LEBANON ENVIRONMENTAL ANALYSIS

1. Background

Sections 118 (Tropical Forests) & 119 (Endangered Species) of the Foreign Assistance Act specify that each country development strategy statement or other country strategic plan prepared by the Agency shall include an analysis of: (1) the actions necessary in that country to achieve conservation and sustainable management of tropical forests and conserve biological diversity, and (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

Lebanon is a small country, 10,450 square kilometers in area, but endowed with a diverse range of environments, including coastal, mountainous, desert and semi-arid systems. Over half of its land surface consists of rocky, non-cultivated lands and degraded rangelands. Forest cover is very limited. Uncontrolled cutting for trees, forest fires, and overgrazing of denuded areas are resulting in degraded forest cover, watershed degradation, high rates of soil erosion, and threatened biodiversity.

2. Objective

Under this Water IQC task order, the contractor shall prepare the mandatory analysis of tropical forests and biodiversity for the Lebanon country strategic plan. This analysis will review: (1) the status of forests and biodiversity in Lebanon; (2) examine the principal threats to their conservation; (3) identify actions necessary to achieve conservation and sustainable management of tropical forests and biodiversity; and (4) conclude with a discussion of the extent to which USAID/Lebanon activities meet these needs.

3. Tasks

The contractor shall:

Task 1: Review the status of forests and biodiversity in Lebanon.

The contractor shall prepare an overview of forests and biodiversity in Lebanon and review current policy and governance systems affecting forest and biodiversity conservation and management.

To develop this overview, the contractor will draw on secondary data sources such as national environmental action plans, relevant national analyses and strategies, and donor investment strategies to the extent possible. The contractor will also interview national and international specialists familiar with environmental policy and practice in Lebanon.

Task 2: Identify and assess the principal threats to biodiversity and forest conservation in Lebanon.

The contractor will assess the principal threats to forests and biodiversity in Lebanon and obstacles to action. Attention will be paid to the policy and regulatory environment, including the extent to which the government of Lebanon enforces existing environmental protection laws.

Task 3: Identify actions necessary to conserve and sustainably use forest and biodiversity resources.

The contractor shall identify key actions necessary to conserve forests and biodiversity in Lebanon, including analysis of policy options for environmental management. Attention will be placed on examination of the institutional and legal framework for environmental management, including the mandates and actual capacity of the various agencies with environmental responsibilities, and the role of the private sector and NGOs.

Task 4: Describe the extent to which actions planned under the Lebanon country strategic plan address forest and biodiversity conservation needs.

Based on the needs assessment and the planning framework provided by the Lebanon country strategic plan, the contractor will provide programming options for directly or indirectly addressing forest and biodiversity conservation needs. This section of the report will also examine programming opportunities that are complementary with other donor initiatives to develop the potential for leveraging other donor technical and financial resources to support improved environmental conservation and management.

4. Deliverables

The contractor shall prepare the following report:

Tropical Forestry/Biodiversity Assessment, including executive summary. The contractor shall provide USAID/Lebanon with twenty-five copies of this report. In addition, the contractor shall provide the report to USAID/Lebanon in electronic copy as a Word 97 file.

5. Level of Effort

Total level of effort of about 36 working days allocated to one US Natural Resource Management Specialist, one local Natural resource Management Specialist, and one Local Environmental Management Specialist.

APPENDIX D

LIST OF MEETINGS AND SELECT MEETING NOTES

Dr. Lytton John Musselman	Visiting Professor at American University of Beirut Plant Taxonomy	July 1, 2002
HE Michel Moussa	Minister of Environment Minister	July 3, 2002
Ms. Lara Samaha	Ministry of Environment Biodiversity Focal Point	July 3, 2002
Mr. Rami Abu Salman	Ministry of Environment Biodiversity Enabling Activity	July 3, 2002
Ms. Wafa Khoury	Agrobiodiversity	July 3, 2002
Mr. Faisal Abu Izzeddine	Consultant, Biological Diversity & Protected Areas Formerly Project Manger on Protected Area Project	July 2, 2002

Dr. Lytton John Musselman

American University of Beirut

Visiting Professor, Plant Taxonomy

July 1, 2002

On: Status of Biodiversity and Forests, especially action recommendations

Since Dr. Musselmann was preparing to return to the United States that day (July 1, 2002), we were fortunate to be able to meet with him before his departure.

After we explained our mission, Dr. Musselman commented that environmentalists should draw on cultural and religious values to communicate their message.

Most of the meeting was spent discussing the importance of taxonomy (specifically plant taxonomy) and the state of taxonomy in Lebanon (no Lebanese taxonomists, out-of-date flora of Lebanon, unsubstantiated claims of endemism, lack of training in taxonomy, lack of access to publications on the flora of neighboring countries, etc.) NOTE - While Dr. Musselman specifically addressed taxonomy of flowering plants, there are probably other areas of biology that suffer similar constraints; e.g., non-flowering plants (especially soil fungi and micro-organisms) and entomology.

Dr. Musselman mentioned that he had begun the task of establishing an interactive website on the flora of Lebanon and mentioned that this initiative will need additional support if it is to live up to its potential of providing a much needed reference for anyone working in a field where the correct identification of plant species is important - ecology, ecosystem management, biodiversity conservation, protected area management, molecular biology, pharmaceuticals, genetics, environmental education, etc. He also mentioned that the Post Herbarium was being established at UAB as a national herbarium where plant specimens from all of the country would be stored

under controlled conditions to minimize deterioration of the specimens. He suggested that anyone collecting plant specimens should collect one specimen of each species for the national herbarium. He added that all specimens should be accompanied by photographs of important characteristics of the specimen (flowers, fruit, entire plant, branching arrangement, leaf arrangement, etc.). Once the specimen has been identified, the photographs and plant description would be added to the website. We discussed the potential benefits of the website as a tool which should become increasingly valuable as its users add additional information.

In response to a question from Bob Mowbray, Dr. Musselman agreed that efforts to update the flora of Lebanon and stimulate interest in taxonomy in Lebanon could benefit from collaboration with one or more internationally respected herbaria or universities (Kew Gardens, New York Botanical Gardens, Missouri Botanical Garden, an appropriate institution from another country, or state, with a Mediterranean climate - France or California perhaps). Dr. Musselman added that he thought it would be difficult to find an institution that would be interested in working in Lebanon.

Rami Abu Salman & Lara Samaha

Ministry of Environment

Project Manager, Top-Up Fund for Biodiversity Enabling Activity Project

Biodiversity Focal Point

July 3, 2002

Ms. Samaha and Mr. Salman summarized the actions that Lebanon has taken under the Biodiversity Convention:

- 1994, ratified convention, passed law 360;
- 1996, completed a 9 volume biodiversity strategy;
- 1998, in accordance with article 26 of the Convention, completed a biodiversity strategy and action plan; and
- 1999, with GEF financing and assistance from UNDP, MOE completed Lebanon's first report on biodiversity in compliance with the Convention's requirement that such reports be submitted every two years.

The action plan gives priority to forests, marine and fresh water ecosystems, and agro-biodiversity.

A new GEF project is working on a follow-up to the '98 strategy looking at needs and actions. The project will work to develop a legal framework for the strategy and assign responsibilities for required actions. It will also examine biodiversity safety concerns.

The Ministry plans to update a study that the National Council for Scientific Research conducted on five areas to be designated as protected areas for biodiversity conservation.

In August the Ministry will hold a national workshop on identifying priorities for biodiversity conservation. The priorities include:

- Monetary and human resources to develop the national capacity in animal and plant taxonomy needed to support efforts to develop the economic potential of Lebanon's biodiversity through activities such as ecotourism, bioprospecting, management of natural areas, scientific tourism, production and marketing of non timber forest products, etc.;
- Assess threats to biodiversity; and

- Identify biodiversity hotspots¹ (threatened ecosystems with high endemism).

Ongoing biodiversity projects include:

- The Protected Areas Project which supports the management of the Al-Shouf, Horsh Eden and Palm Islands Reserves;
- A wetlands project to support conservation of RAMSAR sites in the Bekaa Valley and the coast; and
- An agro-biodiversity project to conserve the genetic diversity of agricultural plants such as wheat and native fruit trees, and
- CAMP, a Coastal Areas Management Project.

The MOE was recently made responsible for reforestation, a responsibility which formerly was housed in the Ministry of Agriculture (MOA) which still has the institutional framework and personnel to carry out this responsibility. Nevertheless, the MOE's budget includes approximately 3.3 million Lebanese pounds for reforestation. The MOE has used consultants to prepare a reforestation plan and guidelines on species to be used in reforestation. The MOE plans to contract with private companies (and NGOs?) to carry out reforestation projects, including the planting of trees in protected areas.²

Mr. Salman and Ms. Samaha suggested that the USAID program in Lebanon would be more effective if it had more links at the national level so that government agencies and others would become more aware of the achievements of the USAID program. They suggested that USAID sponsor workshops and field days to share the lessons learned from the USAID sponsored activities.

Wafa Khoury
National Project Manager
Agrobiodiversity Project
July 3, 2002

Karim El-Jisr and Robert Mowbray met with Wafa Khoury on the afternoon of July 3, 2002.

Ms. Khoury discussed her work on the Conservation and Sustainable Use of Dry Land Agro-Biodiversity project and related subjects with us. This is a regional project based at ICARDA and working in Lebanon, Syria, Jordan, and the Palestinian Authority. In Lebanon the project is based at the Lebanon Agricultural Institute, a semi-autonomous agricultural research agency. The project receives technical backstopping from ICARDA (International Center for Agricultural Research In the Dry Areas), IPIGRI (International Plant Genetic Resources Institute), and ACSAD (the Arab Center for the Study).

The five-year project is a community based project to conduct research on and conserve land varieties and wild relatives of important agricultural plants, such as *Triticum*. The project is currently going on in three pilot communities in Lebanon; Aarsal, Ham & Maaraboun, and

¹These "hotspots" are not hotspots in the sense of hotspots originally defined by Norman Myers in 1988 or further refined by Mittermeier, et.al., circa 2000, but rather are relatively small areas within Lebanon which are habitats for a significant number of Lebanon's endemic species.

²Hopefully, environmental impact studies will be carried out before doing anything which modifies the ecology of protected areas.

Nabha. These communities cover a variety of ecosystems from the coast to 2,000 meters above sea level.

The project tests mechanisms to conserve wild varieties of agricultural plants through sustainable use. After collecting information to understand the community project personnel work with farmers to develop technological packages that conserve natural resources and improve yields of local varieties.

The project also examines the legal and policy environment for the conservation of agro-biodiversity by studying national laws, policies, and programs as well as international conventions.

Some recommendations include:

1. Lebanon needs to update its protected area system to establish different categories of protected areas. Ms. Khoury suggested that all of Lebanon should be protected.
2. USAID could help conserve agro-biodiversity by working in at least one of the project's communities to improve agricultural services like irrigation. (Ms. Khoury mentioned as an example a Creative Associates project to provide irrigation as an incentive for a community which was formerly involved in opium production.)
3. Develop ecotourism in the project's communities.
4. Assist farming communities to develop marketable products, such as cookies and bread, using local varieties of agricultural plants.
5. Assist in developing organic production practices.
6. Assist in developing cooperatives to produce and market local products based on native varieties.
7. Develop cookbooks of local recipes using unusual local ingredients.
8. Empower communities by sharing research and survey data with them.
9. Develop markets for wild fruits.
10. Use native fruit trees in reforestation projects.
11. Conduct research on honey production from native fruit trees and other agricultural plants.
12. Conduct research on native plants that have medicinal properties or can be used as herbal teas.

Faisal Abu-Izzedin

Consultant, Biological Diversity and Protected Areas

July 2, 2002

On: Status of Biodiversity and Forests, especially action recommendations

Faisal opened the meeting by stating that the strategy of making both the central government and NGOs responsible for the management of protected areas was a failed strategy. Bob Mowbray responded that a similar strategy seemed to be succeeding in Latin America, at least in Costa Rica, but added that this "success" occurred only after the central government had failed in its attempts to develop its protected area system into an economic resource. Early attempts, supported by donors, to share responsibility between the central government and NGOs had also failed, but by the early 1990s the government was in the process of evaluating various models of collaboration between the government and NGOs to select a model which the government would promote to develop and protect its entire protected area system.

Faisal agreed that donor supported study tours and exchange programs for young environmental professionals would help promote the development of a viable vision for the conservation of Lebanon's natural resources. In addition to visits and exchanges with other countries in the region, especially Jordan, and developing countries with strong natural resource conservation programs, Faisal suggested that Lebanese professionals might benefit from visits to state, county, and city parks in the United States. He added that there is a need to decentralize efforts to develop protected areas in Lebanon.

He suggested that picnic grounds should be established to revive an old Lebanese weekend tradition, promote the development of a conservation ethic, provide a resource for environmental education, and promote ecotourism.

He mentioned the USAID dairy cow program as an example of a program that may have had a negative impact on the environment and biodiversity. He claimed that the cows needed imported forage and feed, because local pastures were inadequate for these heavy eaters, as well as medicines and other products. He added that these animals, which were intended to be kept in barns, were being released into pastures and forests where they were overgrazing and compacting soils - "plowing through the forests like a bulldozer."

He suggested that USAID become more involved in supporting activities begun by UNDP and UNEP; perhaps by supporting implementation of the thematic studies prepared under the Biodiversity Planning Support Program (BPSP). These thematic studies call for the integration of biodiversity concerns into the agricultural, fisheries, forestry, and tourism sectors as well as the inclusion of biodiversity concerns in environmental assessment procedures, the improved use of economic tools in biodiversity planning, improved financial planning for national biodiversity strategy and action plans, and the harmonization of legal obligations under biodiversity-related multilateral environmental agreements.

Articles 6A and 6B of Lebanon's national biodiversity strategy call for all government agencies to have a biodiversity plan and to integrate biodiversity concerns into their programs as much as possible. Faisal suggested that USAID might assist this process by supporting the preparation of a document on how to integrate and by sponsoring integration workshops and field trips, in Arabic, for high-level officials.

He suggested that the YMCA environmental education program could be expanded to reach a broader segment of the public and that materials on the biodiversity convention could be included in the program. Faisal mentioned that there is a network of trails in Lebanon that could be joined for a form of ecological and cultural tourism.

Other activities that USAID could support include:

1. Development of tools to promote the environment, which could be used by people working in government agencies to promote the environment within their agency.
2. Support the development of a national herbarium including the training of a curator.
3. Provide support for updating the national flora.
4. Support the continued development and maintenance of a Flora of Lebanon online.
5. Sponsor training and workshops related to the development and use of the Lebanese flora and the website.
6. Support other activities that would contribute to the science base needed to conserve and manage biodiversity and forests. For example, assist Lebanese universities and research

institutions to develop collaborative arrangements with similar institutions in the region and elsewhere - perhaps emphasizing institutions in the five Mediterranean bio-climatic zones.

7. Sponsor activities to set priorities for research on forest economics.
8. Support the development of proposals to follow up on ongoing biodiversity conservation projects which are about to end; for example, the development/management of protected areas.

APPENDIX E

LIST OF FIELD VISITS AND SELECT FIELD VISIT NOTES

June 8, 2002	Mercy Corps International South Lebanon clusters	With Said Zaher: Hasbaya, Hibbarieh, Wazzani
June 14, 2002	YMCA and Pontifical Mission Akkar Clusters	With Joseph Kassab: Koss Akkar, Akkar el Atika With Imad Abu Jawdeh: Qobayat
June 18, 2002	Cooperate Housing Foundation Baalbeck-Hermel Cluster	With Bilal Kanaan: Hermel (slaughterhouse and Aamouh lake project), Deir Jabboule (WWTP)
June 22, 2002	Opportunities for ecosystem restoration in the highlands of Mount Lebanon	With Elie Gebrael and Sami Matta
June 29, 2002	Al Shouf Cedars Nature Reserve Ranger and Biodiversity Follow-Up	With Nizar Hani
July 5-6, 2002	Horsh Ehden Nature Reserve Park Manager	With Sarkis Khawaja

Field Trip to the South with Mercy Corps

Saturday, June 8, 2002

Saeed Zaher (Mercy Corps) with Joseph Karam and Karim El-Jisr

Livelihood Park: The hydroponic green fodder production unit (one old, another one coming online) seems to be producing quality barley that is improving milk productivity by the Hoilsten cows, while at the same time reducing production costs (less industrial feedstock and hay, less diseases). According to Saeed, the USDA-offered cows are not well adapted to the climate conditions of South Lebanon (and perhaps of Lebanon overall). The anaerobic digester of the cow waste produces biogas that meets the internal water heating needs of the park (no electricity generation). The park contains an informal, small-scale nursery for various trees and plants (berries, Damascus roses, sumac, forest trees) as well as experimental hatcheries for pheasants and partridges. It is not clear to what extent professionals have been involved in running this experimental wild bird hatchery program.

Dardara spring: Mercy Corps has cleaned the spring area and built a concrete wall around it to contain the spring water and store it in a neatly formed lake, from where it flows by gravity in two irrigation canals leading to the Qlaiaa or Khyiam agricultural fields. The Water Users Association (or water allocation committee) has not been established yet. People have broken into the specially built chambers at the two main lake outlets and broken the valves that control water delivery. As a result, water flows continuously from the lake. It will be interesting to observe the spring flow (and the water level in the lake) later in the summer and early fall. Mercy Corps also rehabilitated the main irrigation canals and the nearby spring of Ruqayqa.

Drainage ditches and water storage lake: Mercy Corps has also rehabilitated and built ditches cutting through portions of the Marjayoun/Kyiam plain in a North to South direction. The purpose of these ditches was not immediately clear: are they intended to receive the residual waters of the Dardara and Ruqayqa springs, after all the fields have been irrigated, and/or are they designed to drain the water-logged soils (if any) of the plain? Or perhaps are they intended to channel unused waters further south to the area where a water storage lake will be built in the future? It was not clear if Mercy Corps had conducted a feasibility study and EA for this rather significant project. Potential impacts would include water loss through evaporation, disposal of excavation materials, import of basalt stone to line the canal sides, growth of reeds and other weeds that could slow drainage, ditch maintenance, etc.

Wazzani Village: Mercy Corps built a sewer network and a wastewater treatment plant for the small village of Wazzani (35 families). By evacuating sewage away from houses, the project has definitely improved sanitation conditions in the village. But there appeared to be no maintenance or monitoring of the treatment plant itself to ensure that it is working properly. During the visit, effluents were not flowing from the second to the third basin, which suggests that either the second basin is leaking or water loss through evaporation and evapo-transpiration exceeded water addition from the first basin. Also, no water appeared to be leaving the third basin.

Wazzani and Hasbani Rivers: The Rivers provide habitat for a local variety of freshwater fish, which swim upstream in the winter to spawn at higher altitudes. After spawning, the small fish travel downstream and across the border all the way to the Houle Lake in Israel. Local environmental groups have observed that the small dams built long ago by the Government of Lebanon on the Hasbani river act as a potential barrier to this migration and are demanding that fish ladders be built on these dams to re-enable easy migration of the fish upstream. Mercy Corps has funded one such project on one of those dams. At the same time, it appears that fish – generally small size (10-15 cm)-- continue to be taken illegally by electrocution of the river waters.

Agricultural roads: Mercy Corps has built around 40 km of agricultural roads improving access of farmers to agricultural fields (olive orchards) and of firefighters to fire-prone forest areas. Mercy Corps leaves it up to the landowners to delineate the exact routing of the roads and to excavate the contours of the road using bulldozers. While this approach lets local landowners negotiate the best routing among themselves, it may not produce the optimal routing from an environmental perspective (e.g., avoiding wooded areas or high-slope areas prone to erosion). Also, excavation contractors need guidance and specific requirements on best practices for building a road. Mercy Corps intervenes to lay the base course of the road. Recently, Mercy Corps has experimented with the use of treated base course (gravel mixed with low doses of cement and water) with apparently successful results.

Al-Hebbariyyeh: Mercy Corps has designed and built a wastewater treatment plant for the village of Hebbariyyeh (2,000 people today). The plant contains the following components in series: anaerobic basins, trickling filters, and sand/cobble filters. Effluents are released into the wadi directly after the sand/cobble filters. Biogas is generated in the anaerobic basin and channeled to a gas storage chamber. There are no headwork facilities such as storm water overflow, grit and sand removal, or flow gauge. Mercy Corps intends to conduct effluent sampling and testing later this summer, which would determine the plant's treatment performance.

Jezzine stream: Immediately following the Israeli withdrawal, Mercy Corps provided assistance to the Municipality of Jezzine in cleaning up the stream that runs through it and lining it with

concrete. This project came as a showcase of the strong commitment of USAID to the liberated south in the aftermath of the withdrawal. It is not clear if alternatives to the concrete lining of the stream were considered. (We did not visit the Jezzine area)

Field trip to Akkar with YMCA

Friday, June 14, 2002

Joseph Kassab (YMCA) and Imad Abu Jawdeh (Pontifical Mission) with JK and KJ

Met Hassan Nather, Director of Secondary School in Ouyoun, and YMCA representative in Akkar region.

Dynamic composting in Akkar el Atika: The plant has been operational for six months. The design of the plant includes two levels. The upper level is the waste reception area and includes storage areas for recovered materials. The lower level consists of two rotating drums in parallel configuration. The drums (capacity of 5 tonnes/day) are sheltered under a naturally ventilated steel structure. Incoming waste is unloaded in the upper level and manually sorted to remove recyclable materials and other non-organic waste residues. Sorted waste items including metals, aluminum cans, glass and plastics are stored in nearby concrete enclosures. Nylon bags are a major problem and must be systematically removed before entering the composting line. The waste is then fed into a shredding machine mainly to reduce the size of incoming waste (i.e., peels of lemon and citrus) and thereby increase the contact area of the waste and the speed of decomposition. The shredded waste is then fed into the drum through a funnel structure. The drum is about 15 meters long and slightly inclined (1 percent) to facilitate the movement of waste and leachate inside the drum. The residence time inside the drum is three days. Composted waste then exists at the end of the drum into a conveyor belt that carries the waste to a trommel unit where foreign objects and large non-composted organic residues are screened and discarded.

The finished compost is then cured in open air. The compost piled on site during our visit contained a relatively large fraction of non-organic residues, such as small pieces of plastics and glass. In the absence of source separation or more effective segregation of commingled waste at the inlet (waste unloading platform), dynamic composting is unlikely to result in better quality compost.

Wastewater treatment plant in Koss Akkar: The plant is located at the bottom of a steep valley and the road leading to it is in poor condition. The plant consists of two sludge retention tanks and three open basins. The residence time for incoming wastewater is approximately 10 days, subject to the volume/rate of incoming wastewater. In response to higher-than-expected incoming flow rates (due to increased household connections), the plant could no longer treat incoming waste and was retrofitted with air diffusers powered by two electrical generators. It will be interesting to see if this makeshift upgrade will improve the plant's treatment performance.

Wastewater treatment plant in Qobayat (with Imad Abu Jawdeh/Pontifical Mission): The plant is located about 3 km from the village on a leveled land. The Pontifical Mission and the municipality helped finance the sewage network. The plant location and sewage network were originally part of GoL's wastewater program for North Lebanon. It uses extended aeration to reduce BOD and coliform. Residence time is 12 days and the plant can serve up to 9,000 people at the rate of 150 l/c/d (about 1,300m³/day). The plant consists of a grit removal compartment at the inlet, a sludge retention tank, and three extended aeration pits each equipped with 128 diffusers, in addition to a settling tank and a chlorination unit before final disposal. The

Pontifical Mission hopes to complete all the works and inaugurate the plant this summer. An on-site diesel generator will supply power.

Olive mill in Qobayat (with Pontifical Mission): The mill is located about 2 km from the village. It was inaugurated just two weeks before the end of last year's olive pressing season but is expected to be fully operational this year. The plant is run by a local cooperative. It consists of an olive cleaning unit, a rotating stone mill, an olive sludge feeding pan, two mechanical presses. The oil is then pumped into an elevated reservoir and fed into the centrifuge for separating the oil from other liquid residues "zibar", which are discharged directly into the environment outside the plant. The plant is covered, spacious and appears to function well. The Cooperative hopes to install a bottling line in order to complete the process.

Field trip to Baalback/Hermel with CHF

Tuesday, June 18, 2002

Bilal Kanaan and Ahmad Singer (CHF) with JK and KJ

Trees in Hermel: CHF has planted several rows of trees (cypress, pine, others) on each side of the road leading to the Qamou' obelisk and the entrance road to Hermel. The Municipality of Hermel is taking good care of the trees by watering them. If this maintenance and care continue for a few more years, the CHF project will have succeeded in greening the entrances to the Qamou' site and the town of Hermel, not a minor feat in this very arid part of the country (about 200 mm of rainfall per year).

Lake near the Qamou' Obelisk: CHF has also built a plastic-lined earth reservoir (capacity 19,000 m³) on a gently sloping site not far from the obelisk (less than 200 meters) and a transmission line to haul water from the Assi River (about 300 meters away) to the reservoir. The transmission line has not been connected to the reservoir yet. Once filled with water, the lake would serve to water the trees that have been planted alongside the road leading to the site, as well as any future tree planting projects around the obelisk. The Municipality also intends to transform the site into a tourist attraction by encouraging entrepreneurs to set up restaurants and souvenir shops around the obelisk and lake. While the Qamou' obelisk is today a neglected tourism landmark, unplanned development of the site in the future could have significant environmental impacts. No plan or environmental examination of site development has been prepared to date.

Hermel Slaughterhouse: Mr. Hisham Iskandar (Municipal council member) and Ali Ehmez (Municipal employee) took us on a tour of the new slaughterhouse facility built by CHF on land provided by the Municipality. In addition to the slaughterhouse, the Municipality built a concrete enclosure (small ranch) to house a cattle market and dug a well in the vicinity of the slaughterhouse. The Municipality will need to equip the slaughterhouse. The Municipality also intends to contract the slaughterhouse operation to the private sector, but it probably would need assistance in preparing the contract specifications (hygiene, by-products and waste management, quarantine procedures, etc.). The facility certainly would help to improve the current situation posed by butcher operations scattered in the area. Had an Environmental Assessment of this facility been undertaken, a number of design and future operational pitfalls could have been avoided. For example, the water well is located within a couple of meters from the cattle ranch and a dozen meters from the slaughterhouse and its liquid waste management tank system, which suggests a very high risk of aquifer contamination. On their way to the slaughterhouse, cows and sheep will have to go through a door with a standard threshold and are likely to trip over it. The two quarantine rooms (one for cows and one for sheep) have a full concrete floor with a small

household-type drain in one corner, complicating the disposal of animal waste and wash water from this room. At the operational level, the flows of live animal, cut fresh meat, by-products, blood, and other waste are not readily obvious.

Deir Jabbouleh wastewater treatment plant: The wastewater treatment plant does not appear to be working: water in the last storage tank emitted a stench odor, was not clear, and had a yellowish to brown color. During the visit, the blowers were not on, but it was not clear if the convent superintendent had simply short-circuited the mechanical aeration system altogether, or the treatment plant was not working properly anymore. Mother Sister Eugénie explained that the maintenance contract proposed by the contractor (Watermaster) was too expensive and that it was written in English. Therefore she has refused to sign it. As a result, the contractor has stopped doing any maintenance on the system. Sister Eugénie also explained that the operation costs of the plant (around \$5,000 per year) were rather prohibitive. She stressed that “we [the Convent] would not have participated in the project had we known the costs of operating and maintaining it.” Bilal explained the importance of maintenance and offered to mediate with the Contractor to reach a mutually agreeable maintenance contract between them and the Convent. Sister Eugénie appeared willing to accept a maintenance contract at a lower cost. Sister Marguerite reiterated the many benefits of the treatment plant built by CHF (no more odors, no need to hire contractors to pump septage from the old tanks and haul it away, reuse of the treated water to irrigate fruit tree fields); she asked for help from CHF to alleviate the high costs of plant maintenance.

Field Trip to Al-Shouf Cedar Reserve and Ammiq Wetlands

Nizar Hani with Elsa Sattout and Robert Mowbray

Saturday, June 29, 2002

We briefly visited the project office, in Moukhtara, where we saw herbarium specimens, mounted butterflies, and some of the equipment purchased for the project. We also looked at digital photographs of some of the reserve's plant species that will be used to support the herbarium specimens. We discussed the fact that the GEF support for the project is coming to an end at a time when so much remains to be done to develop the economic potential of the reserve to benefit local communities. We also discussed the importance of developing the science base for managing the reserve, developing nature education programs, training tour guides, developing ecotourism, promoting scientific tourism, and identifying other sustainable economic benefits which can be developed from the reserve's flora and fauna.

Later we visited an entrance to the reserve at Maasser Al-Shouf where we saw local products ready for sale to visitors to the reserve. We took a short walk in the reserve on a trail that led through widely spaced cedar forest and a cleared area. In addition to cedars, we saw many wild flowers, resembling an alpine meadow, a few small oak stump sprouts, and earth hills created by moles. The terrain was very rocky.

We moved on to another area where we able to see plentiful natural regeneration inside the cedar forest. Apparently soils in the large barren deforested areas are so eroded and degraded from overgrazing that natural regeneration of cedars and oaks does not occur on these areas. As we drove around the interior of the reserve we were able to see many long rows of, mostly stunted, cedars that had been planted 30 to 40 years ago under an FAO "reforestation" program.

It would probably be far more effective and much less expensive to emphasize assisted natural regeneration, site preparation, and/or direct seeding in efforts to reestablish cedars and associated tree species in the Lebanese highlands. Such an approach could involve planting of seedlings or

scattering of seeds in areas which have been identified as presenting the most favorable conditions for tree seedling establishment and growth accompanied by site preparation in areas around these "forests" to promote natural regeneration from seeds produced in the forest. Alternatively, it might be possible to reestablish cedars and associated species on favorable and/or well-prepared sites by direct seeding. Research on various systems of promoting natural regeneration should be a high priority in any effort to reforest Lebanon's deforested mountain slopes.

After leaving Al Shouf, we drove north in the Bekaa Valley and briefly observed the Ammiq wetlands, an unprotected wetland which is a tiny remnant of the swamps which occurred in the Litani valley until they were drained in the early 20th century. Despite their greatly diminished size, these wetlands are important habitat for migratory birds and some wintering waterfowl.

Field Trip to Horsh Ehden Reserve and RMF Nursery
Sarkis Khawaja with Elsa Sattout, Karim El-Jisr, and Robert Mowbray
Friday & Saturday, July 5-6, 2002

Elsa Sattout, Karim El-Jisr, and Robert Mowbray visited the Horsh Ehden Reserve on the afternoon and early evening of July 5.

Sarkis Khawaja is an architect by training - interestingly there are many architects involved in protected area development and management. A government appointed committee (GAC) of 7 members including experts and representatives of the municipality and an NGO provides guidance in the development of the reserve. (This arrangement is remarkably similar to the Board of Directors of FUNDECOR³, a Costa Rican NGO.). In addition to Sarkis, the staff of the Horsh Ehden reserve consists of an agronomist, a biochemist, and 3 rangers (2 of whom were former "aggressors" to the area).

The reserve is situated in a beautiful area high in the Mt. Lebanon Range. The town of Ehden near one of the entrances to the reserve receives so much snow that it is abandoned in winter. The reserve protects a forest of mixed cedar, fir, juniper, pine, oak, and other species. While it has an extensive trail system and 2 recently constructed, but not yet open, buildings that are to serve as a visitor center, the reserve is not well prepared to accept visitors. T-shirts and maps of the trail system exist, but are not easily to visitors to the reserve. There are no brochures and no self-guiding tours. Trails are marked with signs, but the signs have been defaced and there is no indication of where the trails lead or the distances involved.

Trail maintenance could be improved - fallen trees should be cleared from the trail and erosion barriers should be installed. As the reserve is developed consideration should be given to adding educational and recreational facilities and activities - guided nature walks for children, self guiding trails, educational exhibits in one of the visitor center buildings, camping areas, picnic grounds, etc. Managers of the reserve might also want to consider actions to control the population of wild pigs (an introduced species) in the reserve.

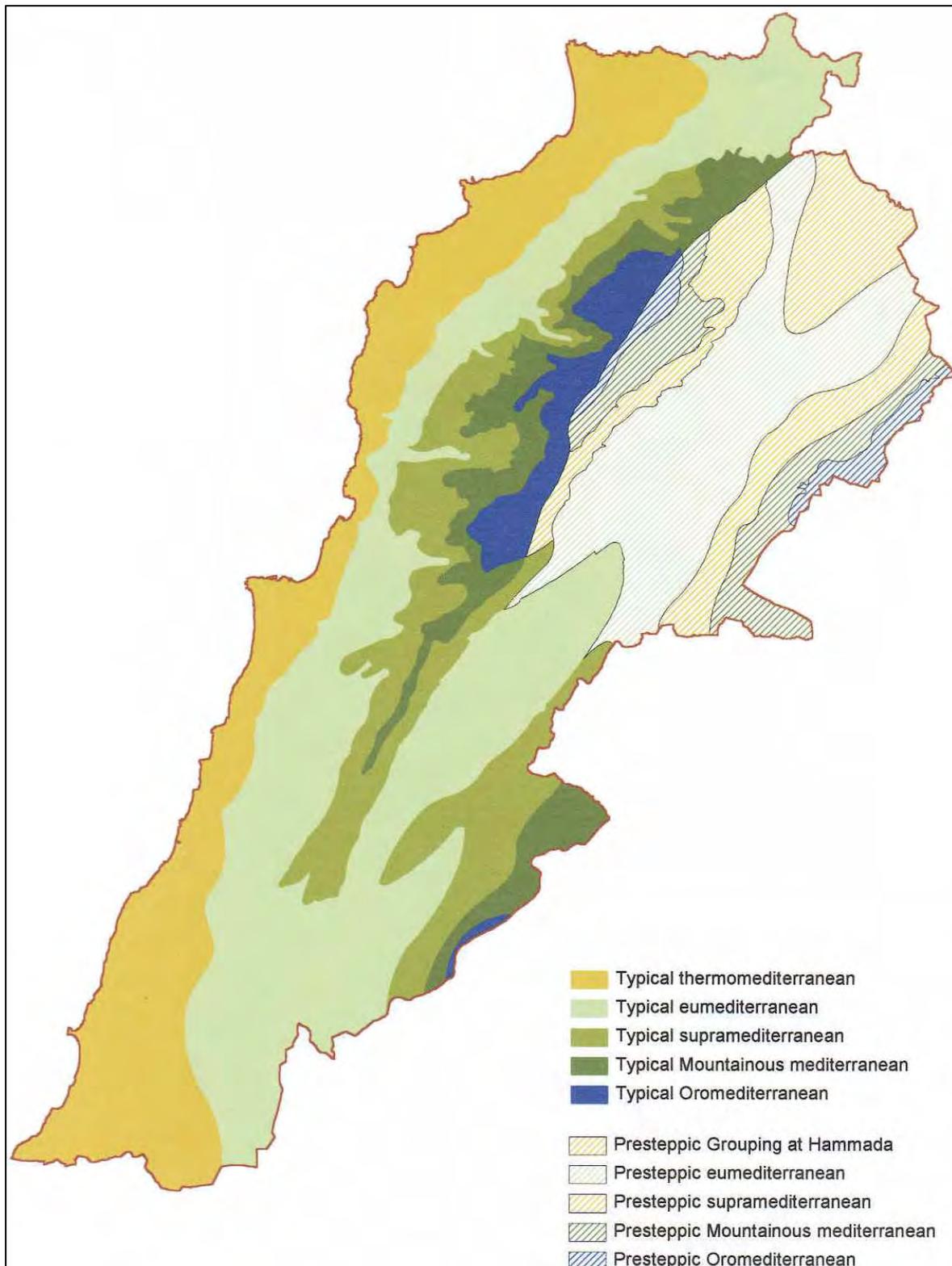
³ FUNDECOR is an NGO created by USAID/Costa Rica in the early 1990s before USAID left Costa Rica. This NGO has a local currency endowment fund created through USAID's large ESF program in the 1980s. This is one of several regional NGOs responsible for assisting the Costa Rican park and forest services to implement conservation programs in the conservation areas which the government of Costa Rica created when it realized that the country had been almost completely deforested and that its protected area system was in danger. FUNDECOR works with private land owners, small NGOs, municipalities, etc. and the national park and forest services within the Central Volcanic Cordillera Conservation Area which includes several protected areas within an area which stretches most of the way from San Jose to Limon

The NGO *Friends of Horsh Ehden* works with reserve personnel to develop and protect the reserve. We understand that at least some members of this group oppose actions to develop the reserve to attract more visitors - including such activities of clearing fallen trees from the trails. We encourage this group to maintain its vigilance, but perhaps, it should be more open to activities make the reserve friendlier to visitors and more useful for environmental education and outdoor recreation.

It should be noted that the area contains many sinkholes as well as several springs. The reserve is probably very important from a watershed management perspective as well as for its value in providing a habitat for biodiversity and its potential value for environmental education and outdoor recreation.

APPENDIX F

MAP OF MAJOR VEGETATION ZONES IN LEBANON



Source: Abi Saleh, B. & S. Safi (1998). Carte de la végétation du Liban (1/2,000,000). *Ecologia Mediterranea*: XIV (1/2): 123-141

APPENDIX G

LIST OF PROJECTS RELATED TO BIODIVERSITY AND FORESTS

<i>Theme</i>	<i>Period (Years)</i>	<i>Donor (Exe. Agency)</i>	<i>Budget (000 US\$)</i>	<i>Description</i>
Biodiversity				
Strengthening of National Capacity and Grassroots <i>in-situ</i> Conservation for Sustainable Biodiversity Protection	96-01	GEF/UNDP (MoE)	2,500	Set in place a function model for biodiversity conservation in three pilot nature reserves
National Biodiversity Strategy and Action Plan (NBSAP)	97-99	GEF/UNDP (MoE)	155	Formulate a national biodiversity strategy and action for Lebanon
Conservation & Sustainable Use of Dryland Agro biodiversity of the Near East.	99-04	GEF/UNDP (MoA)	1,500	Promote the conservation of important wild relatives and local varieties in three pilot sites (Ham, Maaraboun, Aarsal)
Coastal vegetation survey and conservation (Darwin Initiative)	99-02	UKM/BE (---)	229	
Conservation of wetlands and coastal zones in the Mediterranean	01-05	FFEM (MoE)	404	Establish and support an integrated management system to conserve the wetlands of Ammiq and Tyre Coastal Nature Reserve
Assessment of Capacity Building Needs and Country Specific Priorities in Biodiversity	01-02	GEF/UNDP (MoE)	100	Update the NBSAP, assess institutional needs and country specific priorities, establish a biodiversity forum
Bioprospection of Wild Native Lebanese flora	01-05	Mercy Corps and Toledo Ohio State University	NA	Diversify the agro-industrial portofolia of Lebanon
Forests				
Combating forest fires	97-00	MoF-FRA (MoA)	1,767	Technical assistance to MoA forest department (training, equipment)
Assistance a la Protection de la Couverture Végétale au Liban	97-00	EU (MoA)	1,896	Demonstrate sustainable management practices in three pilot sites
Equipment for combating forest fires incidence	99-00	MOF-FRA (CDR)	1,096	Purchase of utility vehicles for combating forest fires
Desertification				
National action programme to combat desertification in Lebanon	00-03	UNDP LEB/MOA* UNSO (MoA)	5 200 80	Set a national action program to combat desertification in Lebanon
Coastal Management				
Coastal Area Management Program (CAMP)	01-03	UNEP-MAP (EC Life-LEDO)	380 18	Establish a viable system of coastal reserves
Integrated Coastal Management between Jbail and Latakia	01-03	EU-SMAP (MoE)	1,000	Pilot sustainable development activities in three coastal regions

APPENDIX H**CITED REFERENCES**

- Abi Saleh, B., N. Nasser, R. Hanna, N. Safi, S. Safi & H. Tohme (1996). *Lebanon Country Study on Biological Diversity: Terrestrial Flora*. Republic of Lebanon, Ministry of Agriculture & United Nations Development Programme. Lebanon. Vol. 3.
- Abi Saleh, B. & S. Safi (1998). Carte de la végétation du Liban (1/2000000). *Ecologia Mediterranea*: XIV (1/2): 123-141.
- Baltaxe, R. (1965). *Projet de bonification integrale de la Montagne Libanaise*. Report on mapping the forests of Lebanon. FAO & Green Plan.
- USAID/Chemomics (2000). *Biodiversity Assessment for Croatia*. Washington, DC.
- Chouchani, B. (1979). Le Liban: Contribution à son étude climatique et phytogéographique. Doctorat de troisième cycle. Université Paul Sabatier. France.
- Chouchani B., M. Khouzami & P. Quezel (1974). *A propos de quelques groupements forestiers du Liban*. *Ecologia Mediterranea*. N.1. 63-77.
- Davis, S. D., V. H. Heywood & A. C. Hamilton (1994). *Center of Plant Diversity: A Guide and Strategy for their Conservation*. Vol. I. The World Wide Fund for Nature and IUCN-The World Conservation Union. Switzerland.
- Ministry of Environment/ECODIT (2002). Lebanon State of the Environment Report 2001. Prepared for the Ministry of Environment by ECODIT, Lebanon.
- Encyclopedia Britannica, (1978). Lebanon, Vol.19, pp. 764-769. Chicago.
- Heywood, V. H. (1995). The Mediterranean Flora in the Context of World Biodiversity. *Ecol. Med.* 21:11-18
- Hilton-Taylor, C. (2000). *IUCN Red List of Threatened Species*. IUCN – The World Conservation Union. UK.
- Medail, F. & P. Quezel (1997). *Hot-spots analysis for conservation of plant biodiversity in the Mediterranean Basin*. *Ann. Missouri. Bot. Garden*. 84:112-117
- METAP (Mediterranean Environmental Technical Assistance Program) (1995). *Lebanon: Assessment of the State of the Environment for the Ministry of Environment*. Final Report, EU/EIB/WB/UNDP, Prepared by Environmental Resources Management.
- Mittermeier, Russell A., N. Myers, P. Robles Gil, and C.G. Mittermeier. No date (circa 2000). *Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Eco-regions*. Conservation International, Washington DC and CEMEX, Mexico.
- Naveh, Z. (1987). *Landscape ecology, management conservation of European and Levant Mediterranean Uplands*. In: Tenhunen & al. (Eds): *Plant Response to Stress: Functional Analysis in Mediterranean Ecosystems*. Springer-Verlag Berlin-Heidelberg. Pp:641-647.
- Nehmé, M. (2000). *Dictionnaire Ethymologique de la Flora du Liban*. Librairie du Liban. Beyrouth. Liban.
- Quezel, P. (1985). Definition of the Mediterranean Region and the origin of its flora. In: Gomez-Campo, C. (Ed.), *Plant Conservation in the Mediterranean Area*, 9-24. W. Junk, Dordrecht.

- Talhok, S. N., R. Zurayk & S. Khuri. (2001). *Conservation of the Coniferous Forests of Lebanon: Past, present and future prospects*. Oryx, 35:3, 206-215.
- Tohme, H., H. Abdul-Nour, A. Farkad, S. B. Hraoui & G. R. Jaradi. (1996). *Etude de la Diversité Biologique: La Faune Terrestre*. République Libanaise, Ministère de l'Agriculture & Programme des Nations Unies pour L'Environnement. Liban. Vol. 4.
- Zohary, M. (1971). *The phytogeographical Foundation of the Middle East*. In: Davis. P. H., P.C. Harper & I. C. Hedge (Eds). *Plant Life of South-West Asia*. The Botanical Society of Edinburgh. UK. Pp. 43-52.
- Zohary. M. (1973). *The Geobotanical Foundation of the Middle East*. Vol. I. Gustav Fisher Verlag. Amsterdam.
- Ministry of Agriculture and UNEP (1996). *Biological Diversity of Lebanon: Comprehensive Report*. Republic of Lebanon.