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

Ministry of Agriculture

National Action Programme to Combat Desertification (NAP)

In Collaboration with

National Council for Scientific Research

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

2002

Chapter One

Introduction

1.1 Purpose and Objective of the UNCCD

The United Nations Convention to Combat Desertification (UNCCD), which entered into force on 26 December 1996, provides the international community with a framework for sustainable development of drylands. The objective of the Convention is to secure the long-term commitment of its parties through a legally binding document. It provides an international framework for states affected by desertification to work jointly with industrialized countries to implement their National Action Programmes. The Convention is thus a powerful instrument for sustainable natural resource management in affected regions and for ensuring long-term, mandatory external support for these efforts.

The Convention is founded on the principle that solutions for the problem of desertification and drought should emanate from the affected dryland populations, supported by partnerships with other concerned actors, both national and international. These solutions and supporting partnerships are undertaken within the National Action Programme (NAP) process as the main instrument for the implementation of the CCD at the national level.

1.2 National Action Programmes

Technical measures alone cannot win the battle against desertification. Efforts to combat desertification must therefore be integral components of national development strategies.

Furthermore, NAPs should define long term strategies and priorities together with the required legal and institutional frameworks.

At the practical level, National Action Programmes must perform two important functions: identify the factors that contribute to desertification in the relevant socio-economic, biological and geographic context; and define practical measures for combating desertification in some or all of the following priority fields:

- Improvement of the framework for poverty reduction
- Promotion of sustainable livelihoods
- Demographic dynamics
- Sustainable management of natural resources

1.3 What is Desertification?

Desertification is a condition of human-induced land degradation that occurs in arid, semi-arid and dry sub-humid regions (precipitation/potential evapotranspiration or P/ETP is between 0.05 and 0.65) (UNEP, 1995) and leads to a persistent decline in economic productivity of useful biota related to a land use or production system. Climatic variations intensify the decline in productivity, restorative management mitigates it. Therefore the following definition has been adopted by the Convention:

> **"Desertification" means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.**

1.4 Causes of Desertification

Climatic changes and human activity are the main causes of desertification. The desertification process results from the complex interactions of physical, biological, political, social, cultural and economic factors (see figure 1.1). Unsustainable land-use practices by the local population and human settlement patterns are conducive to desertification processes. Today many traditional agricultural strategies and methods are no longer suitable in the face of economic and political changes and due to population growth and the trend for nomadic pastoralists to become sedentary. Other factors frequently identified as contributing to desertification and preventing sustainable natural resource management are lack of legal security for land users in land tenure issues, lack

of technical expertise, and unfavorable global economic factors (notably world trade conditions). Wars and other human induced catastrophes also contribute to processes of land degradation.

These developments have led to soil exhaustion, overgrazing and deforestation, thus placing in jeopardy the future of the productive natural resource base.

1.5 Consequences of Desertification

Desertification is closely linked to serious social problems in developing countries such as poverty, poor health and nutrition status, food insecurity and the negative effects of migration and population dynamics. The net effect prevents sustainable economic and social development in the affected countries.

In addition, desertification diminishes soil productivity, reduces food production, takes from the land its vegetative cover, and even negatively impacts other areas not directly affected by its symptoms, e.g. by causing floods, soil salinization, deterioration of water quality, and silting of rivers, streams and reservoirs. Desertification also aggravates famine situation, imposes enormous costs on society, and jeopardizes social stability. Major macroeconomic losses are also incurred. Worldwide, lost income in areas directly affected by desertification is estimated at about US$42 billion per year (UNEP, 1995).

Figure 1.1 outlines the general complexity and inter-linkages of the causes and consequences of desertification.

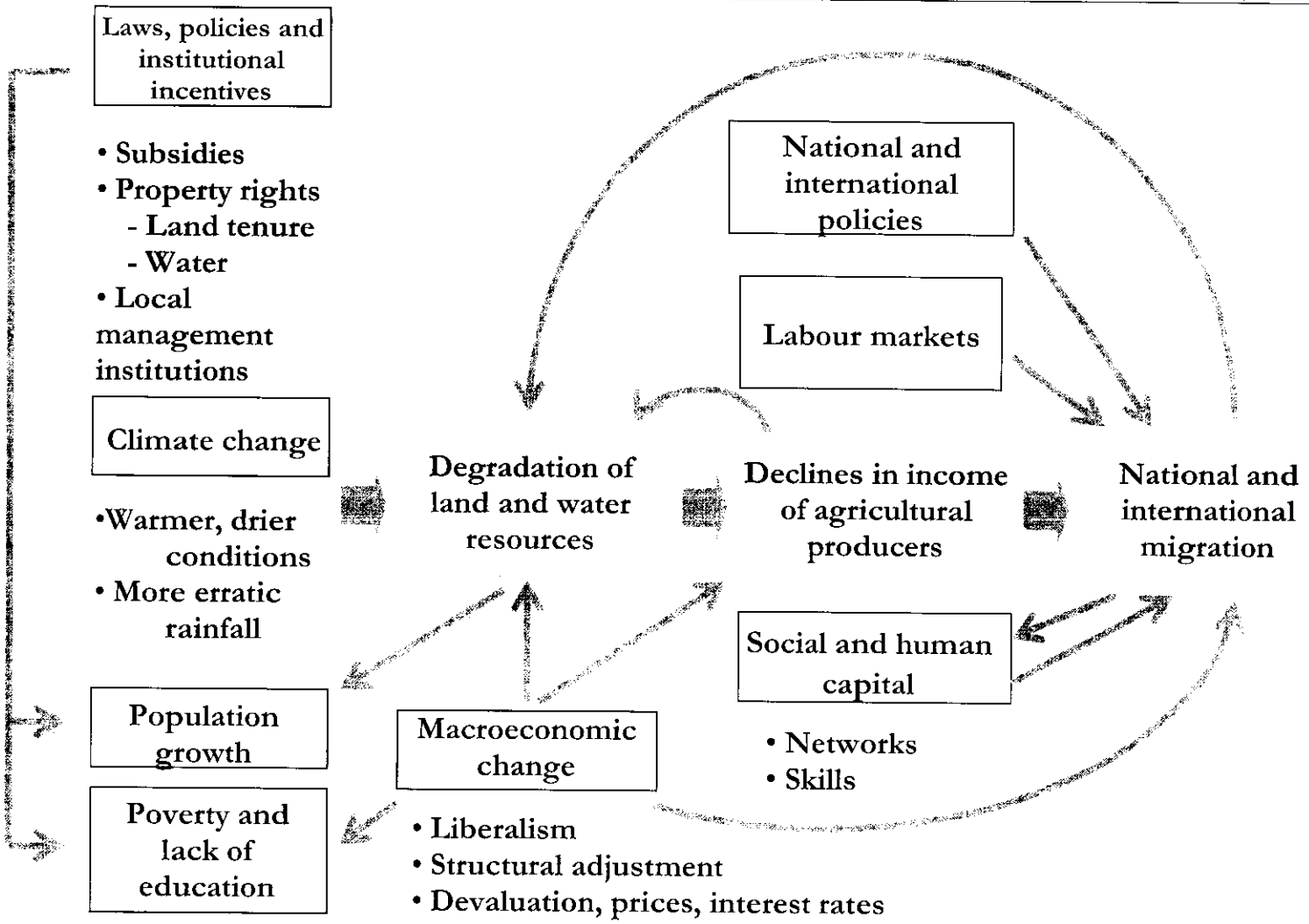
Laws, policies and institutional incentives
• Subsidies
• Property rights
- Land tenure
- Water
• Local management institutions
Climate change
•Warmer, drier conditions
• More erratic rainfall
Population growth
Poverty and lack of education
National and international policies
Labour markets
Degradation of land and water resources
Declines in income of agricultural producers
National and international migration
Social and human capital
• Networks
• Skills
Macroeconomic change
• Liberalism
• Structural adjustment
• Devaluation, prices, interest rates

Figure 1.1

1.6 The NAP Process in Lebanon

Based on the UNCCD recommendations, the NAP elaboration process in Lebanon has been carried out in a participatory way taking into consideration the needs of local communities in affected areas. The process has benefited and made use of the results and recommendations of previously conducted consultations with local communities. Additionally focused group meetings were carried out with national and international experts having profound experience and working closely with communities of affected areas. This ensured that the reached recommendations were based on the needs of the local communities in the different affected areas.

Below are the various steps undertaken during the NAP elaboration process:

1. Compilation of available data in Lebanon
2. Collection of available literature including reports and studies by development actors, research institutions and government organizations.
3. Establishment of CODIS "**Co**mbating **D**esertification **I**nformation **S**ystem"
4. Preparation of maps using the following indicators:
    - Climate
    - Soil
    - Vegetation cover
    - Land use
    - Demography
5. Preparation of Desertification Prone Areas (DPA) map
6. Consultations with national decision makers (Line ministries, Council for Development and Reconstruction) and other governmental bodies (Lebanese Agricultural Research Institute, Green Plan, Litani River Authority)
7. Conduction of Public hearings in affected areas
8. Consultations with cooperatives and other Community-Based Organizations
9. Consultations with regional decision-makers such as the Kaem-makam and Mouhafez

10. Participation in regional coordination meetings between different development actors
11. Conduction of focused group meetings bringing scientists, decision makers and NGOs with solid field experience together to discuss the causes and effects of land degradation and to formulate proper mitigation measures. Nine meetings were conducted, each focusing on one of the topics below:
    - Legislative framework
    - Land use planning
    - Socio-economic frame conditions
    - Water management
    - Forest management
    - Sustainable agriculture
    - Rangeland management
    - Soil conservation
    - Protected areas

    Prior to each of these meetings, a recognized expert prepared a situation paper, outlining the basis for discussion in the focus group meeting. The paper highlights the current situation and problems in the area as well as suggested remedial measures. The group then agrees on the necessary lines of action and formulates recommendations accordingly.
12. Conduction of the National Forum for the adoption of the national action program: The forum brought together representatives of the various stakeholders: relevant government institutions, national and regional research institutes, development actors, UNCCD secretariat, communities of affected areas (municipalities, cooperatives, NGO's) and the private sector.
13. Revision of the NAP based on the recommendations of the National Forum.
14. Organization of a series of decentralized meetings with municipalities of the different Mouhafazats in order to raise their awareness on land degradation processes, UNCCD and on-going efforts at the national level
15. Revision of the NAP based on the recommendations of a national meeting with municipalities of the different Mouhafazats.

16. Facilitation of the national adoption of the NAP by the Lebanese Government.

1.7 Lebanese Government Commitment

The government of Lebanon is committed to combating desertification. For example, it has initiated a large-scale reforestation program and has allocated approx. $16 million to this end. It is also very active in fighting the root causes behind land degradation primarily by promoting the development of rural areas and reducing regional disparities. Several programs aimed either directly or indirectly at rural development and poverty alleviation are financed through a mix of budgetary resources and donor agencies.

A comprehensive list of relevant activities, which have been carried out or initiated, is presented in appendix IV.

1.8 Outlook

This document constitutes a framework, a strategic vision on the actions needed for combating land degradation in Lebanon. It allows for the flexibility needed to deal with changing circumstances. It is envisaged that the strategy outlined in the NAP will be translated into detailed short, medium and long term action plans (including targets and activities) by the national coordination body. Procedures for monitoring and evaluation at the national and local levels will be developed to monitor different aspects including land degradation, the NAP process, UNCCD implementation and the impact of interventions. Feedback from monitoring and evaluation will be used to revise targets and activities based on needs and requirements.

Chapter Two

Environmental Status in Lebanon

Part I: Natural Factors

The Physical Environment

2.1 THE CLIMATE

2.1.1 Overview[1]

The climate of Lebanon is typically Mediterranean, humid to sub-humid in the wet season to semi-arid in the dry season. The wet season coincides with winter period, which lasts from October till May. In winter, the atmospheric pressure perturbations originating from South Europe cause abundant rainfall at the coast and on the mountains parallel to it. The dry season coincides with the summer period, which lasts from June till September. During this period, no rain is recorded and a state of high pressure dominates the whole country.

A typical average transect crossing the country consists of a subtropical coastal climate, a semi-arid continental in the Bekaa Valley and a typical Continental Mediterranean (Chaigneau *et al.,* 1999) climate in the Northern range of Anti-Lebanon Mountains.

The National Meteorological Service defined eight eco-climatic zones. The principal criterion for the zonation is rainfall. According to their geographical situation, the eco-climatic zones are distributed as follow (see Map 2.1):

- The coastal strip, including northern, central and southern coastal zones;
- The mountains, or the Mount-Lebanon, which are divided into two zones; northern and central
- The inland divided into three zones: northern, central and southern Bekaa Valley.

While the coastal and mountainous areas are characterized by abundant rainfall distributed over the winter season, the Bekaa Valley has a semi-arid to continental climate with unpredictable rainfall and recurrent drought.

[1] For a comprehensive understanding of the Lebanese climate, please refer to Safi, S & Abi-Saleh, B., 1999.

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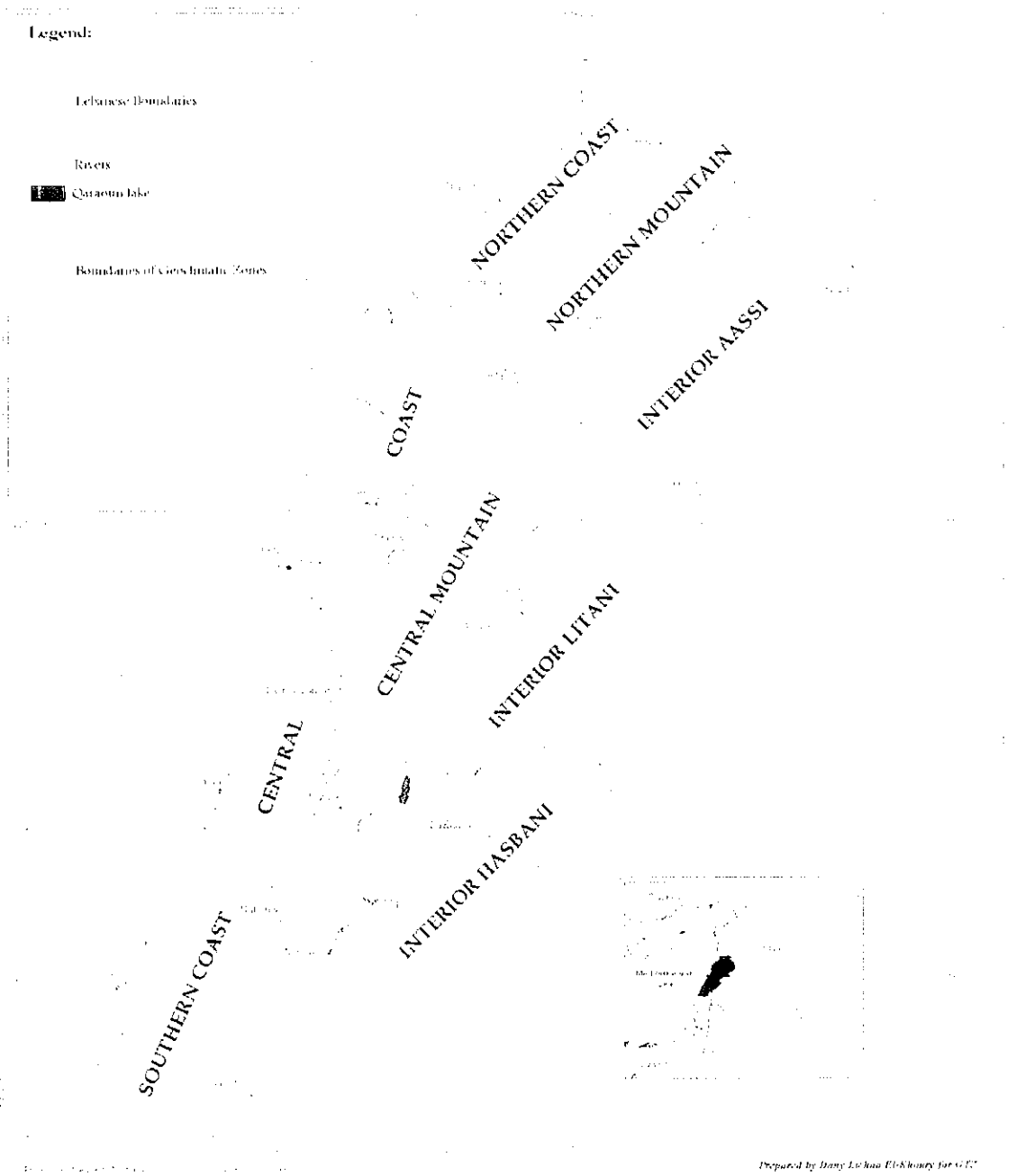

Prepared by Dany Lahaa El-Khoury for GTZ

Map no. 2.1

Title:

Geoclimatic Zones of Lebanon

Source:

B. Abi Saleh & S. Safi
Geoclimatic Zones
Climate Change Final Report - 1999

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10 0 10 20 30 Km

2.1.2 Precipitation

In Lebanon, precipitation constitutes the only renewable water resources, with annual average of approx. 840 mm. Map 2.2 shows the distribution of annual precipitation in Lebanon.

The long-term weather data indicate that 95% of the precipitation fall between October and April, and the remainder 5% between May and September. Figure 2.1.a shows the monthly rainfall distribution in different locations and periods.

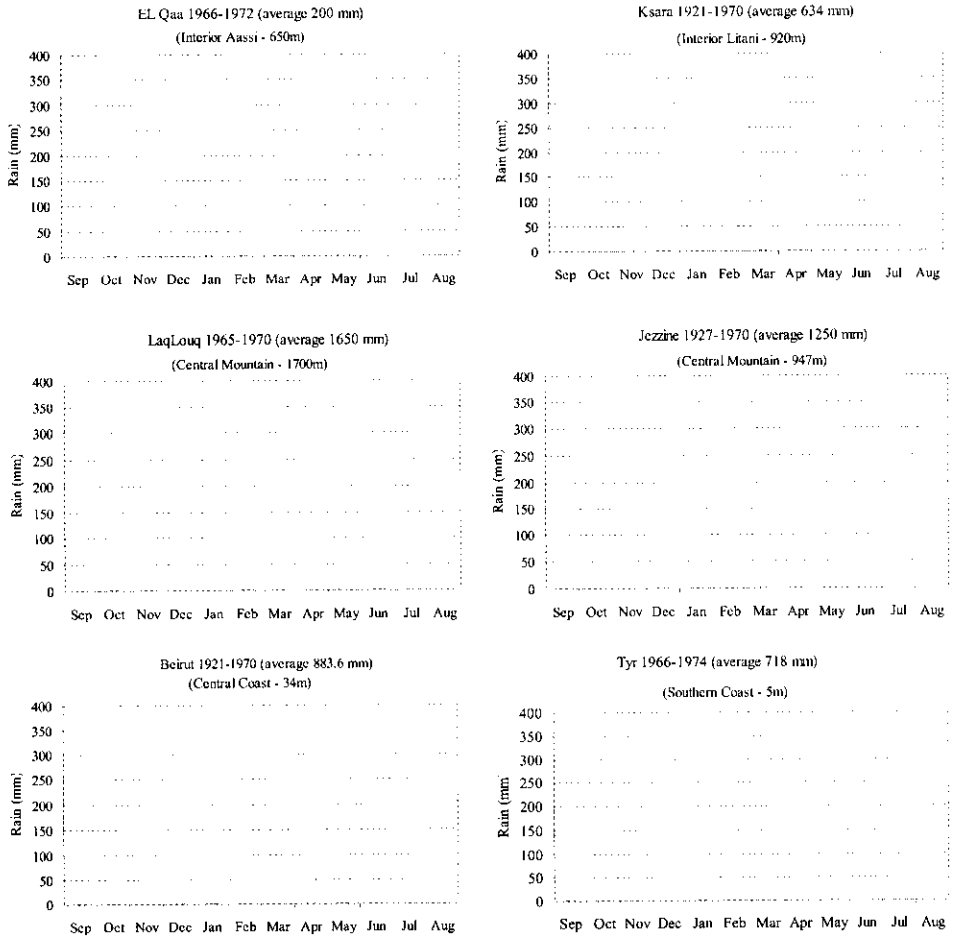
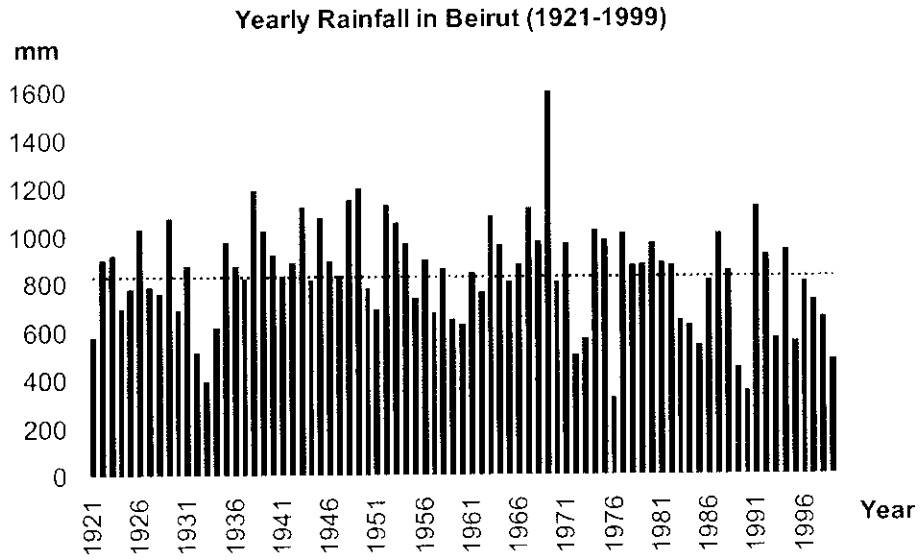
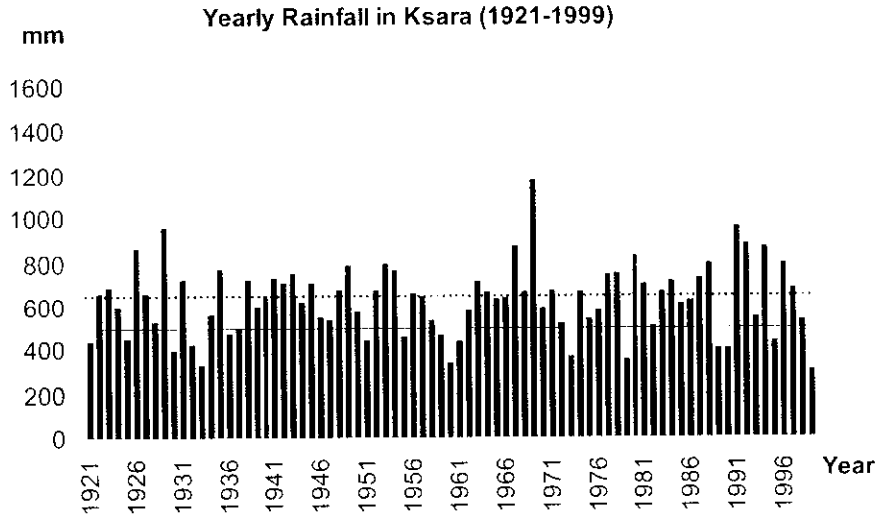


Figure 2.1.a. Monthly rainfall distribution in different locations and periods

Long-term time series records were only accessible from two stations (Beirut and Ksara). These are presented below. The analysis of the records (Decadal rainfall average) shows clearly a declining trend for Beirut and a relatively stable pattern for Ksara. More consistent long-term data is needed for a more comprehensive analysis.

Figure 2.1.b Long-term time series records for Beirut and Ksara.
Source: Meteo Liban, 1999, 2000, 2001; LARI 2000-2001.





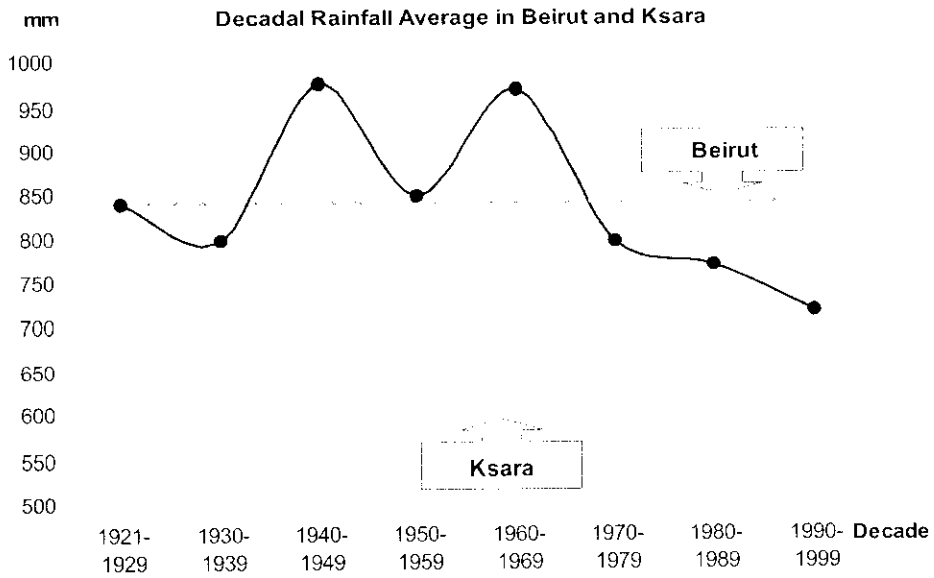


Figure 2.1.c. Decadal rainfall average in Beirut and Ksara.

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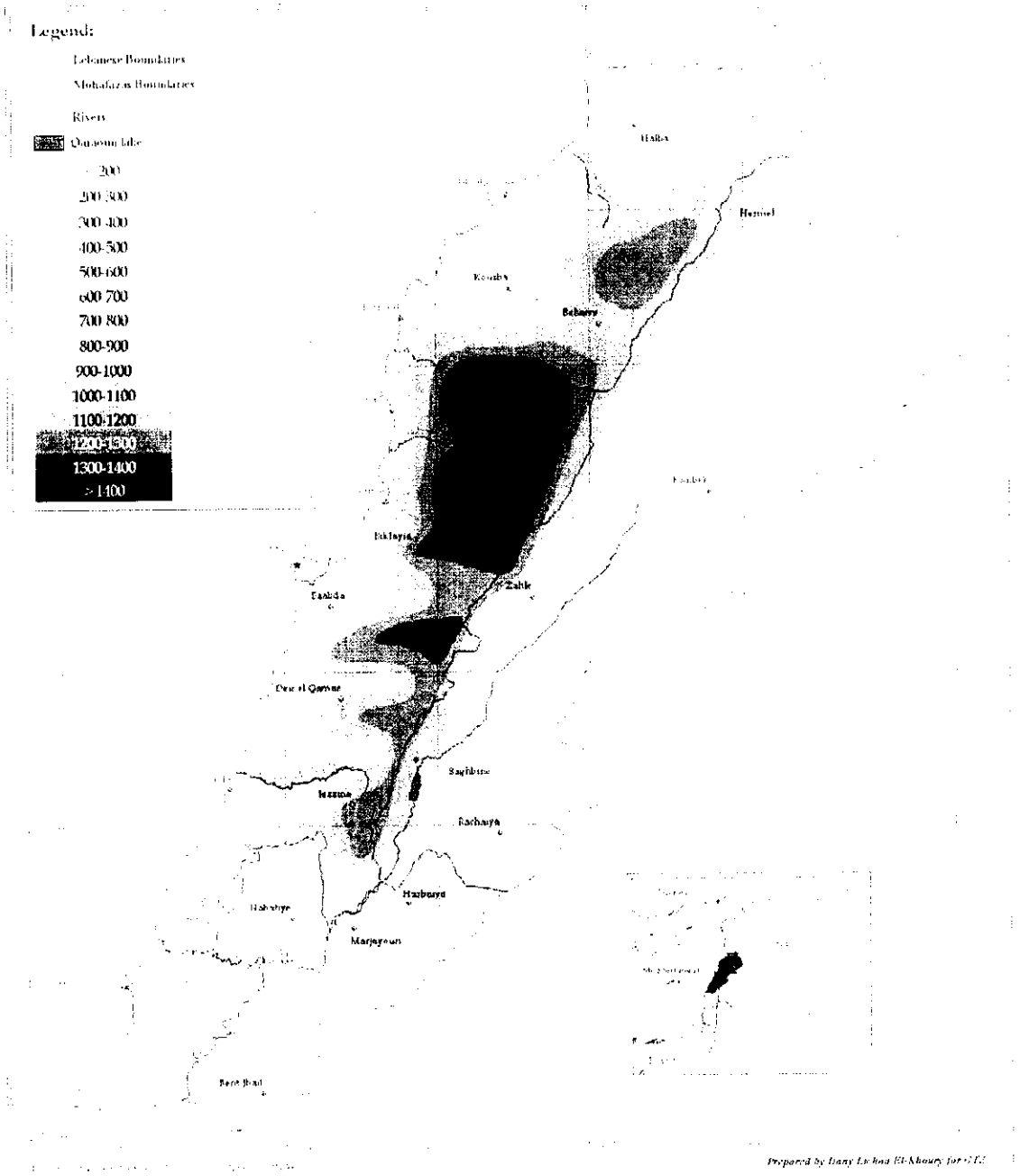

Map no. 2.2

Source:

Carte pluviometrique du Liban 1971
Scale: 1/200000

Title:

Annual Precipitation Distribution in Lebanon

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10 0 10 20 30 Km

2.1.3 Temperature

Mean annual temperature varies on the coast between 19.5 °C and 21.5 °C. It decreases approximately 3°C for each 500 m elevation. At 1000 m a.s.l., mean annual temperature is around 15 °C and decreases to 9°C at 2000 m a.s.l. The lowest temperatures are recorded in January, the highest temperatures in August, where maximum daily temperatures exceed 35°C in the Bekaa Valley (see Figure 2.2).

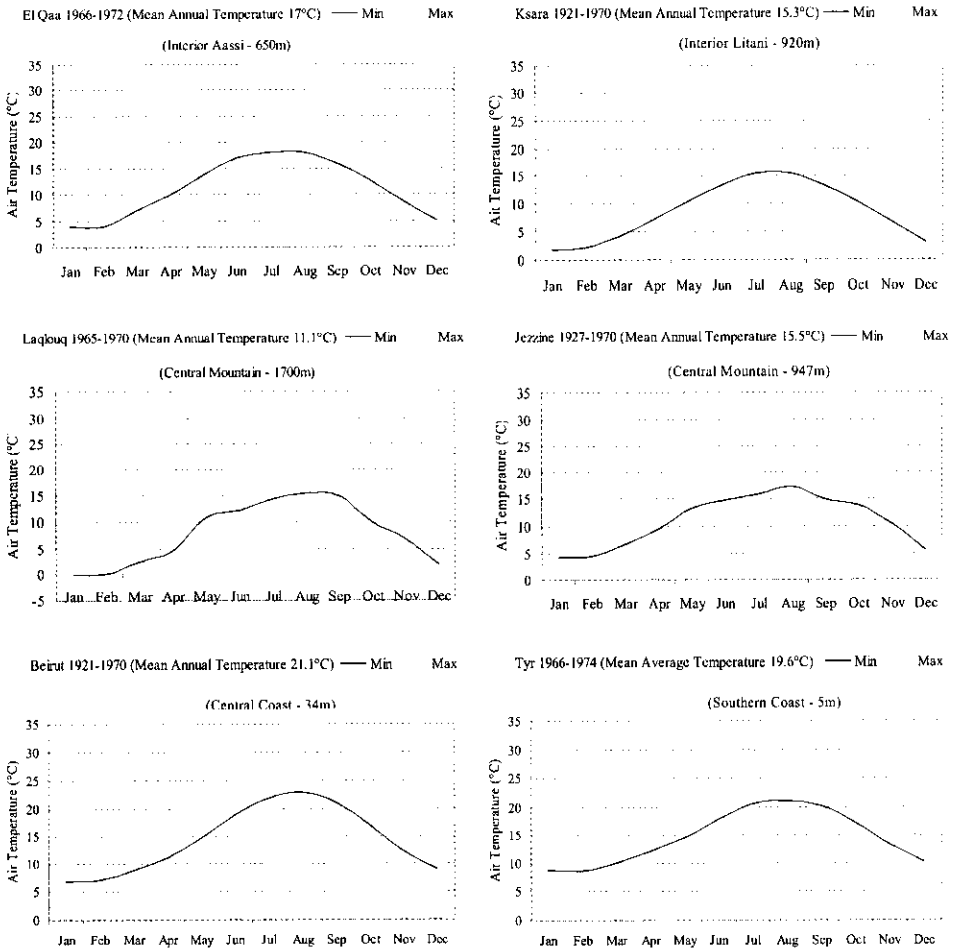

Figure 2.2 Monthly air temperatures at different locations and periods.

2.1.4 Potential evapotranspiration

Data reported by AbouKhaled *et al.,* (1972) show high potential evapotranspiration values for summer period, where maximum values were observed in July. Figure 2.3 illustrates the rain-potential evapotranspiration plotting curve, which shows clearly the negative water balance in the summer period. Less adverse effects are observed on the coast than in the Bekaa Valley, where advection effect due to wind drift and high vapor pressure deficit in the air are dominant. Map 2.2 shows the distribution of the potential evapotranspiration (ETP).

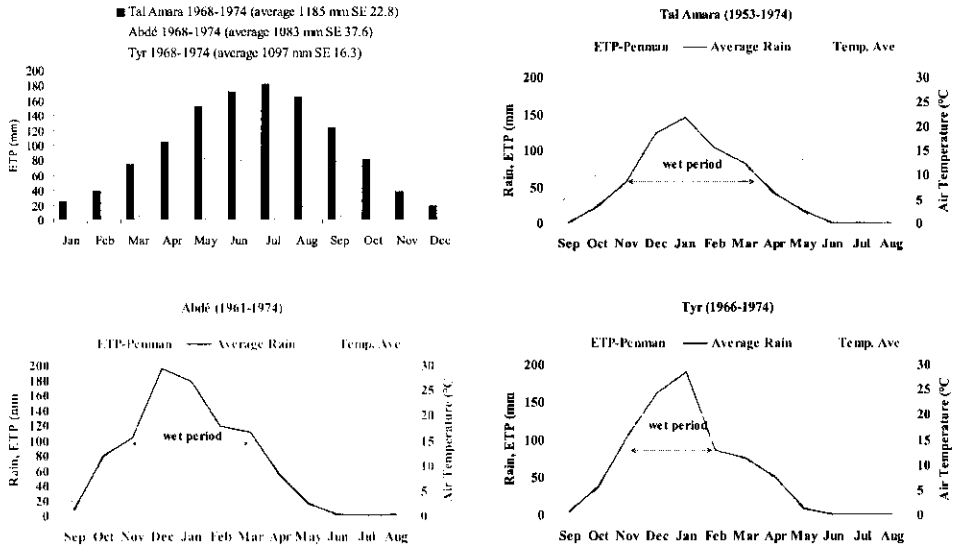

Figure 2.3 Average monthly potential evapotranspiration, rain and air temperature at different sites

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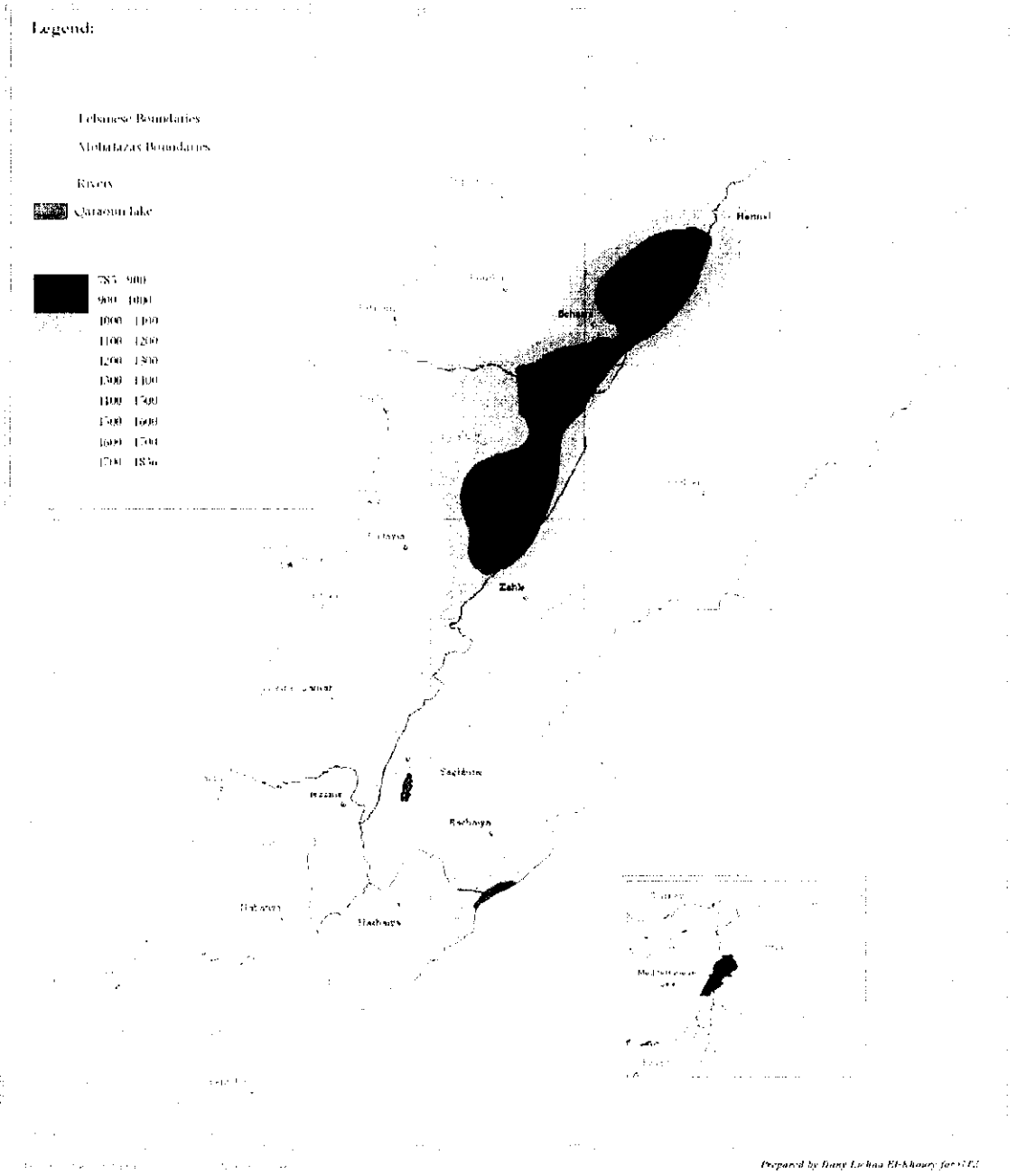

Map no. 2.3

Source:

Elaborated from:
Atlas climatique du Liban
1966

Title:

Distribution of Annual Potential Evapotranspiration in Lebanon

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Scale: 1/600000

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2.2 GEOLOGY AND TOPOGRAPHY

2.2.1 Geological setting

About 70% of Lebanon is constituted from carbonate rocks that range in age from Middle Jurassic to Eocene. Most of them are extensively fractured and cavernous limestones. The exposed stratigraphic column starts from the Mid Jurassic, through the Cretaceous, Tertiary and Quaternary, with some hiatus at certain ages. The exceptions to the carbonate lithology are sandstones at the base of the Cretaceous, basalts and other minor volcanics mostly interbedded through Jurassic and lower Cretaceous, but dominant and massive in the Pliocene of Akkar. Other clastics are minor shales in the Albian, conglomerates in the Miocene and unconsolidated deposits in the Quaternary (see Map 2.3).

Obviously, the responses of those lithologies to superficial processes differ greatly. The clastics are generally more prone to instability, the soft carbonates or marls are easily dissected by water, producing badlands, the resistant carbonates are normally karstified and the volcanics also vary according to their physical characteristics.

Concerning relief and landforms, there is a marked contrast in the terrain. This is mainly the result of the tectonic regime during the intense history of structural build-up and uplift, which left a rugged and highly dissected terrain with dense faulting. There are four distinct morphological units (see Figure 2.4), i.e. the narrow coastal plain, the elevated Mount Lebanon or western chain (which receives snow and the most intensive rainfall), the inner Bekaa valley, and the inner or Eastern Mountain chain. The short distance over which the topography changes (exceeding 3000 m elevation within 60 km horizontal distance) makes the general character of the terrain quite steep and prone to instability (see Map 2.4).

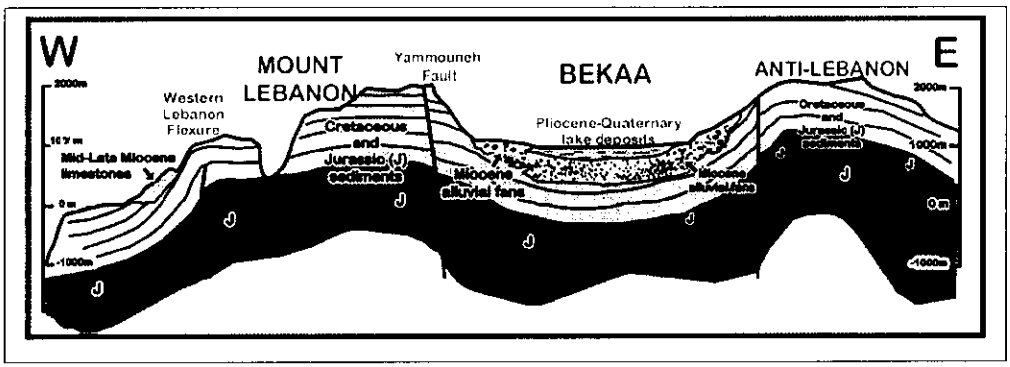

Figure 2.4 Schematic east-west cross section of Lebanon
(adopted from C.D. Walley, The Geology of Lebanon, DDC – AUB)

This, in addition to the uplifting and dissection, has led to an intensive rate of superficial movements and processes. The result is a generally high local relief, which, in itself, enhances notably differential degradation operations, i.e. weathering and erosion.

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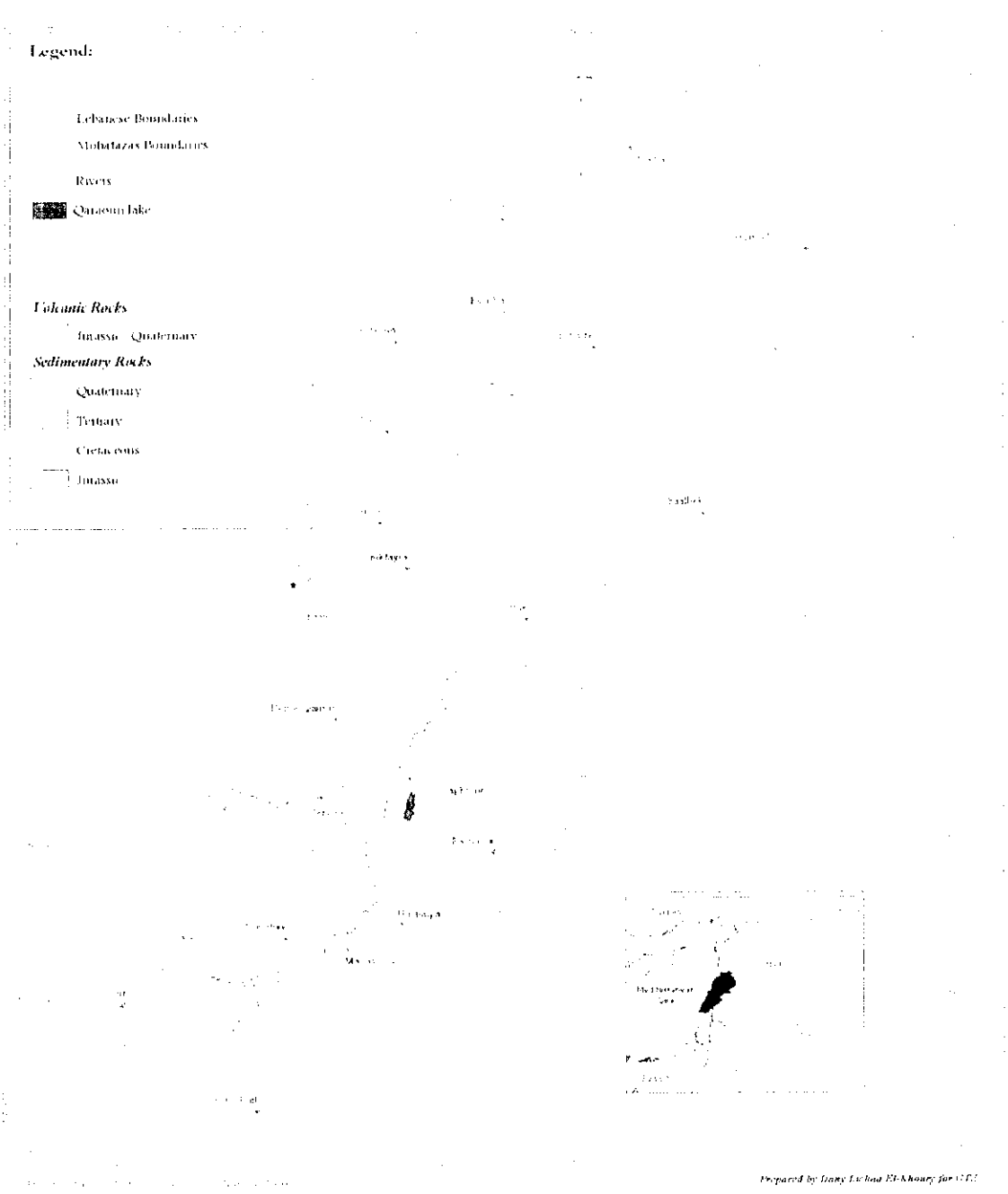

Prepared by Jamy Lechaa El-Khoury for CDL

Map no. 2.4

Title:

Geological Map of Lebanon

Source:

Adapted from:
National Center of Remote Sensing
National Council of Scientific Research

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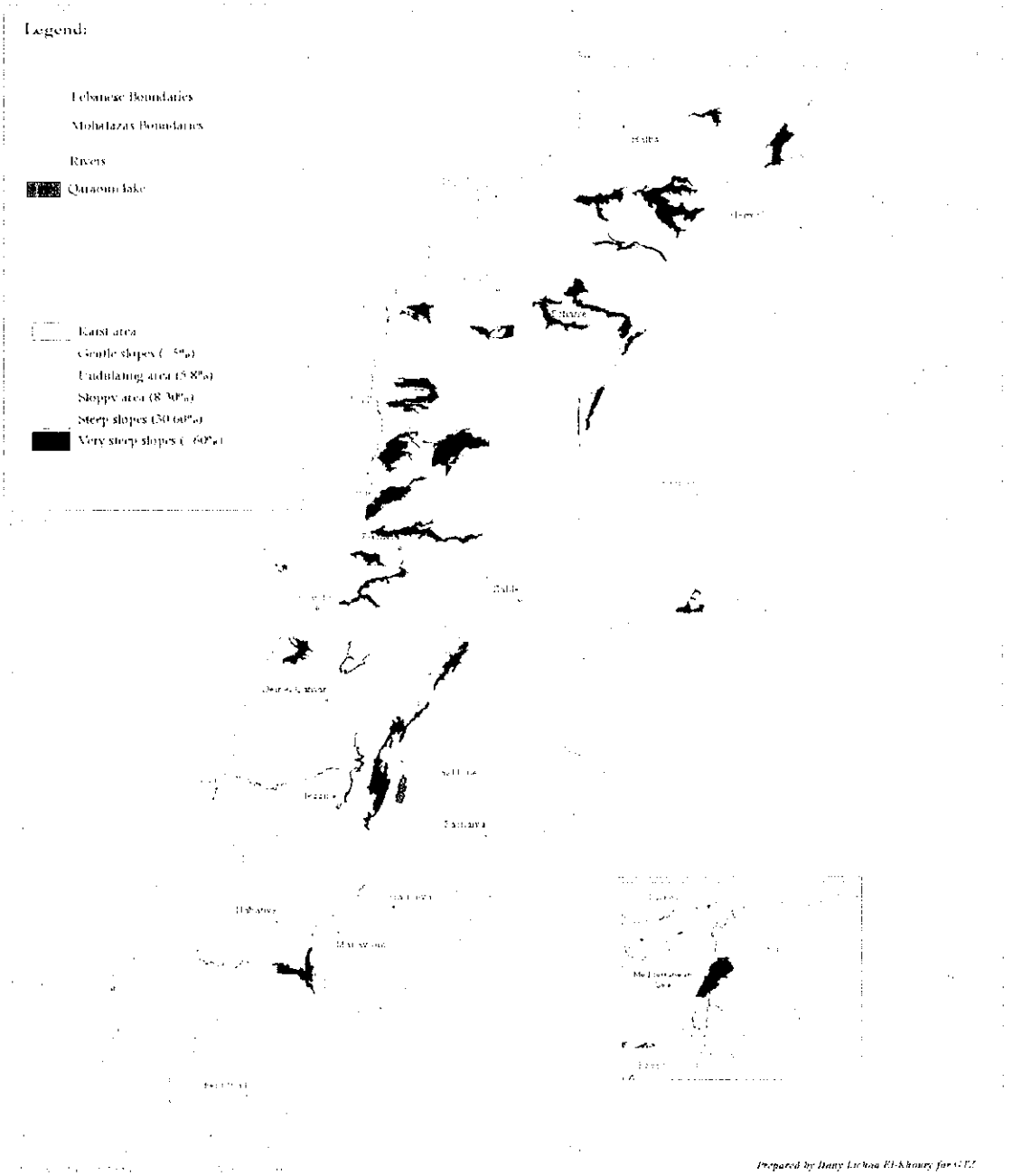

Map no. 2.5

Title:

Landform Map of Lebanon

Source:

National Center of Remote Sensing
National Council of Scientific Research

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10 0 10 20 30 Km

2.2.2 Geological Processes

Geological processes include weathering, mass movements and erosion. In the semi-arid and dry sub-humid climatic conditions of Lebanon where rainfalls often are torrential, erosion is strongly linked to flash floods with devastating effects. An analysis of such events over the last three decades shows they are frequent, recurrent and widespread and have contributed to land degradation significantly. Moreover, also under conditions of dense precipitation, very often-unconsolidated superficial deposits on large sloping areas become oversaturated, lose their strength and slide in huge masses. Mass movements are very common in Lebanon, and the process is considered a significant aspect of superficial instability contributing to land degradation.

The alternation of permeable limestone layers with clay and the presence of faults enable the emergence of water springs, which influence the development of agriculture and human settlements in Lebanon.

2.3 WATER RESOURCES IN LEBANON

Desertification is the draining of the life-supporting capabilities of arid or semiarid land. Characteristic of this process is the declining of the groundwater table and depletion of surface water supplies, the salinisation of water and topsoil, increasing erosion and diminution of natural vegetation. Drought or misuse by humans makes land susceptible to desertification which spreads into arid and semiarid areas.

The use of water resources in Lebanon is approaching unsustainable levels. This is mainly due to a lack of effective management policies, increased consumption as a result of expansion of irrigated agricultural land, escalating uncontrolled exploitation of groundwater resources, population growth and industrial development.

2.3.1 Water Balance in Lebanon

While snowfall is not adequately estimated, the average annual precipitation in Lebanon is estimated at about 840 mm/year. This amount of water may appear relatively large in comparison to neighboring countries; however, its use is limited by temporal and spatial disparities. Temporally, precipitation occurs during a short period (about 80 rainy days between September and May). Spatially, it is not evenly distributed creating sharp regional disparities whereby the annual precipitation varies from a low of 200 mm/year in the northern inland extremes of the Bekaa Plateau to more than 1,500 mm/year at the peaks of Mount Lebanon (see Map 2.1). This uneven distribution is a direct result of Lebanon's geomorphology whereby despite its relatively small area, Lebanon exhibits contrasting physiographic features and well-differentiated geomorphologic regions (see Map 2.4).

The country's limestone formations have many fissures and fractures, which enhance the percolation and the infiltration of snowmelt and rainwater deep into the ground to feed aquifers. Ultimately, the water in these layers either:

1) remains stored in aquifers, some may be exploited through wells while others remain in deep layers untapped;
2) reappears as surface water, at lower elevations, in the form of seasonal fresh water springs (nearly 2,000) that feed into various streams (nearly 40); or
3) forms submarine springs about 60, 15 of which are offshore while the rest are littoral ones, (CNRS,2000)

A number of streams (14 to 17 depending on the source of information) are classified as perennial rivers, while the remainder is seasonal. These perennial rivers are distributed as follows (Map 2.6):

1. Thirteen rivers flow westwards from their source in the heights of Mount Lebanon towards the Mediterranean Sea. These rivers have an average length less than 60 km.;
2. El Kebir river, which is a coastal river that traces the northern border of Lebanon with Syria;
3. The Litani river that drains the southern Bekaa plateau, transverses the southern edge of the Mount Lebanon range and discharges into the Mediterranean;
4. The Hasbani river, which crosses the southern border and forms one of the tributaries of the River Jordan; and
5. El Assi (Orontes) river that flows northwards into Syria draining the northern Bekaa plain.

Tables 2.1 and 2.2 below show the average discharge of rivers and the average debit of main springs, respectively.

Table 2.1 The average discharge of rivers in Lebanon

River	Gauging-station location	Years of observation	Discharge, m^3/sec		
			Wet season Nov- Apt	***Dry season May- Oct***	***Annual average values***
El-Kebir	Arida	1966-68	13.20	1.84	7.51
Ostouen	Beit el haj	1966-68	3.16	0.98	2.04
Arka	Hakour	1966-68	3.12	1.01	2.06
Bared	Bared	1952-56	1.81	1.22	1.51
Abou Ali	Kousba	1948-68	4.93	2.18	3.56
	Abou Samra	1966-68	21.20	8.92	15.10
Jaouze	Beit Chlala	1966-68	4.25	1.42	2.84
Ibrahim	Mouth	1966-68	19.45	11.60	15.52
El- Kelb	Mouth	1949-60	11.45	4.30	7.88
Beirut	Mouth	1948-62	5.94	0.51	3.24
Damour	Jisr el Qadi	1966-68	14.45	1.78	8.10
Awali	Marj Bisri	1961-68	8.30	1.15	4.75
	Mouth	1961-68	13.15	4.86	9.00
Zahrani	Road to Sour	1965-68	1.20	0.03	0.60
Litani	Mansoura	1938-68	14.20	4.46	9.34
	Karaoun	1931-61	20.25	5.81	13.02
	Khardale	1921-51	29.20	11.40	20.40
	Kasmie	1965-68	4.84	3.38	4.11
Hasbani	Wazzani	1963-67	6.34	2.11	4.25
El-Aassi	Hermel	1966-68	12.97	14.30	13.63

Source: Khair *et al.*, 1994

Table 2.2 Average discharge of main springs in Lebanon

Springs	*Years of Observation*	*Discharge, m^3/Sec*		
		Wet Season	*Dry Season*	*Annual Average Values*
Rachine	1960-68	1.26	0.94	1.10
Dalle	1966-68	2.82	1.04	1.93
Afka	1995-68	5.45	3.80	4.62
Jeita	1949-60	4.80	4.15	4.48
Antelias	1950-51	0.72	0.41	0.56
Ain el Delbe	-	-	-	2.2
Safa	1929-55	1.62	1.23	1.43
Barouk	1945-68	1.23	0.81	1.03
Jezzine	-	-	-	0.50
Tasseh	-	-	-	0.80
Ras el Ain (Tyr)	1959-68	0.93	0.83	0.88
Ain Zerka	1962-68	2.96	1.91	2.44
Laboue	1960-68	0.88	1.12	1.00
Yammoune	1967-68	2.08	3.54	2.82
Ras el Ain (baalbeck)	1960-66	0.36	0.34	0.35
Ain el Baida	1963-68	0.27	0.25	0.26
Berdauni	1952-68	2.25	0.57	1.41
Chtaura	1961-68	0.58	0.34	0.46
Ras el Ain (terbol)	1963-68	0.33	0.11	0.22
Kab Elsia	1961-68	1.02	0.34	0.68
Chamsine	1961-68	0.50	0.43	0.46
Anjar	1961-68	2.62	1.43	2.00
Ammik	1961-68	1.07	0.34	0.71
Koryazat	1961-68	0.35	0.25	0.30
Hasbani	1963-68	1.75	0.48	1.12
Chebaa	-	-	-	0.32
Sreid	1963-68	1.57	0.45	1.01
Wazzani	1963-67	1.82	1.51	1.86

Source: *Khair et al.*, 1994

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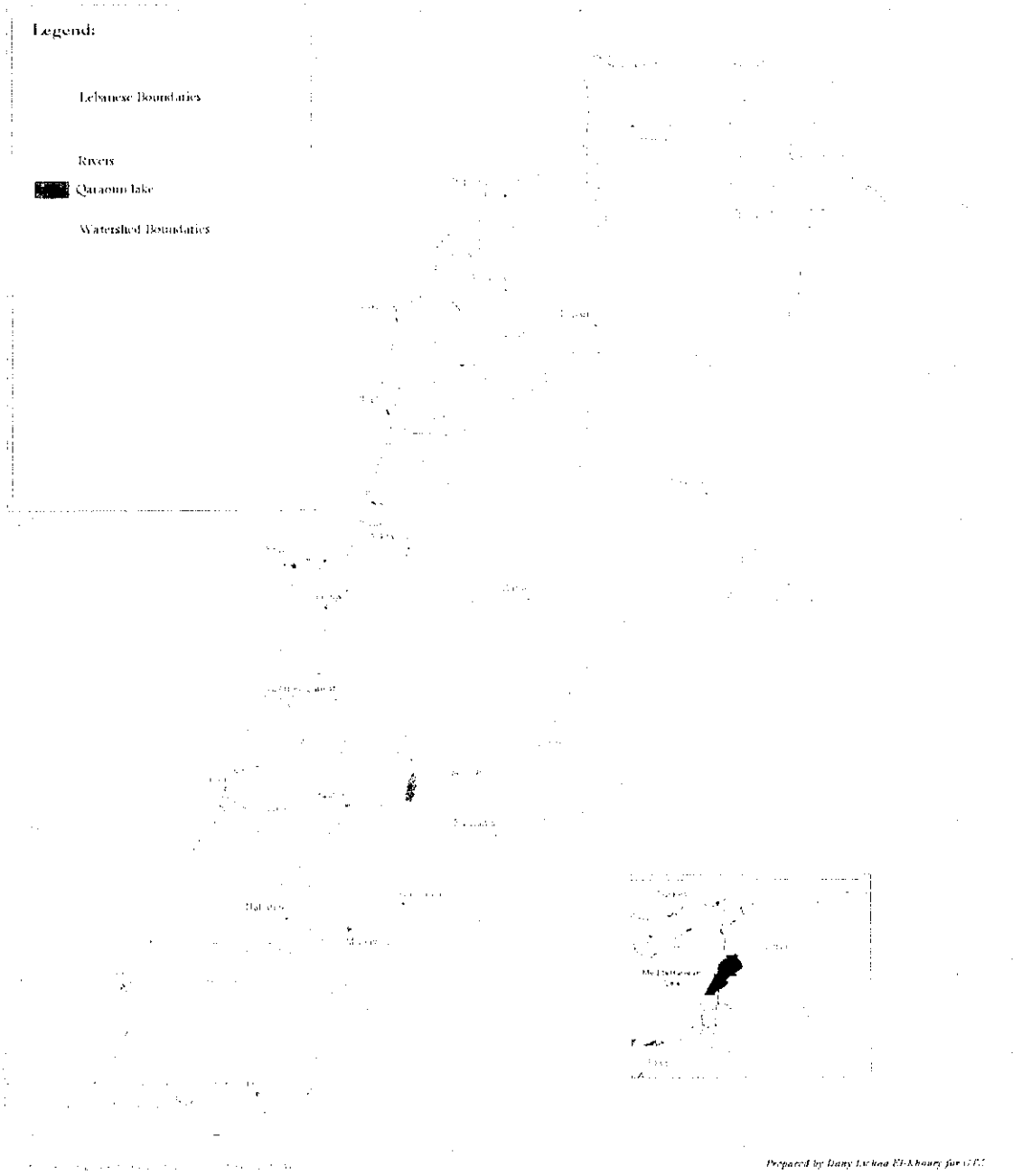

Prepared by Dany Lichaa El-Khoury for GTZ

Map no. 2.6

Title:

Major Rivers & Basins in Lebanon

Source:

National Center of Remote Sensing
National Council of Scientific Research

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Various estimates of the resulting water balance in Lebanon have been reported. Recognizing the limitations associated with the accuracy and representativeness of these estimates, Table 2.3 presents the typical water balance in Lebanon. About 50 percent of the average yearly precipitation of 8,600 MCM is lost through evapo-transpiration. Other losses include surface water flows to neighboring countries (almost 8 percent) and groundwater seepage (12 percent) leaving 2,680 MCM of surface and groundwater that is potentially available, of which 2,000 MCM are exploitable.

Table 2.3 Annual water balance in Lebanon (C.Abdallah, FAO 2001; Jaber, 1994)

Description	**Average yearly flows MCM**
Precipitation	8600
Evapotranspiration	4300
Unexploited ground water and ground water losses to sea	880
Ground water losses to lake Haula	150
Losses to Syria:	
Assi River	415
El Kabir River	95
Allocation to Lebanon from El Assi	80
Losses to Palestine:	
Hasbani River	160
Exploitable ground water	400
Net potentially available surface flow	2280

2.3.2 Water Demand and Supply

Water demand has traditionally been shared between three principal sectors, namely, agriculture, domestic, and industry (Figure 2.5). Agriculture is by far the largest consumer of water in Lebanon accounting for more than two-thirds of the total water demand, reaching upwards of 85% in certain predominantly agricultural regions. This may increase the cost of water resource management, and diverts valuable water resources from other potential uses especially the

supply of potable water. Other activities that exert additional water demand include the generation of hydroelectricity (power plants), recreation (water parks and sports), and aquaculture.

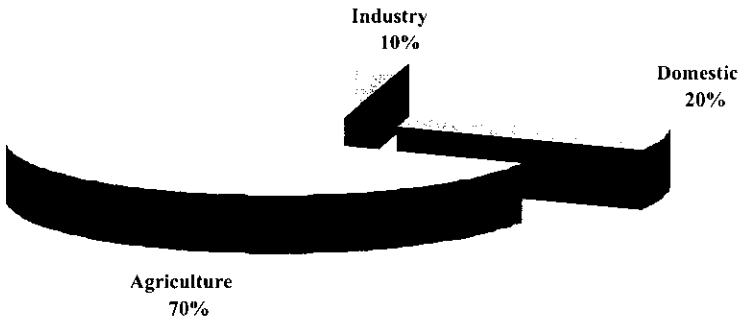

Figure 2.5 Water demand per sector (Jaber, 1995)

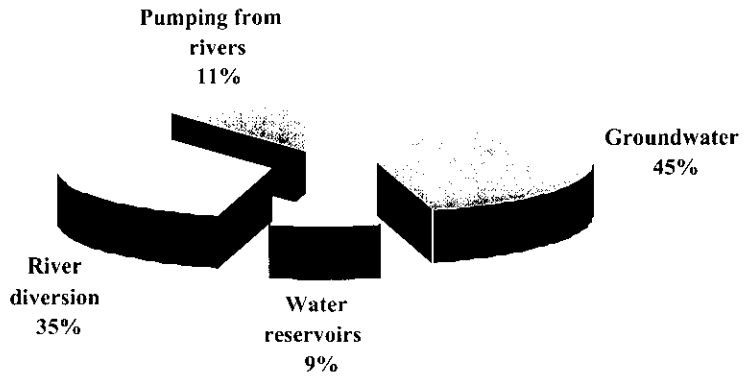

Figure 2.6 Water withdrawal percentages (Source: Irrigation in the Near East Region, 1996)

The traditional and future water demands vary widely because of different assumptions used in the estimation process, particularly in relation to available land for agriculture, average consumption per hectare, annual population growth, average per capita consumption, and future industrialization potential. While the numbers vary, the consensus is that there will be a deficit in the quantities of water required within the next ten to fifteen years as depicted in Figure 2.7. Using the water balance presented in Table 2.3, it is clear that the total quantity of fresh water available for exploitation (2,000 MCM/year out of 2,680 MCM/year) (C.Abdallah, FAO 2001; Jaber, 1994) will result in a water shortage in the near future; A projection done by Jaber (1995), shows that there will be a water shortage of 1055 MCM during the dry period (see Table 2.4 below); hence the need to address the issue of water management through proper policy setting.

Figure 2.7 Lebanon's future water demand and deficit

Table 2.4 Projected water demands by year 2015 in Lebanon

Use	Annual Demand (MCM)	Dry period demand (MCM)
Domestic	650	325
Industry	240	120
Irrigation	1410	1410
Total	2300	1855
Available surface flow	2280	800
Shortage	**20**	**1055**

2.3.3 Constraints Facing the Water Sector

The water sector is facing several constraints and problems, which need to be addressed through an integrated approach that combines practical technology with political and social support to avoid water shortages in the future. The major difficulties include:

1) mounting relative water scarcity,
2) water quality deterioration,
3) inter-sectoral water allocation conflicts,
4) inefficient cost recovery and wasteful operational performance,
5) excessive government involvement and bureaucratic restraint, and
6) weak institutional arrangements,
7) lack of a national water management plan.

2.3.4 Water Quality Constraints

Water quality is as important as its quantity since quality affects usage and vice-versa. In Lebanon, the discharge of untreated sewage water into surface and ground waters, especially in the mountainous rural areas where this water is later used for irrigation or as a potable source of water, presents serious health problems as evidenced by bacterial contamination of rivers, springs and ground water.

In addition, water used for irrigation purposes accounts for more than two-thirds of the water demand in Lebanon. The seasonal disparity between the period of precipitation (winter) and the time of maximum demand for irrigation water (dry summer) has consistently led to excessive and uncontrolled withdrawal of groundwater to meet these demands. Such patterns of chaotic water withdrawal have led to severe lowering of the water table and ultimately caused saltwater intrusion along the coast. Saltwater intrusion poses a serious threat to the

quality of fresh water in coastal areas, particularly that in some locations seawater has actually intruded several kilometers inland into coastal aquifers. In addition, some agricultural practices have also contributed to a diminishing water quality. Excessive fertilizer utilization in some areas has led to nitrate leaching which has been detected in elevated concentrations in ground waters. In addition, the unregulated application of pesticides may cause the contamination of surface and groundwater, particularly in shallow aquifers.

The uncontrolled disposal of solid wastes in watersheds has also led to the contamination of river basins due to the leaching of chemicals. While these wastes will likely contaminate surface waters in the area, the leachate might also infiltrate through fissured bedrock and pollute the groundwater downstream of a dumpsite, leading to a widening of the contaminated region.

The intensive use of groundwater is a salient practice not only for agricultural purposes but also in industry, which supplies 60 to 70 percent of its needs from groundwater. With respect to industrial pollution two main categories can be identified. The first is the surface and subsurface disposal of liquid effluents laden with organic chemicals and heavy metals, which find their way through the highly porous and fractured bedrock into the groundwater. The second and more widespread source of industrial pollution is from leaky underground gasoline storage tanks and the uncontrolled surface dumping of waste oils and petroleum by-products and residues (El-Fadel, 2002).

2.3.5 Recent Activities in Water Resources Management

Many projects on water infrastructure have been initiated through the assistance of grants and loans from major donor organizations and governments. These projects include rehabilitation and maintenance works on water treatment plants, pumping stations, groundwater wells and surface reservoirs (Green Plan and World Bank activities) and extension of existing and newly constructed potable water supply and distribution networks. Despite the various studies and projects, much remains to be done in the way of

sustainable and long-term water management. Although an assessment plan was conducted on water infrastructure, a master plan for water resource management and protection has yet to be initiated and implemented.

In the wake of projected water shortages that Lebanon will face within the next couple of decades, the Ministry of Energy and Water instigated steps aimed at setting the general policy for the management of the Lebanon's water resources, through the formulation of the 10-year plan for the years 2001 till 2011 for water and wastewater management (Technical cooperation with the Japanese Government). This is a first step towards proper, sustainable, and comprehensive water management. This proposed plan has six main components, five of which deal with water issues namely, procurement of additional water resources, potable water supply projects, irrigation schemes, wastewater projects, and alignment and maintenance river projects. The sixth component relates to electric equipment.

Nearly two-thirds of the budget is allocated towards procurement of additional water resources (i.e. supply-side measures), which is not surprising given that the projected increase in water demand will exceed the currently exploitable supply of resources within the next two decades. This traditional water planning methodology that seeks to alleviate water shortages by increasing water supplies through large-scale infrastructure projects (dams and lakes) should be complemented by improvements in water efficiency, and alternative non-conventional water resources usage such as wastewater reclamation and perhaps desalination, in the long term.

2.3.6 Outlook

Lebanon is blessed with a relatively good share of water resources compared to other countries in the region. However, these resources are characterized with spatial and temporal limitations, which are likely to result in water deficit within the next two decades; but the major problems are the poor management and control of water resources. The establishment of a clear and well-defined management plan and policies is imperative. Resorting to unconventional water sources may be required in the future to meet the expected rise in water demand. In addition, there is an urgent need to fully update hydrological data in terms of quantity of precipitation, river flows and groundwater characteristics. In this context, a centralized water data management system for information dissemination is essential for water resources assessment.

While there are many hurdles and challenges towards proper development of the water sector, these can be overcome by suitable planning and policy implementation. Training programs for employees and technicians of water authorities are essential for the proper operation and maintenance of equipment and facilities, including monitoring of water quantity and quality. Establishing a new pricing structure that allows cost recovery of capital investments as well as proper operation and maintenance of water supply facilities is urgently needed. Institutional strengthening and administrative reforms through reduced government involvement and bureaucratic control coupled with user participation should be instituted to enable the proper and sustainable management of available water resources. In addition, educational campaigns targeting the user and promulgating scarcity of water and the necessity for conservation should be established to increase the minimal public awareness relating to water scarcity issues.

Finally, it is very important to emphasize that since the 1970s, little to no improvement has been made in quantifying water resources in Lebanon. Much of the available data is based on old measurements dating back to the 1960s and 1970s, and do not take into consideration the impact of changes in land use

and deforestation on both surface and ground water. Evidently, these data do not account for the reduction in spring and river base flows and boreholes yields due to irrigation and other water uses.

2.4 SOIL AND SUPERFICIAL PROCESSES

2.4.1 Status

Land resources in Lebanon, like other Mediterranean countries with a long history of human exploitation, have been subject to increasing pressure for thousands of years. The abundance of mountain rocky lands with shallow soils and bare rocks points to processes of severe erosion and land degradation. Several natural and human-induced factors contributed to land degradation. These are described below: *(For detailed information check chapter 5)*

2.4.1.1 Direct natural factors

Intensive rainfall causing flash floods that carry mud and stones to the valleys and plains are causing damage to the orchards, roads and houses. 64% of the Lebanese territory has a complex landform consisting of sloping and steep lands. Thus, steep slopes are a major physical factor enhancing water erosion in the Lebanese mountains. Sheet erosion, a removal of the soil upper layer, develops on Lebanese lands with undulating landform, weak soil structure and limited water holding capacity. V-shaped gullies form in materials that are resistant to erosion. This might be due to clay illuviation and accumulation in the subsoil like the Red Mountain soil "terra-rossa" on Cenomanian rocks in Mount Lebanon. Alternately this could be attributed to natural subsoil compaction like Inceptisols on basalt in Akkar plain and plateau, in the northern part of Lebanon. Map 2.6 below shows the distribution of the different soil classes of Lebanon.

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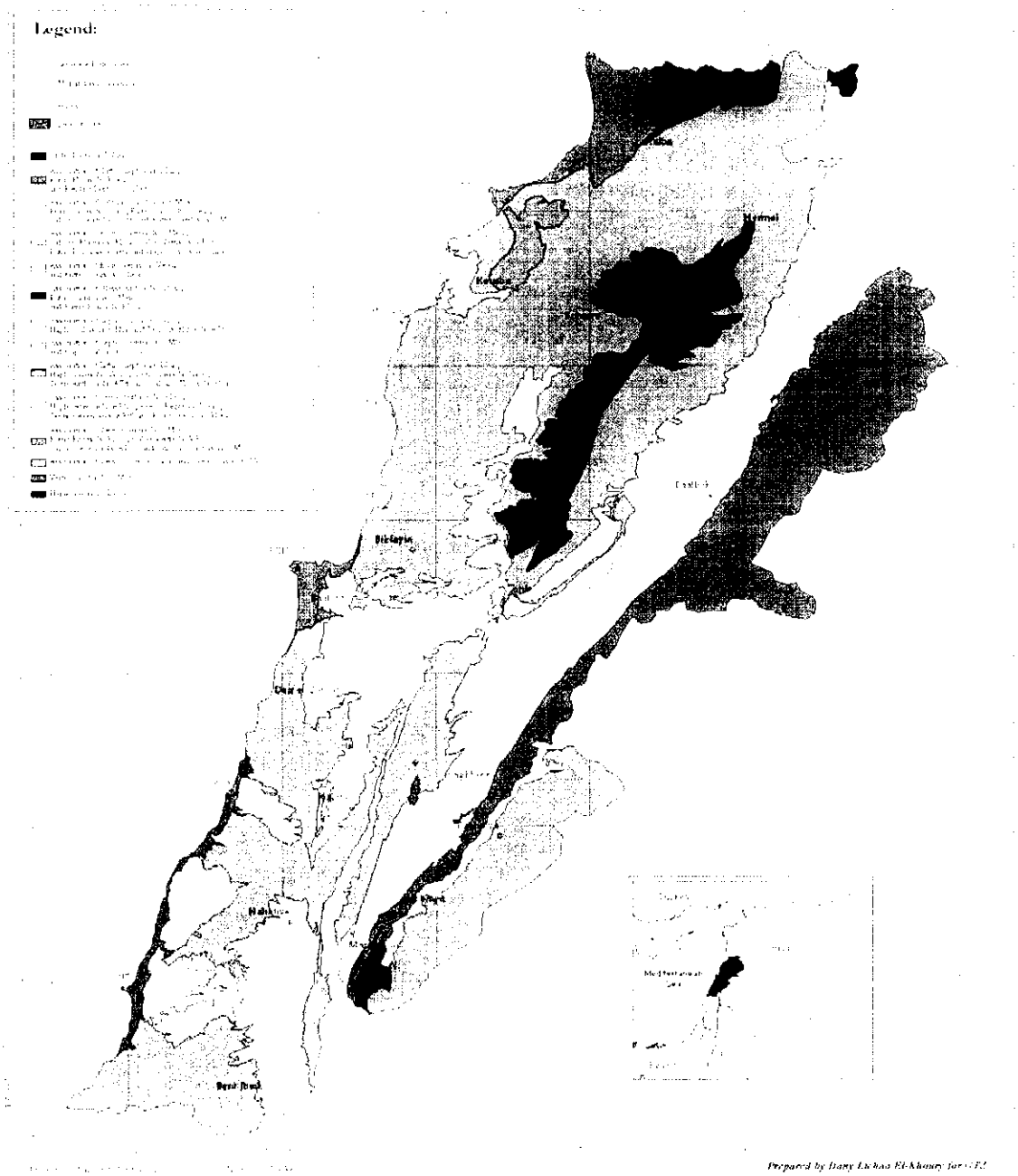

Map no. 2.7

Title:

Soil Map of Lebanon

Source:

F. Darwish
National Center of Remote Sensing
National Council of Scientific Research

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10 0 10 20 30 Km

U-shaped gullies form in materials that are decreasingly resistant to erosion with depth (Rendzinas on Senonian parent materials forming what we call Bad Lands as an example in Shakka, North Lebanon).

Tunnel erosion may occur in soils with subsurface horizons or layers that are more subject to entrainment in moving free water than is the surface horizon or layer. The result is the formation of tunnels or pipes. A similar picture is largely observed in the karstic region of Byblos, Qartaba, and Sannine.

2.4.1.2. Indirect natural factors

Land sliding is another process modifying landscape and is mainly due to restricted natural drainage. A series of stresses related to soil nature contributes to land vulnerability leading to catastrophic results.

2.4.1.3. Direct human induced factors

Deforestation and degradation of vegetative cover are causing increased water erosion in the majority of Lebanese mountains. This also accelerates wind erosion in the inland Baalbeck-Hermel semi-arid area.

Additionally, secondary soil salinization is another human induced factor resulting in land degradation in the country. Such chemical soil deterioration is mainly due to bad irrigation practices and fertilizer application, which reduces the soil productivity and net return from agriculture. This is relevant not only in the extremely dry areas, but also on the more humid coastal zone with intensive greenhouse cropping notably in Batroun, Tabarja, Jieh and Rmaileh.

Moreover, improper irrigation practices lead to the deterioration of groundwater quantity and quality. Agricultural activity and the dumping of solid and liquid wastes into open inland water bodies and reservoirs increase the chance of soil

contamination. Irrigation with organically and chemically contaminated water threatens the limited soil resources in the country.

Furthermore, monoculture and unsustainable rotation, especially, in Akkar and Bekaa plains are responsible for chemical and physical soil degradation.

2.4.2. Impact of land degradation

2.4.2.1. Natural factors

2.4.2.1.1. Water erosion

The mountainous areas constitute a fragile ecosystem. Bare lands with Lithic Leptosols (WRB, 1998) dominate on the hilltops and mountains peaks with erosion rate exceeding 50 tons/ha/y (Eswaran & Reich, 1999). The resulting runoff can accelerate rill and gully erosion and reduces groundwater recharge. Sheet erosion decreases the natural fertility of the upper soil layer where organic matter, Phosphorous and Potassium fertilizers accumulate. Another long-term sheet erosion results in gravel abundance on the soil surface.

Estimates on soil erosion for Lebanon show that if a tolerance level of 10 ton/ha/y was considered (Eswaran & Reich, 1999), more than 60% of its area has unacceptable erosion rates. The study of erosion risk assessment using remote sensing and GIS in the central Lebanese karstic mountains (Qartaba-Jbeil area) showed the following categories of erosion classes: 6% very high, 88% moderate and 6% as low erosion (Faour *et al.*, 1999; Boukeir *et al.*, 2001). This indicates the extent of the problem and pressure put on land resources leading to ecosystem degradation in Lebanon.

Besides the physical removal of soil particles, erosion affects the soil biological and bio-chemical processes like nitrogen fixation from the atmosphere and the decomposition of organic matter to mobilize the soil nutrient reservoir. The shallow soil loses its structure, which negatively affects soil aeration especially

in the compacted subsoil horizon. With increasing runoff, water reserve becomes a limiting factor for the growth of natural vegetation and crops. The resulting low soil porosity develops anaerobic conditions enhancing denitrification and loss of nitrogen to the atmosphere.

2.4.2.1.2. Soil related stresses

With few exceptions, Lebanon is considered as a country with a "Xeric Soil Moisture Regime". This implies that a series of soil factors and land resources stresses are as important as soil erosion for making the soil vulnerable to desertification. The mountain soils on steep slopes, with heavy silt and clay texture, are characterized by a relatively low permeability. Over saturation with water leads to mass soil movement, devastation of infrastructure and loss of entire soil properties. This leads to various socio-economic conflicts and problems.

More than two third of the soil resources in Lebanon are facing significant stress components (as shown in Table 2.3 below). This reduces the quality of the soil properties drastically.

Table 2.5 Estimates of major land resources stresses. (Darwish, CNRS)

Kind of stress	Area Sq. Km	Major Locations	% of total area
Salinity/ alkalinity	1000	Baalbeck-Hermel area	9.5
Seasonal moisture deficit	1486.5	Central and Western Bekaa, Coastal Plains Southern plateau	14.2
Low nutrient and water holding capacity	3000	Sandy and rocky lands of the Central Mountains and Coastal area	28.7
Long moisture deficit	1200	Belt from Baalbeck-Hermel to Rachaya	11.5
Water stagnation	313.5	Central Bekaa, intermountain and coastal Plains	3
Other soil constraints*	3452	Coastal and highland plains. Halba and Nabatiyeh plateau. Depressions.	33.1
Total	10452		100

*Soil compaction, cracking, sealing, stone and gravel content, CaCO3 content, reduced productivity.

One major constraint is the formation of calcic and petrocalcic layers in the soil. This usually limits the soil infiltration rate, soil active zone, root penetration and the relevant land capability class. Another process then starts which is the development of seasonal water stagnation and epigleyic soil properties. Seasonal water stagnation is observed mainly on level lands interfering with agricultural activities and reducing soil aeration. On the other hand, the exchangeable Calcium maintains the soil structural stability. The development of soil salinity and sodicity results in the destabilization of soil aggregates. This reduces soil water holding capacity and enhances runoff that reflects on groundwater recharge and moisture reserve in the soil.

2.4.2.2. Human-induced factors

2.4.2.2.1. Soil salinization

Studies on soil salinization in Lebanon proved that the problem has increased to a large extent during the last 20 years. In greenhouses, a steady increase in the soil electrical conductivity (ECe) from 0.4 dS.m-1 to 15 dS.m-1 was observed (Solh *et al.*, 1986). This is mainly associated with the excess input of fertilizer (Atallah *et al.*, 2000).

In open field, more than 52% of the monitored sites in Qaa (Hermel area) showed an ECe in the range of slightly saline and saline soils (Khatib *et al.*, 1998). The output is a decline of yield and reduction in the choice of salt tolerant crops. In more humid areas with intensive vegetables and field cropping systems, like the Central Bekaa, the accumulating salts and notably nitrates are leached to the shallow water table. High salinity level and nitrate content restrict the use of groundwater.

2.4.2.2.2. Soil pollution

In the absence of proper land use zoning, industry, manufacturing and agricultural activities, resulted in soil contamination with Ni, Cr, Cd and Pb in some limited areas of Central Bekaa (Darwish *et al.,* 1999). This might limit the vegetable production due to metal accumulation hazards in the leafy esculent crops. This may lead to a gradual shift to other land uses. The current status of this problem implies the necessity for the elaboration of national criteria and threshold of soil contamination and related land use.

2.4.2.2.3. Urban expansion

Rapid urban chaotic growth is one of the principal causes of desertification in the Mediterranean Sea (Eswaran & Reich, 1997). Multi temporal image analysis of Tripoli and surrounding revealed the urban area increasing about 35%, with a simultaneous expansion of Grassland/degraded land to about 16%, and decrease of cultivated land about 38% (Darwish *et al.,* 1999). On the coastal stretch of Lebanon, 200 km length and 8 km width, more than 24% of the terrain was urbanized (Huybrechts, 1997).

2.4.3. Outlook

Continuous soil erosion would result in a deep change in the hydrology of watersheds. The absence of erosion control measures, like terracing and contour plowing reduces the quantity and quality of the soil cover. The lack of water harvesting and reforestation practices in the Lebanese mountains will result in more intensive flash floods events, which could also pollute water bodies. Increasing deforestation will enhance water runoff and reduce the ground water feeding. This will affect the renewable water resources available. Changes in land use and cover may lead to increased number of catastrophic flash floods. Converting rural and suburban lands to urban complexes will reduce the soil resource available per capita, increase pressure on land and

results in densely populated and more polluted areas. It is obvious that reduced soil resources and lower soil quality lead to economic losses that make people abandon their lands or use it as grazing sites for animals. Overgrazing results in further soil deterioration. On the other hand, the introduction of adequate rotation is essential to maintain soil fertility and productivity. The absence of rotation with legumes results in nutrient imbalance and organic matter depletion. Crop rotation increases the soil organic matter content that contributes to higher water holding capacity. This affects other soil properties like structure, natural fertility and human sustained productivity.

Soil pollution reduces the quality of the soil resource available for food production. The current relatively non-hazardous level of some toxic heavy metals requires an active intervention to prevent any further deterioration of the situation. The construction of adequate treatment plants and the provision of good quality irrigation water to farmers will protect soil quality. Setting criteria for soil contamination and relative land use standards are crucial factors contributing to soil conservation.

The appropriate management of water and fertilizer inputs is a prerequisite to reduce human-induced salinization. The integrated crop production based on crop nutrient and water demands will also save water, lower production cost and improve quality. The introduction of new agricultural methods like fertigation based on fertilizer application in the irrigation water and integrated pest management will serve this goal. Excess of chemical use affects yield and quality and leads to increased pest residues in fruit. Organic farming gain popularity for its environmental and economic advantages. Irrigation scheduling based upon crop evapotranspiration and frequency can manage soil cracking in Vertic soils that cause root damage. Inefficient water use leads to the depletion of groundwater and the exhaustion of surface water resources.

The Biological Environment

2.5 TERRESTRIAL FLORA

2.5.1 Overview[2,3]

Despite the severe degradation of the vegetation cover caused by human activities, Lebanon is still regarded as very diverse, sheltering an estimated number of 4200 species. This noted diversity is mostly the result of the physiography of the landscape and the country's location at a crossroad between continents.

In 1973, the floristic richness of the country was estimated at 2600 plant species (Zohary, 1973), comprising a total number of 311 endemic species. Thus, the percentage of these species (12%) is considered high when compared to other countries in the Mediterranean region (Davis *et al.*, 1994; Quézel and Medail, 1995; Khouzami *et al.*, 1996[4]). The isolation effect characterizing the high summits of the two mountain ranges (Qamoua, Quornet es Sauda, Ehden, Sanin and Mount Hermon) renders the alpine uplands a reservoir for endemic species. Consequently, more than hundred species specific to Mount Hermon and the Anti-Lebanon Range have been counted. (Medail & Quezel, 1997)

On the other hand, the country consists of two major Mediterranean climate zones, the Mediterranean zone and the pre-steppe areas, harboring ten bioclimatic regimes and 22 vegetation associations (Talhouk, S. *et al.*, 2001). Nevertheless, the war, which lasted more then twenty years, has seriously degraded many plant communities, habitats and landscape e.g. the formations of *Cedrus libani* (Medail and Quezel, 1997), resulting in the loss of many species.

[2] Common and Latin names of all species mentioned in this section are given in table 2.7 at the end of the section

[3] For a comprehensive understanding of the Lebanese vegetation, please refer to the following studies: Abi-Saleh, B & Safi, S. , 1988 and Abi-Saleh, B & Safi, S. et al., 1996

[4] Refers to the Country study report on the biological diversity of Lebanon (Khouzami M. was the national coordinator of the project and member of the editorial team for the report).

Additionally, the Lebanese mountains are characterized by the presence of a considerable number of northern species, which may be regarded as relics of past humid vegetation and are still growing sporadically in the remaining forest patches such as Hop hornbeam (*Ostrya carpinifolia*), Maple (*Acer tauricolum* and *hermoneum*), Rhododendron, Manna ash, Rusty foxglove and many others (Zohary, 1971). On these mountains, a fairly large number of forest trees find their southern most limits. These thrive in forests such as Juniper (*Juniperus sp.*), Cedar, Cilician fir (*A. cilicica),* Turkey oak (*Quercus cerris var. pseudo cerris)* as well as other species classified under the service tree (*Sorbus sp.*) and Maple genus (*Acer sp.*).

Moreover, an estimated number of 212 species in Lebanon have an economic value and are characterized as medicinal plant species or edible crops (SEPASAL Database, RBG Kew).

2.5.2 Vegetation zones and plant composition

The Mediterranean Mountains in their seaward aspects can be differentiated along the altitude into the Thermo-Mediterranean, Eu-Mediterranean, Supra-Mediterranean, Mountainous Mediterranean and Oro-Mediterranean zones. A belt of evergreen maquis and garrigue characterizes the formers, while the latter are respectively covered by summer-green forest climax and dwarf thorny vegetation characterizing the alpine and sub-alpine zones (see Map 2.7).

The Thermo-Mediterranean zone, ranging 0-500 m altitude, comprises, at the sea level, a coastal strip once harboring two plant communities characterizing the sandy and rocky beaches. The former comprises many species such as Tamarisk (*Tamarix tetrandra)*, sea Medik (*Medicago marina*), Sea holly (*Eryngium maritimum*), sea daffodil (*Pancratium maritimum*), Coast spurge (*Euphorbia paralias*), Shaggy birdsfoot-trefoil (*Lotus villosus*), and Kalli cyperus (*Cyperus Kali*), etc. The latter include Rock samphire (*Crithmum maritimum*), Stonecorp catchfly (*Silene sedoides*), Golden samphire (*Inula crithmoides*), Hispid sea-heath (*Frankeniana hispida*), Trifid stock (*Mathiola crassifolia*), Sieber's sea-lavender (*Limonium sieberi*). These vegetation communities have

been subject to despoliation caused by overexploitation of shorelines, urban expansion and pollution. Plant community degradation is also shown in the upper vegetation characterized by an evergreen garrigue. In this zone Carob (*Ceratonia siliqua*) and Pistachio (*Pistacia palaestina*) trees grow. 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 (*Myrthus communis*), Hairy thorny-broom (*Calycotome villosa*), Spanish broom (*Spartium junceum*), Sumac (*Rhus coriaria*), etc. (Zohary, 1971).

At an altitude ranging from 500 to 1000 meters, lays the Eu-mediterranean zone, which is mainly covered by maquis vegetation dominated by the calliprine oak (*Quercus calliprinos*) and pistachio (*Pistacia palaestina*). These forests were heavily destroyed; hence, the climax oak maquis has almost disappeared and has been replaced by a degraded garrigue (METAP, 1995). Nevertheless, single trees and shrubs of this formation are encountered also at much greater altitudes, such as the kermes oak noted at 1500 m (Zohary, 1971). Additionally, Pine forests (*Pinus pinea* and *Pinus brutia*) are largely found in these areas together with the associated species to the oak maquis like Juda's tree (*Cercis siliquastrum*), and the widely found *Styrax officinalis*.

The Supra-Mediterranean zone (1000-1500) situated above the evergreen vegetation is characterized by a deciduous forest climax. In this zone, the vegetation cover is denser as the population density is lower and major human settlements are more recent. At present, this zone is occupied by Calliprine oak and *Q. infectoria*, Calabrian pine (*P. brutia*) degraded forest and Stone pine (*P. pinea*). Wherever biotically possible, these forests which although belong primarily to the evergreen lower zone penetrate into the middle zone of the mountains as high as or even higher than 1500m. At this altitude, *Quercus brantii* and *Q. cerris var. pseudo cerris* and *Juniperus drupacea* forests were destroyed by man and lost their ability to regenerate.

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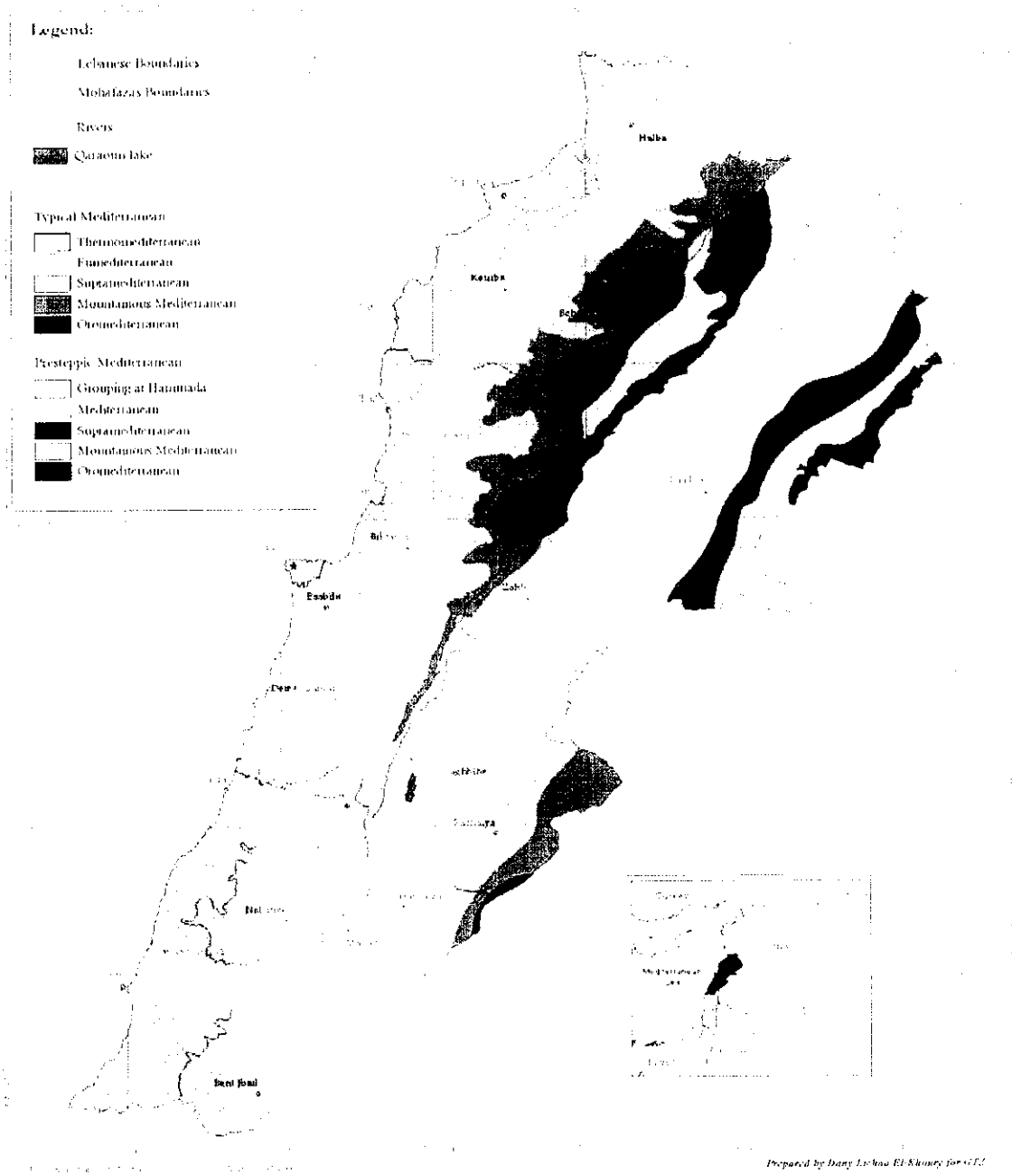


Map no. 2.8

Source

B. Abi Saleh & S. Safi
Carte de la vegetation du Liban
Ecologia Mediterranea - 1988

Title

Vegetation Levels in Lebanon

N

10 0 10 20 30 Km

A higher zone of coniferous forest climax, ranging from 1500-2000 meters altitude, replaces usually the zone of the summer-green forest. This mountainous Mediterranean zone harbors relic forests of Cedar, Cilician fir (*Abies cilicica*) and Grecian juniper (*J. excelsa*). Plant communities encountered comprise Cedar Oak (*Q. cedrorum*) (in Ehden and Qammou'a), Calliprine Oak, Calabrian pine, Hop hornbeam (*Ostrya carpinifolia*), Fan-leaved service tree (*Sorbus flabellifolia*), Lebanon buckthorn and Olive-like daphne (*Daphne oleiodes*). Additionally, wild apples (*Malus trilobata*), wild plums (*Prunus sp.*) and wild pears (Pyrus *syriaca*) are important land races, which are also found in the area.

In the high summit dominating the Mount Lebanon chain, lie the Ore-Mediterranean zones where the leading plant community is a xerophytes vegetation comprising a formation of cushion-like dwarf thorn shrubs such as Lebanon prickly-thrift (*Acantholimon libanoticum*), Angular milk-vetch (*Astragalus angustifolia*), Red flowered milk-vetch (*Astragalus cruentiflorus*), Hoary vetch (*Vicia canescens*), Stumpy spurge (*Euphorbia caudiculosa*), Bladder whitlow-grass (*Draba vesicaria*), Makmel garlic (*Allium makmeliana*) and Grecian juniper (*Juniperus excelsa*), the only tree present at this altitude. In these alpine uplands, a high endemism level is marked as the result of the isolation effect.

The Eastern Mount Lebanon foothills are steppic and desiccated. They are either occupied by a heavily degraded garrigue or barren, and the sub-desertic soils support a poor, overgrazed rangeland.

The pre-steppic vegetation zone ranging between 1000 and 1500 m is mainly composed of heavily grazed forestlands of Calliprine oak. In the supra-mediterranean zone, Kermes oak is found mixed with Cyprus oak. Then follows sparse Grecian juniper stands, which extends to higher altitude and figures as sporadic tree mixed with dwarf thorny shrubs. However, the dominant formation on these slopes is a degraded garrigue used for grazing. On the Western slopes of the Anti-Lebanon chain, the pre-steppe vegetation is similar to the one present on the eastern slopes of the Mount Lebanon chain (METAP, 1995).

However Mount Hermon presents some particularities including the presence of endemic species such as Ferula hermonensis.

2.5.3 Forests stands

Since ancient times, Lebanese forests have been the suppliers of high quality timber to the Mediterranean people (Miksell, 1969). The intensive woodcutting over several millennia, followed by the expansion of agro-pastoral activities and subsequent urbanization resulted in only relic forest patches and scrub vegetation remaining. Today, Lebanon's forest cover is estimated at 70.000 ha (7%), with a similar percentage categorized as degraded forests (METAP, 1995).

The estimated forest areas show a clear imbalance in the species composition, with only 21,000 ha (30%) of the total forested area occupied by coniferous trees, while the bulk of the forest cover (49,000 ha) consists of Oak and Juniper trees (see Table 2.6).

2.5.3.1 Cedar, Fir and Juniper forests

The remaining evergreen Cedar forests, once covering the mountainous Oro-mediterranean zone, can be found on the western slopes of the Mount Lebanon Chain as mosaic patches occupying 2,200 ha. These forests are located in the northern part of the country in Karm Shbat, Ehden, Qamou'a, Danie, Bsharre, Hadeth-Tannourine and in Mount-Lebanon in Jaj Bmohray, Ain-zhalta, Barouk Maasser al-Shouf and Niha (Chouchani & al., 1974).

Table 2.6. Estimated forest areas and their status in Lebanon (Hamade *et al.*, 1996 adapted from Baltaxe, 1965)

Type of communities	Good condition (ha)	Degraded surface (ha)	Total surface area (ha)
Oak Underwood	14 000	26 000	40 000
Pinewoods on limestone (Pinus brutia)	5 600	3 400	9 000
Pinewoods on sandstone (P. pinea)	5 000	3 000	8 000
Cedar groves	1 500	700	2 200
Fir tree groves		1 000	1 000
Juniper groves		9 000	9 000
Cypress groves	200	300	500
Total	**26 300**	**43 400**	**69 700**

Mixed forests of Fir and Cedar are found in Qamou'a, Fir thrives in Ehden in its southernmost limits at lower density mixed with the Cedar and other tree species. Only 2000 ha of extremely degraded cedar stands are located, often within dominant stands of Fir, Juniper and Oak. On the other hand, sparse Grecian Juniper forests, covering an area of 9000 ha (Baltaxe, 1965), are found mainly in patches on the eastern slopes of the mountain chain in the Caza of Hermel.

All these forests have endured ancient deforestation leading to severe deterioration in their natural habitats and colonization by degraded garrigue resulting in an intensively eroded soil (METAP, 1995).

In the mid nineties, Al-Shouf Cedar and Ehden forest reserves were declared as protected areas. These important forest stands are considered as a reservoir for the Lebanese Flora and Fauna. These forests can be considered as a main source of seed for further reforestation campaigns. Additionally, they can serve as a model in terms of plant communities and plant association encountered.

2.5.3.2 Pine forests

Pine forests are limited to the western slopes of the Mount Lebanon chain. They occupy an area of 17,000 ha with nearly half of Stone pine managed for edible seed production, and the other half occupied by the Calabrian pine deteriorating

under the pressure of overexploitation for firewood. The Stone pine forests extend on latitudes ranging between sea level and 1500m and are localized on the sandy soils of the Metn, Baabda and Jezzine, where they have been diminished by the effects of the war and urban encroachment.

On the other hand, the other types of pine forests are located at middle elevation where Calabrian Pine forests occupy a large area in the North. Aleppo pine (*Pinus* halepensis) extends over an area of 400-500 ha and is located in the Southern part of the country in the Cazas of Marjaaoun and Hasbaya.

2.5.3.3 *Oak forests*

Calliprine oak forests dominate the lower altitude of the western slopes of the Mount Lebanon chain indicating the regression of the ecosystems and the degradation of the habitat. These forests cover approx. 40,000 ha. On the eastern slopes of Mount Lebanon oak coppices 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 and diminutive oak stands persist, mainly east of Baalbeck, Masnaa and around Rachaya (METAP, 1995). 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 wood cutting for charcoal production and to overgrazing which has lead to their deterioration and their replacement by highly degraded garrigue.

2.5.3.4 *Evergreen Cypress*

Evergreen Cypress forests are almost extinct in Lebanon; some remaining patches grow in Akkar on hard limestone and in Ras Chekka area on marl soils. They are mainly accompanied with Mediterranean buckhorn, Calliprine oak, *Q. brantii*, oriental strawberry-tree (Chouchani, 1974) and in Ehden, in the Convent of Mar Sarkis region. The presence in this association of Maple, Whitehorn, False senna, hop hornbeam and others indicates the rather mesic nature (Zohary, 1973).

Sporadic trees of evergreen cypress grow in Calabrian pine forest, in the Northern part of the Mount Lebanon chain, in Karm-Sadet and Aito areas.

2.5.4 Threats

During the last decades, the chaotic expansion of urban settlements and agricultural practices has exacerbated the depletion of natural resources due to landslides, flash floods and forest fires (METAP, 1995; Talhouk & al., 2001). Moreover, practices such as logging, grazing, and hunting have contributed to the loss of vegetation cover and disturbance of wildlife habitats.

Grazing in forests is controversial in Lebanon and in the whole Mediterranean region. However, and over the past centuries, grazing has annihilated the regeneration in slow growing coniferous forests (Cedar, fir and Juniper) and compounded the effects of deforestation.

Inappropriate fuel wood gathering and charcoal production deplete forests, disturb watersheds and enhance erosion. In addition, Forest fires destroy large areas of forests each year. Forestry service reports indicate that 1,200 ha of natural forests are burnt every year.

The over exploitation and illegal cutting of plants such as Oregano (*Origanum syriacum*), Sage (*Salvia sp.*), *Ferula hermonensis* and *Gundelia tournefortii* lead to the degradation of these resources. However, the government has recently issued legislation for regulating the exploitation of these species except for the *Gundelia tournefortii.*

Quarrying is a major threat, which has contributed to the removal of forest cover. A recent estimate reported more than 690 quarries distributed unequally in the five Cazas in Lebanon (MoE, 2000). Other then the loss of vegetation cover, quarrying on steep mountainsides inevitably results in an increased tendency to slope failure, landslides, soil and gulley erosion. No attempt has

been made to stabilize mountainsides and abandoned rock quarries in the perspectives of rehabilitation and restoration.

Table 2.7 Latin names of mentioned species

Common name	Latin name
Aleppo pine	Pinus halepensis
Angular milk-vetch	*Astragalus angustifolia*
Bladder whitlow-grass	*Draba vesicaria*
Calabrian pine	*Pinus brutia*
Calliprine Oak	*Quercus calliprinos*
Carob	*Ceratonia siliqua*
Cedar	*Cedrus libani*
Cedar Oak	*Quercus cedrorum*
Cilician fir	*Abies cilicica*
Coast spurge	*Euphorbia paralias*
Common hemp-agrimony	*Eupatorium cannabinum*
Cypress	*Cupressus sempervirens*
Cyprus Oak	*Quercus infectoria*
Fan-leaved service tree	*Sorbus flabellifolia*
Golden samphire	*Inula crithmoides*
Grecian juniper	*Juniperus excelsa*
Hairy thorny-broom	*Calycotome villosa*
Hispid sea-heath	*Frankeniana hispida*
Hoary vetch	*Vicia canescens*
Hop hornbeam	*Ostrya carpinifolia*
Kalli cyperus	*Cyperus kali*
Kermes oak	*Quercus coccifera L.*
Laurel	*Laurus nobilis*
Lebanon prickly-thrift	*Acantholimon libanoticum*
Lebanon willow	*Salix libani*
Makmel garlic	*Allium makmeliana*
Manna ash	*Fraxinus ornus*
Monk's pepper	*Vitex agnus-castus*
Myrtle	*Myrtus communis*
Oleander	*Nerium oleander*
Olive like daphne	*Daphne Oleoides*
Oriental alder	*Alnus orientalis*
Orientale plane	*Platanus orientalis*
Pistachio	*Pistacia paleastina*
Red flowered milk-vetch	*Astragalus cruentiflorus*
Rock samphire	*Crithmum maritimum*
Rhododendron	*Rhododendron ponticum*
Rusty foxglove	*Digitalis ferruginea*
Sea daffodil	*Pancratium maritimum*
Sea daffodil, sandy lily	*Pancratium maritimum*
Sea holly	*Eryngium maritimum*

Common name	Latin name
Sea medik	*Medicago marina*
Shade figwort	*Scrophularia umbrosa*
Shaggy birdsfoot-trefoil	*Lotus villosus*
Sieber's sea-lavender	*Limonium sieberi*
Small flowered pancratuim	*Pancratium parviflorum*
Spanish broom	*Spartium junceum*
Stinking St John's-Wort	*Hypericum hircinum*
Stonecorp catchfly	*Silene sedoides*
Stumpy spurge	*Euphorbia caudiculosa*
Sumac	*Rhus coriaria*
Tamarisk	*Tamarix tetrandra*
Trifid stock	*Mathiola crassifolia*
Turkey oak	*Q. cerris*
Water mint	*Mentha aquatica*
White willow	*Salix alba*

Chapter Two

Environmental Status in Lebanon

Part II: Anthropologic Factors

2.6 POPULATION DISTRIBUTION AND DENSITY

2.6.1 Human Settlements: Rural vs. Urban

Rapid urbanization has been a major factor affecting living conditions and the environment in Lebanon. The pattern of urbanization changed during the war period, which caused a rapid expansion of the peripheral areas around cities mainly Beirut, Zahle, Tripoli and Saida.

According to the Ministry of Social Affairs (MOSA), 88% of the population lives in urban areas. The estimated total population growth rate is at 1.8 %. This rate is a negative for rural areas and is positive and increasing for the urban areas (Table 2.8). The urbanization level increased from 79.4% in 1985 to 89.7% in 2000 and is expected to attain 93.5% by 2025 (Figure 2.8).

Table 2.8: Selected Demographic Indicators of the Lebanese Population

DEMOGRAPHY	1985	1990	1995	2000	2005	2010	2015	2020	2025
Total population (x1000)	2,668	2,555	3,009	3,289	3,535	3,742	3,961	4,193	4,424
Urban population (x1000)	2,119	2,151	2,632	2,951	3,224	3,448	3,668	3,902	4,136
Rural population (x1000)	549	404	376	338	311	295	293	291	289
Urbanization level (%)	79.4	84.2	87.5	89.7	91.2	92.1	92.6	93.1	93.5
		1985-1990	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
Total population growth rate (%)		-0.86	3.27	1.78	1.45	1.14	1.14	1.14	1.07
Urban population growth rate (%)		0.30	4.04	2.29	1.77	1.34	1.24	1.23	1.16
Rural population growth rate (%)		-6.13	-1.42	-2.17	-1.66	-1.06	-0.12	-0.12	-0.18

Source: United Nations Human Settlement Program

A large portion of the population (38.8%), although registered in their various Mouhafazats of origin actually resides in Beirut (Table 2.9). There is an intensive internal national migration towards Beirut and its suburbs. This exerts

a big pressure, which in the absence of proper land use planning and adequate infrastructure, results in major environmental problems.

According to the Ministry of Displaced, about 28% of the resident population, 810,000 citizens, were displaced during the war. Economic and social considerations have played a role in determining the pace of return. Displacement was associated with large-scale destruction of villages, towns and housing units, rendering immediate return impossible. More than 940 villages and towns were affected. The most seriously affected Mouhafazat was Mount-Lebanon followed by the South.

Table 2.9: Distribution of resident population versus place of registration

Place of registration ⇩	Beirut	Beirut suburbs	Mount-Lebanon *	North	South	Nabatieh	Bekaa
Beirut	50.4	13.0	3.5	0.3	1.1	2.2	0.3
Mount-Lebanon	12.6	35.7	82.8	0.5	1.2	0.2	0.6
North	3.2	4.2	5.1	91.4	0.1		
South	7.7	9.4	1.8	0.2	69.0	1.9	0.2
Nabatieh	11.8	17.0	0.8	0.1	5.3	94.9	0.5
Bekaa	3.5	14.4	2.4	0.5	0.6	0.2	96.3
Total Lebanese	89.2	93.7	96.4	93.0	77.3	99.4	97.9
Non-Lebanese	10.4	6.2	3.5	6.8	22.7	0.6	2.0

* Excluding suburbs

Source: CAS, 1997

Figure 2.8 below shows the actual and projected increase of urbanization between 1985 and 2025.

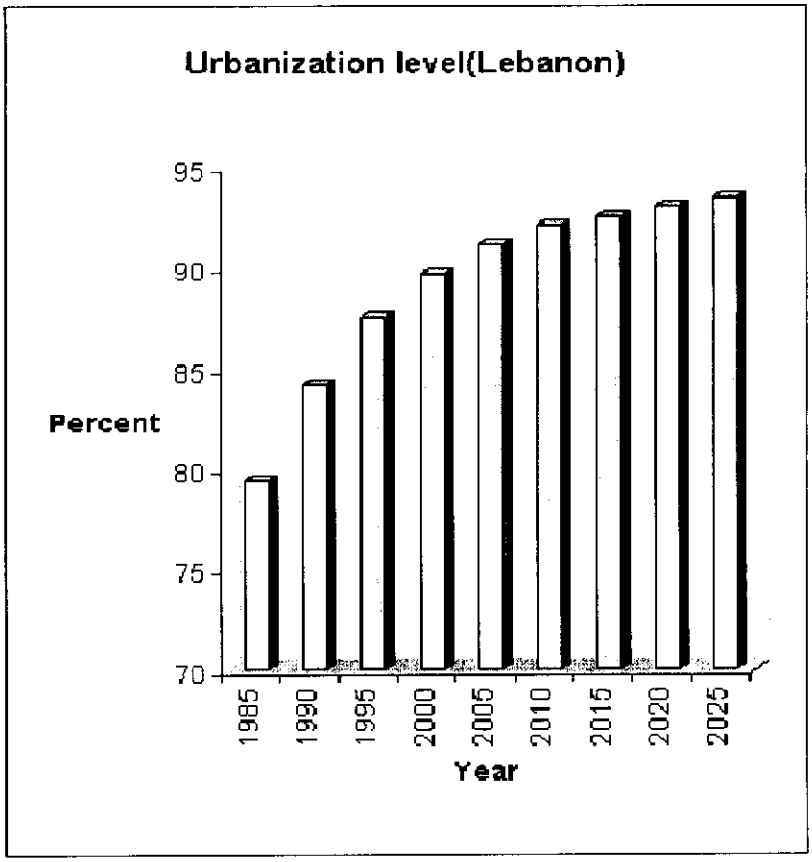


Figure 2.8 Changes of urbanization levels between 1985 and 2025 (United Nations Human Settlement Program)

2.6.2 Population Distribution and Density

The last population census was carried out in 1932. Recent estimates based on surveys reveal a population ranging from 3,112,000 (MOSA 1996) to 4,005,000 inhabitants (CAS, 1997).

According to UNDP, the population growth is projected at a moderate and declining rate of less than 2% for the next twenty years. In general, the population density is 400 persons/km^2 (CAS, 1997), against 72 persons/km^2 in year 1932.

Population density at the Mouhafazat level reveals that highest pressure is put on Beirut city followed by Mount-Lebanon (including the suburbs), and the least with Bekaa followed by Nabatieh. This highlights the rural urban migration towards urban centers.

Table 2.10 Regional Population Distribution and Population Density, 1997

Mouhafazat	Number	Percent	Area[1] (km^2)	Population density person/km^2
Beirut	403 337	10.0	19	21228.3
Beirut Suburbs	899 792	22.5		
Mount-Lebanon	607 767*	15.1*	1986**	759.1**
North Lebanon	807 204	20.1	2008	402.0
South Lebanon	472 105	11.8	939	502.8
Nabatieh	275 372	6.9	1102	249.9
Bekaa	539 448	13.6	4163	129.6
Total Lebanon	4 005 025	100	10,217	400

Source: CAS, 1997

* The rest of Mount-Lebanon (excluding suburbs)

** including Beirut suburbs

1 Numbers are different from official sources due to cartographic projection

2.7 LAND COVER / USE IN LEBANON

In 1990 and based on 1987 remote sensing data, FAO prepared a land cover/use map of Lebanon and highlighted the following land cover/use pattern:

Table 2.11 Land cover / use in 1987

Land use / Cover	Hectares	Percentage
Arable land	260000	25
Forest, with cover of at least 10%	70000	7
Forest, sparse (less than 10% cover)	65000	6
Abandoned lands, mostly old terraces	70000	7
Rocky, non-cultivated lands, degraded range lands	515000	52
Urban and constructed areas	27000	3
Total area	1017000[1]	100

[1] *Due to cartographic procedures, this number shows a difference with the official number, which is 1045200 ha*

2.7.1 Change between 1961 and 1987

A recent study (Masri et Al., 2002) compared the overall change in land use pattern between 1961 and 1987 based on two available data sets: The 1961 agricultural map (la Carte Agricole du Liban) and the FAO land cover/use map 1990 (data taken in 1987). The results show a general decrease in cultivated land, an increase in barren or deserted areas and a drastic decrease in forest cover (-32.5%) as shown in the table below:

Table 2.12 Land cover changes between 1961 and 1987 in ha

Land cover	1961	1987	Change	Change %
Forest	93430	62980	-30450	-32.5
Citrus	26800	17400	-9400	-35
Fruits	54460	19560	-34900	-72
Olives	43700	30100	-13600	-31

In assessing the impact of the change in land cover/land use on land degradation, the following aspects should be considered:

1. The abandonment of agricultural land and degradation of terraces, which enhance soil erosion.
2. The inappropriate land use
3. The uncontrolled urbanization and its consequences

The most recent information on land use/cover is based on the FAO supported project entitled "Assistance au recencement agricole, 1999". It shows the following land use pattern:

- A total arable land of about 385.000 ha (around 37% of the total surface area of the country)
- A total cultivated land (or cropland) of about 250, 000 ha of which 100,000 ha are irrigated.
- A total of 140,000 ha of abandoned agricultural land (it includes productive lands that have been abandoned for a period of more than 5 years). Of which 50,000 ha are within the agricultural holdings.
- A total of 120,000 ha of forests of which 20,000 ha are within the agricultural holdings.

The 1999 data is based on a census whereas the 1990 data is based on remote sensing applications. This makes it difficult to compare the data sets directly. However some trends are clear:

a) a further decline in forest cover although the rate is decreasing,

b) a dramatic increase in the area of abandoned lands and

c) a further increase of urbanization.

2.7.2 Cultivated land

Lebanon produces a wide variety of temperate zone agricultural products. The Bekaa Valley provides about 42% of the total agricultural land and almost 50% of the irrigated land. Nearly 26% of the agricultural land is in the North and about 14% in the South. The Bekaa Valley also has the highest greenhouse area, approx. 2,200 ha, followed by North Lebanon, approx.1,200 ha, and Mount Lebanon approx. 1,000 ha.

The Bekaa Valley is the major region for production of fruits and vegetables. The FAO 1999 Census indicates that 37% of fruits and 57% of vegetables are produced in the Bekaa Valley. The second major vegetable growing area is North Lebanon. Deciduous fruits (apples, pears, peaches, apricots, cherries) are produced primarily in the Bekaa Valley and North Lebanon, while Citrus fruits are concentrated in coastal areas.

Table 2.13 Principle Land Use by Mouhafazat (percentage)

Mouhafazat	Fruit Trees	Olives	Cereals	Industrial Crops	Vegetables
Bekaa	37	6	57	62	57
North Lebanon	23	40	23	15	28
Mount Lebanon	16	15	1	1	7
Nabatieh	3	22	12	16	3
South Lebanon	21	17	7	6	5
Total	100	100	100	100	100

Source: MOA/FAO Agricultural Census Project, 1998

2.8 AGRICULTURAL PRACTICES

Based on the FAO 1999 agricultural census, the agricultural arable land covers 385,000 ha (approximately 37% of the total surface area of the country), 248,000 ha of it are currently cultivated. The Bekaa valley and the plains of Akkar and Marjaayoun are the major fertile areas of Lebanon. Rainfed agriculture occupies 144,000 ha of the cultivated area most of it found in favourable zones (rainfall over 400mm/year).

Irrigated agriculture surface increased dramatically from 40,775 ha in 1961 to 104,000 ha in 1999 (almost 42% of the total cultivated area). Irrigation practices evolved during this period; drip and sprinkler irrigation systems were introduced and used on a wide range of crops especially in greenhouses and tunnels (on the coastal area) and on watermelon, potato and sugar beet in the plain of Akkar and the Bekaa valley.

2.8.1 Agricultural Holdings

The total number of agricultural holders amounted to approx. 195,000 covering an area of 248,000 ha, of which 29% are in the North- Lebanon followed by Bekaa (18%), Mount-Lebanon (22%), and the rest is equally distributed in the two Mouhafazats of South and Nabatieh (Table 2.12). The total number of agricultural holders has increased by 36% since 1961. The highest percent increase was registered in South-Lebanon (74%) followed by Bekaa (40%), and North-Lebanon. Mount-Lebanon had an increase of about only 3%. It was noted that the increase in the number of holders was parallel to an increase in the area abandoned agricultural land.

About 53% of the holdings have less than 5 du[1] of cultivated land or cropland (SAU)[2], covering 9% of the total cultivated land, whereas only 1.6% of the holding size of more than 100 du, covers 30% of the total cultivated land (SAU).

[1] Du: Dunum = 0.1 ha
[2] Superficie Agricole Utile

The average agricultural holding size is about 12.7 du. The average holding size decreased (by 28%) since 1961.

Table 2.14 Distribution of Cultivated Land and Agricultural Holders by Mouhafazat

Mouhafazat	Agricultural Holders		Cultivated Land		Irrigated Land	
	Number	%	Du	%	Du	%
Bekaa	35,146	18	1,029,481	42	536,316	52
North	56,538	29	637,275	26	254,894	24
Mount-Lebanon	42,146	22	256,672	10	99,706	10
Nabatieh	31,495	16	260,264	10	21,442	2
South	29,504	15	29,504	12	127,429	12
Total	194,829	100	2,479,396	100	1,040,087	100

Source: MOA/FAO Agricultural Census Project, 1998

2.8.2 Inappropriate practices leading to land degradation

Irrigation triggered the intensification of cropping systems (monoculture and multiple cropping, cultivation under greenhouses, plantation of high yielding cash crops). Intensive agricultural production requires more inputs (water, fertilizers, pesticides and herbicides) and proper management skills. Poor management and insufficient technical know-how have led to land degradation in many places.

Excessive and uncontrolled pumping of groundwater for agriculture, especially in dry years, resulted in the lowering of the groundwater table in many places and in saline water intrusion along coastal areas.

Inadequate use of drip irrigation and fertigation systems resulted in salinity and soil degradation in Northern Bekaa and in greenhouses on the coastal plain.

Excessive fertilizer use results in a higher level of nitrates in groundwater. This limits its use option.

Another problem related to intensive cropping system is monoculture and successive cropping of the same species. This increases soil infestation by weeds, pests and diseases, damages soil structure and decreases yield and soil fertility.

The use of non-certified planting material, which could contaminate local species and the import and use of hybrid varieties (with intensive input requirement) from developed countries without proper consideration of local conditions may also lead to further land degradation.

2.8.3 Major problems

The major problems facing agricultural production in Lebanon include:

- The small size of the agricultural holdings which is the main reason for the high cost of production
- Lack of medium and long-term agriculture and land use policies, programs and plans, limited governmental support and reactive interventions.
- Inadequate agricultural calendars specifying type, quantity and timing of imported produce Inadequate extension services
- High production costs resulting in poor competition with subsidized crops entering Lebanon from neighbouring countries
- Poor post-harvest (storage and processing) services and weak marketing infrastructure.
- Lack of specialized agricultural credit (medium and long-term, low interest).
- Lack of programs and interventions targeting women; this leads to their poor representation in all aspects of agricultural production with negative repercussions on their own socio-economic status and that of their households.

2.9 LIVESTOCK PRODUCTION

Grazing areas in Lebanon are almost restricted to the small ruminants (sheep and goat) since cattle and pigs are not found in large numbers, and are mainly raised in modern farms.

According to the 1999 FAO agricultural census, the number of goat heads was 436,000. It has slightly decreased from 445,000 in 1980. During the same period, the number of sheep increased from 145,000 to 378,000. Most of the small ruminant herds are found in the Bekaa valley and adjacent slopes. In addition, semi-nomadic herds come from the Syrian Desert to the Bekaa during the summer period, while numerous Lebanese shepherds take their herds to Syria during winter.

On the western slopes of Mount Lebanon, the herds move from the coast (in winter) towards the mountains in spring and summer.

The carrying capacity in Lebanon is estimated at around 1 head of small ruminant/ha on good rangelands and 0.2 on degraded marginal lands in the Bekaa. However the carrying capacity is a function of management and can be increased with proper management.

2.9.1 Distribution of livestock production

The highest number of agricultural holders practicing livestock production is found in North-Lebanon followed by Bekaa.
Bekaa comprises about 28% of the total number of cows (22,000) and 68% of sheep (279,000), and 44% of goats (206,000). It is followed by the North-Lebanon comprising 18 % of both sheep (45,000) and goat (63,000).

Table 2.15 Distribution of Agricultural Holders and Livestock Production by Mouhafazat

	Number of Holders	Cow (Head)	Sheep (Head)	Goat (Head)
Mount- Lebanon	2 624	13 669	28 038	46 262
North-Lebanon	9 454	23 722	45 055	63 278
Bekaa	6 429	21 442	278 803	206 250
South-Lebanon	1 672	8 580	7 068	41 549
Nabatieh	2 410	8 461	19 086	78 626
All Lebanon	22 589	75 874	378 050	435 965

Source: MOA/FAO Agricultural Census Project, 1998

2.9.2 Inappropriate practices leading to land degradation

Urban sprawl, land protection and encroachment by agriculture are leading to reduction of the area of rangelands. This leads to increased pressure on the remaining land. Additionally, inappropriate practices on existing rangelands lead to overgrazing and the acceleration of the land degradation processes.

Overgrazing is due to several reasons:

- Overstocking and absence of adjustment of herd size to year to year condition change
- Inappropriate management of grazing relevant to both timing and intensity
- Limited alternative feed sources
- Poor herd management skills

As a result, the vegetation cover is degraded, water retention is decreased and soil erosion accelerated resulting ultimately in barren land.

2.10 Pollution[3]

An important factor leading to land degradation in Lebanon is pollution from various sources. It includes industrial discharges, uncontrolled dumping of solid and toxic wastes and discharge of untreated municipal and industrial wastewater. Point source industrial pollution is a concern, particularly from the cement industry, but also from paper, pharmaceutical, paint and plastic producers as well as thermal power plants and refineries.

Lebanon has a high population density reaching 1,600 persons/Km in the coastal areas, which contain 60% of the total population (CDR, 1994). The rapid population growth in the urban areas outstripped the provision of necessary infrastructure and led to an increase in the sources and types of pollutants. This drastically affected the environmental conditions of the country including air, water and soil quality.

Additionally, the war caused severe damage to sewerage systems in the country. Large portions of the networks were badly damaged and there was widespread clogging and silting. Many of the sewerage systems are undersized in relation to the population that they now serve and lead sewage untreated to rivers and the sea. This is polluting rivers (MoE, 1998) and the adjacent coastal area (Kouyoumjian and Safa, 1992), especially around the ports, stressing strongly the marine life (Mansour, 1993). In addition, at sea ports the discharge and disposal of ballast waters, the effect of dredging, and petroleum pollution from accidental spills from tankers, increase the pollutants and their concentration.

For example, in Tripoli and Akkar, the sewage systems are old, and terminate with relatively short outfalls resulting in the diversion of part of the sewage to the open storm water channels from which it is used for irrigation, and contaminate the soil with Nitrate, which find its way to groundwater (METAP, 1993). Six of the seven communities in the caza of Bcharre provided with sewer networks discharge their sewage into Kadisha/Abu Ali River whose waters are tapped by

[3] Information taken from a report prepared by Najib Haddad, LAU
http://csrd.lau.edu.lb/Publications/StudentReports/Pollution%20in%20Lebanon.htm

lower altitude communities. Part of the sewer networks serving the Koura and Zgharta communities are made of open channels. These channels often flood their contents contaminating the surrounding areas and exposing the inhabitants to potential risk of acquiring endemic diseases.

In 1993 the MoE collected data on bacterial contamination at 38 sites along the coast of North Lebanon from river outlets. The bacterial count ranged from 35 at Ras el Saker to1100 in Jbail and Al Buhsas, to 11,000 at the Ramlet EL Baydah (Helweh and Hamzeh, 1994).

Unproper sewage is affecting surface and groundwater supplies, which are in many places used for drinking purposes. This has severe consequences on human health and productivity.

The non-hazardous waste liquid effluent and slurries generated from industrial manufacturing (SPNL, 1992) add another variety of pollutants to the water system in the country. Industrial waste is disposed off, untreated, through municipalities, in addition to other disposal routes including informal on-site incineration, disposal to wells, and informal dumping concentrated on the western slopes and foothills of Mount-Lebanon, leading to additional contamination of ground and surface water. Also many industrial processes use water for cooling purposes leading to thermal pollution when heated cooling water is released into streams and lakes, and changing the basic viable conditions for the survival of the marine life (Khawlie, 1991).

Although the impact of industrial discharges is focused on the coastal zone, the Litani river and Karaoun lake are seriously threatened by industrial run off from Zahle, Chtoura and Rayak, centers of agro processing (dairy products, wineries, food processing), Tanneries and Glue factories at Machghara, which discharge non-grading heavy metals such as chrome and arsenic (CDR 1994, WB 1998).

Pollution from agriculture results indirectly from irrigation and directly from farm organic wastes in the form of manure slurries, silage effluent, and diary washings. This type of pollution is widespread resulting from the many small agricultural enterprises in many areas of the country. Moreover, farmers have

poor knowledge of irrigation techniques and agrochemical use. Irrigation rate often exceeds crop water demand. Flood irrigation is still widely used. This leads to extremely low efficiency in use, increased risk of long-term soil salinization, and break down of soil structure.

Moreover, the excessive use of agrochemicals represents a direct polluting factor. It leads to contamination of ground and surface water as well as food products and marine life. In intensive agriculture, fertilizers are widely used. They are available at relatively low cost and are promoted by the private sector (vendor-diven). Their excessive use leads to soil and water contamination in many places.

Chapter Three

Socio-economic Situation

3.1 Introduction

Lebanon is divided into 6 Mouhafazats or governorates as follows: Beirut, North-Lebanon, South-Lebanon, Nabatieh, Mount-Lebanon and Bekaa (see Map 3.1 for the geographical distribution of the Mouhafazats and Table 3.1 below for the area of each Mouhafazat, its population number and density). The economy of Bekaa is predominately agricultural, as are those of the North and South. The coastal cities Beirut, Tripoli (Northern Lebanon), Saida (Southern Lebanon) have large ports and mostly engaged in commerce and other services. The bulk of industry is concentrated in Mount Lebanon the sea front suburbs of Beirut and the coastal area of northern Lebanon.

The favorable geographic position, combined with the high entrepreneurial ability of its population and a liberal, market-oriented economic policy, made of Lebanon the gateway to and the turntable of Near-East economy, especially in the services sector. This sector accounts for almost 70% of GDP and industry for 18%. As for the agricultural sector, the literature review from different sources showed that contribution of the agricultural sector to GDP has been around 8-12% during the last few years. However, this sector has long been given a low priority in government policy.

Lebanon is a major food importer, with local production satisfying only 20% of local consumption. Food deficit is mostly manifested in cereals. Fruits, vegetables and poultry production exceed the local market consumption and could contribute substantially to increasing exports.

According to 1998 survey results, (Ministry of Industry, 2000) the food industries showed to be the largest industry in the economy accounting to around 23% of the industrial enterprises, and almost 26% of total industrial output. Almost half of the enterprises of the sector are bakeries and are generally of small units.

The agricultural labor force went down from over 30 % in 1964 to approx. 9% today. Regional variations exist however. In Bekaa, for example, the figure goes up to 20.4% because the population is highly dependent on agriculture (Table 3.2) and to as high as 40 % when the proportion of population indirectly involved in agriculture is also considered.

Table 3.1 Population distribution and density per Mouhafazat

Mouhafazat	Population Number	Percent	Area (km^2)	Population density person/km^2
Beirut	403 337	10.0	19	21228.3
Beirut Suburbs	899 792	22.5		
Mount-Lebanon	607 767*	15.1	1986	759.1
North Lebanon	807 204	20.1	2008	402.0
South Lebanon	472 105	11.8	939	502.8
Nabatieh	275 372	6.9	1102	249.9
Bekaa	539 448	13.6	4163	129.6
Total Lebanon	4 005 025	100	10,217	400

Source: CAS, 1997

Table 3.2: Distribution of Population Labor Force by Sector and Region

Mouhafazat	Agriculture	Industry	Construction	Commerce	Services	Total
Beirut	0.2	12.4	6.4	24.2	56.8	100
Beirut suburbs	0.6	20.8	9.5	24.4	44.7	100
Mount-Lebanon	5.1	14.1	14.6	20.4	45.8	100
North Lebanon	14.8	14.9	10.4	21.0	38.9	100
South Lebanon	16.4	12.2	14.5	23.5	33.4	100
Nabatieh	17.2	12.3	16.9	21.8	31.8	100
Bekaa	20.4	12.5	9.5	20.3	37.3	100
Lebanon	**9.0**	**14.7**	**11.2**	**22.3**	**42.8**	**100**

Source: CAS, 1997

3.2 The war (1975-1990) and its consequences

Today, in 2003, the Lebanese economy is still struggling to recover from nearly two decades of civil conflict and instability created by Israeli occupation and military actions. While economic growth was strong early in the decade of the 90s, the economy has shown little or no progress in recent years and unemployment remains high.

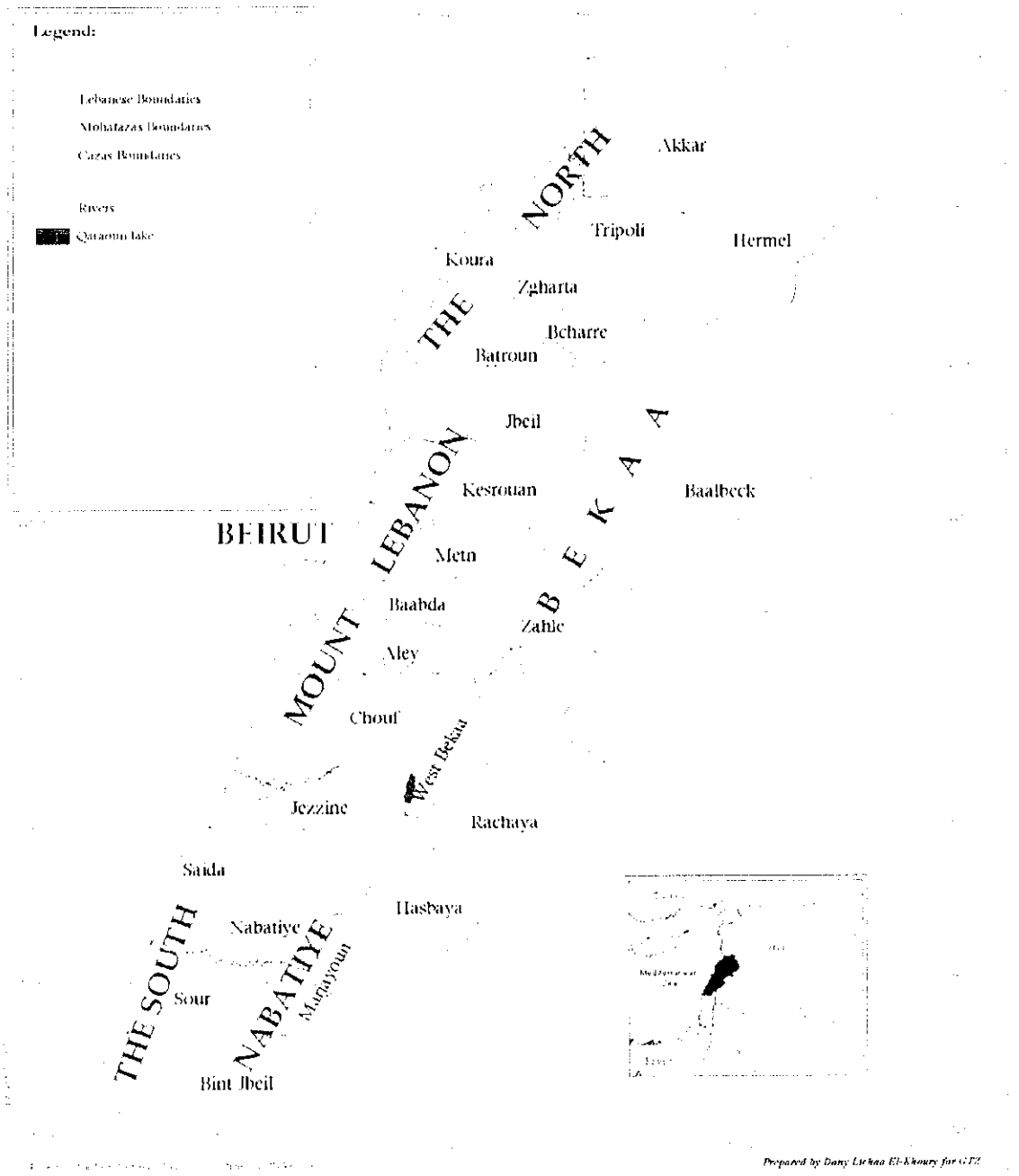
The war that devastated Lebanon attained the majority of cities, towns and villages and affected all productive resources. The widespread high inflation rate from the mid 1980 and until 1992 has been the most important prominent impoverishment mechanism, leading to the deterioration in real incomes of the Lebanese.

Ministry of Agriculture - LEBANON

Combating Desertification in Lebanon

CoDeL

gtz German Technical Cooperation



Prepared by Dany Lichaa El-Khoury for GTZ

Map no. 3.1

Title:

Administrative Map of Lebanon

Source:

N

10 0 10 20 30 Km

Agriculture was severely affected through direct loss of structures, resources, and assets where the agriculture support institutions almost completely stopped activities.

According to UNDP, among a population of 3 million, about 150,000 people lost their lives, 200,000 were injured and 50,000 were left with serious disability. In addition, nearly half a million were displaced and about one third of the population, or 900,000, left the country. Losses in terms of infrastructure were estimated at $25-$30 billion US, ten to twelve times the national income.

3.3 The social situation

The long war led to forced displacement of very large numbers who suffered acute impoverishment in the process as a result of loosing their productive resources and being obliged to leave their place of residence or work.

The alarming emigration rate is also adding to the problems of the Lebanese labor market. It is mostly young skilled male who emigrates. Since 1992 it has been estimated that around 690,000 Lebanese are thought to have emigrated (UNDP, 2000).

Displacement is not only due to deprivation but also due to different reasons. These include economic and social pressures, namely the lack of employment opportunities (Baalbeck, Akkar), the Israeli occupation and security considerations (Nabatieh Mouhafazat and Bent-Jbeil, Marjaayoun and West-Bekaa cazas), forced displacement (some cazas of Mount- Lebanon), and cultural consideration residing in the pursuit of improvement of life conditions (See section 2.6.1 on Human Settlements).

The extensive emigration abroad has distorted the population pyramid. The majority of these emigrants were young people, in the age group 20-25 years, mostly male, which was also reflected in the rise of the ratio of the female population to the total.

The national age dependency[1] ratio is around 57% (MOSA and UNDP, 1998). The dependency ratio is at its highest (86.6%) in Akkar, compared to 43.7% in Kesrouan (Table 3.3). The high age dependency rate implied added burdens for the economically active population in having to support a larger than average number of persons. It results from the interaction of several factors among which the internal displacement or migration abroad reflected in imbalance between the number of females and males, and between age groups, that is as a result of the migration of male youth.

Moreover, some of the cazas with low indicators have a low ratio of old people (Akkar, El-Minieh, Baalbeck, Hermel) indicating that the average age is below the national average. However, it is the reverse case in some cazas (Bent-Jbeil, Marjaayoun, Jezzine) implying a high rate of emigration among young people, or in other cazas where the migration of young people is due to other than security considerations (Bcharre, Batroun, Zgharta, Jbeil), among which are low economic conditions associated with the availability of resources and better opportunities.

Today, significant poverty and income disparities prevail as society is increasingly dichotomized between the very rich and the poor. Illiteracy reaches 15% to 20% in the disadvantaged areas of the Bekaa valley, South Lebanon and the North, and is acute amongst women. Unemployment reaches up to 16% and is highest amongst the young. Tight monetary policy, a narrow tax base, and economic recession have led to declining real incomes of many salary earners. Without adequate social integration, the problem of poverty, particularly in cities, may prove destabilizing. Public welfare programs and social safety nets are largely non-existent in Lebanon, are narrowly based, and often subject to mismanagement. Remittances from expatriates alleviate the situation amongst underprivileged communities.

Additionally, national health care policy is absent. The system favors equipment, curative and tertiary services driven by the supply of an abundant

[1] The percentage of persons in the ages defined as dependent (under 15 and over 65 years old) to those in the ages defined as economically productive (15 to under 65 years) in the population.

private sector, rather than primary health care and prevention. There is a need to develop national poverty reduction programs, to establish a comprehensive social development policy, and to tackle health care.

Rights of women are affected by various forms of sectarianism (e.g. there is no civil marriage law). Their participation rate in public and political life is low (only 2% of the 128 parliamentary deputies are women; only three of the 300 municipal councils are headed by women), when measured against university graduation rates (50% women), and contribution to employed labor force (27%).

Table 3.3 Characteristics of the most deprived cazas compared to the average and to the least deprived Caza of Kesrouan

Caza	Average household size	School enrollment ratio (6-12 years) %	Illiteracy rate (10 years and above), %	Age dependency ratio (%)
Akkar	5.95	83.5	30.5	86.6
El-Minieh	5.69	85.0	24.8	70.5
Marjaayoun	4.50	90.1	23.6	67.5
Hermel	5.77	86.7	23.2	68.8
Bent-Jbeil	4.84	91.4	19.6	71.3
Baalbeck	5.26	90.7	18.3	68.9
Tyre	5.07	89.2	16.6	67.1
All Lebanon	4.65	88.9	13.6	56.8
Kesrouan	3.96	90.1	7.9	43.7

Source: MOSA and UNDP, 1998

3.4 Income inequalities and the erosion of purchasing power

According to UNDP (2000) currently 80% of the families receive 50% of the national income, the next 10% receive 15%, and the richest 10% receive 35% of income (Table 3.4). The average purchasing power of households in 1999 was 20.9% against 1974 and the mean income dropped from 1.5 million Lebanese Pound in 1997 to 1.2 m in 1999.

In a survey (CAS, 1997) on the living conditions of households the total Lebanese families' showed that the average annual household income

amounted to L.L. 18.5 million (1.54 million per month). Regional variations reveals that the average annual family income in Beirut is more than 70% of that of the families of Northern Lebanon which recorded to have the lowest value among the Lebanese Mouhafazats (Table 3.5).

In fact according to the MOSA and UNDP (1998), it appears that 42.8% of the Lebanese households fall below the threshold of satisfaction with respect to the index of income related indicators and that Hermel Caza comes first in this classification (68.1%), followed by Marjaayoun (67.7%), Akkar (62.1%), Bent-Jbeil (61.7%), Baalbeck (57.7%), and the last is Kesrouan (21.2%).

Table 3.4 Change in purchasing power of families between 1992 and 1999

	Purchasing power change between 1992 and 1999 (1988 prices)	% of families		
		1974	1992	1999
High income	4.8%	19.5	10.3	8.8
Middle income	-8.4%	60.1	40.2	29.3
Low income	-4.6%	20.4	54.6	61.9

Source: Calculations of Ibrahim Maroun based upon studies made by CAS Reach-Mass and Yves Schemeil (St. Joseph University)

3.5 The unbalanced development and access to basic services

The spread of poverty and impoverishment are often attributed to war and political instability. However, poverty has also structural causes and determinants that are not related to war. Many social researches distinguish between "central" and "peripheral" Lebanon in terms of socio-economic and development indicators (Nehmeh, 2001).

Disparities can be observed in the economic diversity and activities; human development levels; social structure and living conditions; and in political representation and participation in decision-making processes. Economic growth and reconstruction have favored some regions, notably parts of the Beirut region, to the detriment of large parts of the country. It has also favored

services sectors over typically labor-intensive employing activities in agriculture and industry.

Table 3.5 Socio-economic profiles of regions.

Regions	Average size of household	Illiteracy rates %	Schooling 10-15 years (%)	Individuals less than 20 years (%)	Unemployment (%)	Income (USD/month)	Poverty (LCI level)%		
Beirut	4.3	8.7	96.1	31.7	7.5	1,379	low	Intermediate	High
Beirut suburbs	4.6	8.7	94.9	37.2	8.6	1,149	18.4	38.7	43.0
Remaining Mount Lebanon	4.4	6.6	98.4	32.3	7.0	1,297	24.7	43.6	31.7
North Lebanon	5.5	16.7	90.0	45.5	10.6	823	43.8	37.6	18.7
South Lebanon	5.0	14.4	93.3	42.9	9.1	756	36.9	44.7	18.4
Nabatieh	4.4	14.8	96.8	38.8	9.6	726	51.0	39.8	9.3
Bekaa	5.0	103.5	93.3	41.4	10.7	842	40.6	43.3	15.9
Average	**4.8**	**11.6**	**93.9**	**38.9**	**9.0**	**1,026**	**32.1**	**41.6**	**26.4**

Source: CAS, 1998

According to a study conducted by UNDP and Ministry of Social Affairs, estimating the poverty phenomenon in Lebanon in a broader term as measured by the Living Condition Index within each Mouhafazat (and subsequently within each Caza), i.e., the degree of satisfaction of basic needs (see Table 3.6).

The study showed that 32.1% of the households residing in Lebanon live below the threshold of the Living Condition Index, 42% at the intermediate level, while 26% reach the high end of the Index. Disparities at the Mouhafazat and Caza level do exist.

In summary, the study reveals that, in general, the Caza having a low Living Conditions Index share a number of features that indicate high rates of deprivation. These cazas are characterized by high illiteracy rates, low school enrollment ratios for children aged 6-12 years, have a large household size and a high age dependency ratio (see Table 3.5).

Disparities were also shown in educational attainment and dwellings services between Beirut, other cities and rural areas. For example, over one third of the dwellings were not connected to the water network compared to only 6% in Beirut.

Moreover, the regions suffering most from deprivation (in terms of the ratio of the deprived to total resident population), are mostly rural cazas. The deprived, however, are concentrated in urban areas and are of rural origins and have displaced for different reasons.

The bulk of the deprived is wage earners and is self-employed (representing 40.9% of the pupation falling within the category of low satisfaction). The deprived are to be found in the following occupations: farmers, and skilled workers, and employees engaged in selling and services, agricultural workers and fisheries, and unskilled workers in mines, construction, and public works industry and transport.

The study also suggests that priority should be given to programs that are directed towards improving wages, providing more productive employment opportunities and reducing the cost of commodities and services that enter into the formation of the basic needs especially education and health. As for water and sewerage, priority in this field is to be given for rehabilitation and for increasing the hours of water supply and quality control.

Table 3.6 The Living Conditions Index According to Caza: 3-Level Classification in Descending Order Based on the Percentage of Households Having a Low Degree of Satisfaction (Percent of Households in the Caza)

	Low	**Intermediate**	**High**	**Total**
Bent-Jbeil	67.2	28.5	4.3	100
Hermel	65.9	28.6	5.6	100
Akkar	63.3	29.1	7.6	100
Marjaayoun	60.0	32.3	7.6	100
El-Minieh	54.2	39.3	6.5	100
Baalbeck	49.2	40.1	10.7	100
Tyre	45.0	41.0	14.0	100
Hasbaya	41.5	48.4	10.1	100
Nabatieh	40.0	47.4	12.6	100
Rachaya	39.5	51.9	8.7	100
Jezzine	35.7	49.8	14.5	100
Tripoli	34.9	38.2	26.9	100
Bcharre	34.8	45.4	19.8	100
Batroun	34.2	45.0	20.8	100
Lebanon	**32.1**	**41.6**	**26.4**	**100**
Baabda	31.6	42.2	26.1	100
Chouf	31.0	50.0	19.0	100
Western Bekaa	30.7	53.6	15.8	100
Jbeil	30.1	46.7	23.2	100
Zgharta	29.7	43.0	27.3	100
Saida	28.9	47.2	23.0	100
Zahle	28.9	45.3	25.8	100
Koura	27.0	44.7	28.3	100
Aley	25.0	45.6	29.3	100
EL-Metn	19.7	43.9	36.4	100
Beirut	18.4	38.7	43.0	100
Kesrouan	**13.5**	**38.3**	**48.2**	**100**

Source: MOSA and UNDP, 1998

3.6 Government challenges

Since the war ended Lebanon witnessed the launching of massive reconstruction and economic recovery process in an earnest effort to compensate for the earlier losses. However, efforts to deal with the social issues and the distortions and disparities that existed before the war need to be intensified. This reflects a lack of an overall development vision, which would otherwise ensure balance among regions and sectors. The political instability and the awaited administrative reforms represent main hinders for economic growth more than the economic financial constraints.

The government, however, is now aware of the problem. To this effect, a number of projects are starting or are within the pipeline and managed by CDR. These projects aim to improve public services in certain rural areas that have limited economic development and lack basic services and to develop their agricultural, industrial and handicraft production in the framework of balanced development (Appendix IV).

Moreover, CDR considers the key outputs in social development as "the improvements, which are possible to make in the quality of life of the more disadvantaged groups through a sustainable and balanced approach to development, focusing on equity, empowerment and on redressing disparities" .

To this effect, CDR's role has been to strengthen the institutional as well as the managerial capacities of both the Ministry of Social Affairs (MOSA) and the National Employment Office (NEO).

However, coordination and or complementarity of all the socioeconomic development and poverty alleviation efforts ensuring the sustainable use of natural resources, and mainstreaming gender issues in the programming process within the country both at the national and local levels and based on a decentralized and community driven approaches is still a challenge.

To this effect, the line of action of socioeconomic national frame is to be elaborated in accordance with these ongoing efforts and agreed upon within the concerned stakeholders.

Chapter Four

Legislative Framework

4.1 Introduction

There is better recognition in Lebanon that environmental protection requires a collaborative and concerted effort at all levels. Working within the framework of an evolving legal and regulatory framework, government agencies at the national and local levels are becoming more aware of the need to consider the environmental impacts of their policies and actions, and are gradually building their capacity to manage the environment. (State of the Environment Report 2002)

This awareness has led to the formulation of Law 667/9, Article 3, which calls for establishing a National Environmental Council. The Environmental Council would be charged with formulating proposals and recommendations for a comprehensive and integrated environmental policy as well as suggesting implementation plans, which would become binding upon their approval by the Council of Ministers. Membership of the National Environmental Council is to be evenly divided among representatives of concerned ministries and those of civil society (NGOs, private sector, academia). However, to date, the Council is still not in place.

Currently, a number of laws, decrees, and ministerial decisions govern environmental management in Lebanon. However, there is lack of clarity and internal inconsistencies in legal and regulatory texts. Moreover, enforcement remains a major weakness of the environmental control system. Deficient enforcement is sometimes, but not always due to institutional weaknesses, special interests, and political interference that stand in the way of effective enforcement.

4.2 Relevant laws and decrees

Below are some relevant present laws and decrees related (directly or indirectly) to land degradation.

Land and Soil

- Articles 8 & 7 of law decree 69 dated 6/9/1983 (referred to as the Code of Urbanism) provides that a detailed urban plan should determine "the lands to be protected for agricultural use". The enforcement of this article has immediately appeared to be very problematic and complex because of the boom in urban expansion and the will of the landlords to avoid a formal and legal classification of their lands for rural and agricultural purposes.

- The law promulgated on 9/11/1951 grants the Ministry of Agriculture with the authority of implementing a reforestation policy as an initiative for soil protection

- Some articles of the Ottoman Medjelle[1] are still applied such as article 1234, which provides that herbs in a common land are for all.

Pesticides

- Decree 10659 dated 21/9/1970 specifies the formal legal conditions to produce and sell pesticides, to control their production and distribution with a view of protecting the environment and human health.

Protection of natural sites and monuments:

- Decree 434 promulgated on 28/3/1942, has listed eight sites to be protected: the Cedars, Deir el Kalea in Beit Mery, Village of Bois de

[1] The Medjelle, which was published between 1870 and 1876, is in reality a vast compilation drawn from the Napoleonic Code, the habits and customs of the countries of the Middle East, and the Shari'a. Although it was repealed in Lebanon progressively since 1920 by the enactment of various legislative texts, some of its provisions remain in force.

Boulogne, the Oaks of Mrouj, Forest of Beirut, historical site of Baalbeck, the lake of Yammouneh, natural bridge on Nabet el Laben (Faraya). In the nineties, further sites have been added to the list such the valley of Nahr el Jaouz in Batroun.

- Law 121 dated 9/3/1992 introduced the concept of protected areas in Horch Ehden and Palm Island.

- Several laws adopted declared areas in Lebanon such as law 532 dated 24/7/1996 (Cedar in the Chouf area), law 718 dated 5/11/1998 (Natural marine reserve in Ras el Ain - Tyr), law 9 dated 20/2/1999 (Cedars forest of Tannourine) and law 11 dated 20/2/1999 (protected area in Bentael).

- On October 20th, 1990 Lebanon has passed law no. 19, which allowed the ratification of the UNESCO Convention for the protection of the world cultural and natural heritage.

- Decrees 19/1, 22/1, 21/1 all dated 11/3/2002 declare Kammoua, Dalhoun forest and Wadi al Karakir respectively as natural sites for protection.

Forests

- The forest law was passed on January 7, 1949. This law organizes the protection and the utilization of forests in Lebanon. The law consists of 151 articles detailing the general conditions of forests and specifying what constitutes a forest and the manner of managing them.
  Article 2 of the forest law divides forests into four types as follows:

  - State-owned forests;
  - State-owned which give villages the right of utilization;
  - Municipality and village-owned forests; and
  - Forests owned by individuals.

The function and use of the various types of forests have been defined in the law. Moreover the forest law laid down various penalties for offenses perpetrated by individuals. These penalties are in the form of fines or imprisonment from three to six months.

- Law 558 dated 24/7/1996 provides a legal framework for the protection of forests.

Water

Water legislation in Lebanon is governed by several statutes that cover various aspects related to water. In addition to certain Ottoman decrees and those parts of the Medjelle Al Ahkam Al Adlya[2], which are still in force, two fundamental statutes on water were enacted in 1925 and 1926: Decree 144 of 10 June 1925 relates to the public domain and Decree 320 of 26 May 1926. They constitute the fundamental texts governing water in Lebanon. They have undergone minor amendments since then, although their original underlying principles have not been altered.

There is in addition a short text entitled the Ottoman Irrigation Code. It is dated 18 Rabih Awwal 1332 (11 February 1913). Another remaining law of March 1918 relates to the arrangement and the renovation of common irrigation canals.

At the same time as these fundamental laws were enacted, a series of decrees was progressively promulgated to regulate some sectors of water law. These are:

- Law No. 320 of May 26, 1926
- Decree 14438 of May 2, 1970 concerning the use of groundwater
- Decree 10276 relates to the delimitation of the perimeter of protection of sources.
- Legislative decree No. 112 of December 16, 1983

[2] The parts of the Medjelle still in force in the field of water are Title 4, Chapter 10, Articles 1234 to 1328. These articles have not been repealed by subsequent legislation

- Decree No. 680 of September 5, 1990
- Law No. 221of May 29, 2000
- Law No. 241 of August 7, 2000
- Law No. 377 of December 14, 2001
- Decree No 8122 of July 3, 2002

The general principle concerning water resources in Lebanon is that title belongs to the State by virtue of its control of "the public domain". There are some important exceptions.

Groundwater

- Art. 6 of Decree 320/26 and Decree 14438 of 2 May 1970 define specific legislation concerning the use of groundwater. The latter decree regulates the granting or the exemption of the prospecting permit.

Quarries

- Until 1994, quarries were regulated by decree 235 dated 8/11/1935.
- In 1996, decree 5616 dated 6/9/1994 was promulgated to regulate the situation of quarries in Lebanon but the provisions of this decree were not enforced.
- Decree 8803 dated 4/10/2002 was promulgated to enhance enforcement and to establish the formal conditions to obtain a permit for the exploitation of a quarry.
- Decision 2, 77th session of the council of Ministers made the following amendments:
  - localization of quarries in the eastern mountain chain
  - Mandatory rehabilitation of quarried sites at the expenses of the owners by terracing and replanting.

Code of the Environment

- *Law 444, August 8, 2002.*

4.3 Analysis of the legislative framework

The Government of Lebanon has signed and ratified the UNCCD in addition to other UN conventions. This entails obligations including the provision of an enabling environment by strengthening, as appropriate, relevant existing legislation and where they do not exist, enacting new laws and establishing long-term policies and action programmes. Articles of the UNCCD defining obligations of affected country parties have to be mainstreamed within national legislation and development plans.

An analysis of the legal situation shows that many texts regulate natural resources but that some gaps are apparent at the legal, administrative, information and organizational levels.

At the legal level

Despite efforts to update the legislation in vigor by the issuance of new texts like, for example, for protected areas, the prevailing legislation does not distribute, in a comprehensive view, the roles of the different partners involved in the protection of nature. The prevailing legislation results from a situation of necessity and no coordination is promoted between the public and the private sector.

At the administrative level

Roles and responsibilities of the various ministries and government institutions are not clearly defined. This leads to overlapping, conflicts and inefficiency in the management of natural resources. A major challenge would be to define clear roles and responsibilities. Additionally enforcement of current legislation is

inadequate. Special attention need to be given to the issue of enforcement before the enactment of any new laws and decrees. New legislation need to take into account the needs of all affected communities to facilitate respect and enforcement of the law.

Chapter Five

Causes and Effects of Desertification in Lebanon

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

5.1 Desertification in the Mediterranean Basin and Middle East

Most of the Mediterranean Coast and the Middle East is covered by drylands and all nations in the region have suffered desertification. The intensive development of the Mediterranean coast and the burgeoning population are putting tremendous stress on delicate, dryland ecosystems. In the Middle East, where the rate of population growth is 3% annually, there were 76 million people in 1950. The figure is now approaching 200 million.

The heightened demand for fresh water for domestic, industrial and agricultural use is depleting or polluting limited reserves of fresh water; virtually every country bordering the Mediterranean suffers from salt-water intrusion into its coastal aquifers. The development of resort areas and the growth of cities along the coast are accompanied by another water problem - unregulated sewage dumping which pollutes sea water and beaches and percolates into fresh water aquifers.

Over-irrigation, an age-old practice, and the use of chemical fertilizers and weed control agents have caused salinization in marginally productive drylands throughout the region. Even areas with ample fresh water resources and fertile land suffer salinization and waterlogging.

Soil erosion is a problem of vast proportions. In the past 25 years the increased cultivation of marginal lands and poor management of rangelands have contributed to the loss of two million hectares of agricultural land in North Africa. About 35% of the Middle East experiences soil erosion of between 5 to 50 tons per hectare annually as a result of over exploitation and over 130 million hectares of rangeland have degenerated (UNCCD). In many areas overgrazing destabilized sand dunes, causing them to drift and lose their productivity.

However, it is not erosion alone that has caused the loss of productive land. It is also gobbled up by rapidly expanding urban and industrial sprawl.

5.2 What are the main causes of desertification?

"Thou shalt not transgress the carrying capacity" (Hardin) - a fundamental ecological principle - highlights the limits that nature imposes on man when it comes to the use of a natural resource such as land. Forgetting this basic fact sets in motion a vicious cycle of events leading to land degradation and desertification with dire consequences.

A common misapprehension about desertification is that it spreads from a desert core, like a ripple on a pond. The truth is that land degradation can and does occur far from any climatic desert; the presence or absence of a nearby desert has no direct relation to desertification. Desertification usually begins as a spot on the landscape where land abuse has become excessive. From that spot, which might be around a watering point or in a cultivated field, land degradation spreads outward if the abuse continues. Ultimately the spots may merge into a homogeneous area, but that is unusual on a large scale.

A second misconception is that droughts are responsible for desertification. Droughts do increase the likelihood that the rate of degradation will increase on non-irrigated land if the carrying capacity is exceeded. However, well-managed land will recover from droughts with minimal adverse effects when the rains return. The deadly combination is land abuse during good periods and its continuation during periods of deficient rainfall.

Desertification as previously defined can only occur on land prone to desertification processes. Land vulnerability to desertification is determined by current climate, relief, and the state of the soil and natural vegetation. Human activities are the main factors triggering desertification processes on vulnerable land. These activities are many and vary by country, society, land use strategies and the technologies applied.

5.2.1 Natural factors determining vulnerable land in Lebanon

5.2.1.1 Topography

Lebanon is a much dissected country with steep slopes, which makes land very susceptible to erosion in the absence of proper land management practices. Deforestation and unsustainable agricultural practices on slopes have caused accelerated land degradation especially on the eastern slopes of Mount-Lebanon and the western slopes of the Anti-Lebanon where erosion has removed the soil altogether in many places so that the mother rock is exposed.

5.2.1.2 Climate

Lebanon has a relatively favorable position as far as its rainfall and water resources are concerned, but constraints consist of the wide variations in average annual rainfall per region. Average annual rainfall is estimated at 840 mm, varying from 600 to 900 mm along the coastal zones to 1 500 mm on the high mountains and decreasing to 400 mm in the eastern parts and less than 200 mm in the north-east of Lebanon. Moreover there are large seasonal variations with 80-90% of the annual rainfall falling between November and March and less than 5% falling between May and September. This leads to limited water availability during the dry summer months where evapotranspiration may reach up to 200 mm per month and resulting in a large water deficit, severing vegetation, encouraging forest fires and exposing the soil to wind erosion. Table 5.1 below shows the land area belonging to the different climatological zones.

Additionally, rainfall events with very high intensity lead to severe water erosion on slopes in the winter season especially in areas with scarce vegetation cover causing flash floods mainly in the north-western part of the country (esp. the Baalbeck-Hermel region). Flash floods cause casualties and serious damage to infrastructure and lead to large amounts of a scarce resource leaving the area as runoff adding to the water deficit of the area.

Table 5.1 Land area belonging to the different climatological zones.

Zone	Area (ha)	Area %
Arid	70595	6.75
Semi-arid	348130	33.31
Dry-sub-humid	218709	20.93
Sub-humid and humid	407766	39.01

Source: Elaborated from climate index map CoDeL project (See annex I)

5.2.1.3 Soils of Lebanon

The soils of Lebanon are typically Mediterranean in character. Most of the soils are calcareous except for the sandy soils formed on the basal cretaceous strata, basaltic soils spread in Halba plateau and alluvial soils of Central and Western Bekaa. The most widely represented soils in the mountains are the Luvisols "Terra-Rossa" developed from hard limestone. On the steep landscapes of Mount and Anti-Lebanon ranges, where water erosion can be extreme, Luvisols often develop into Lithosols.

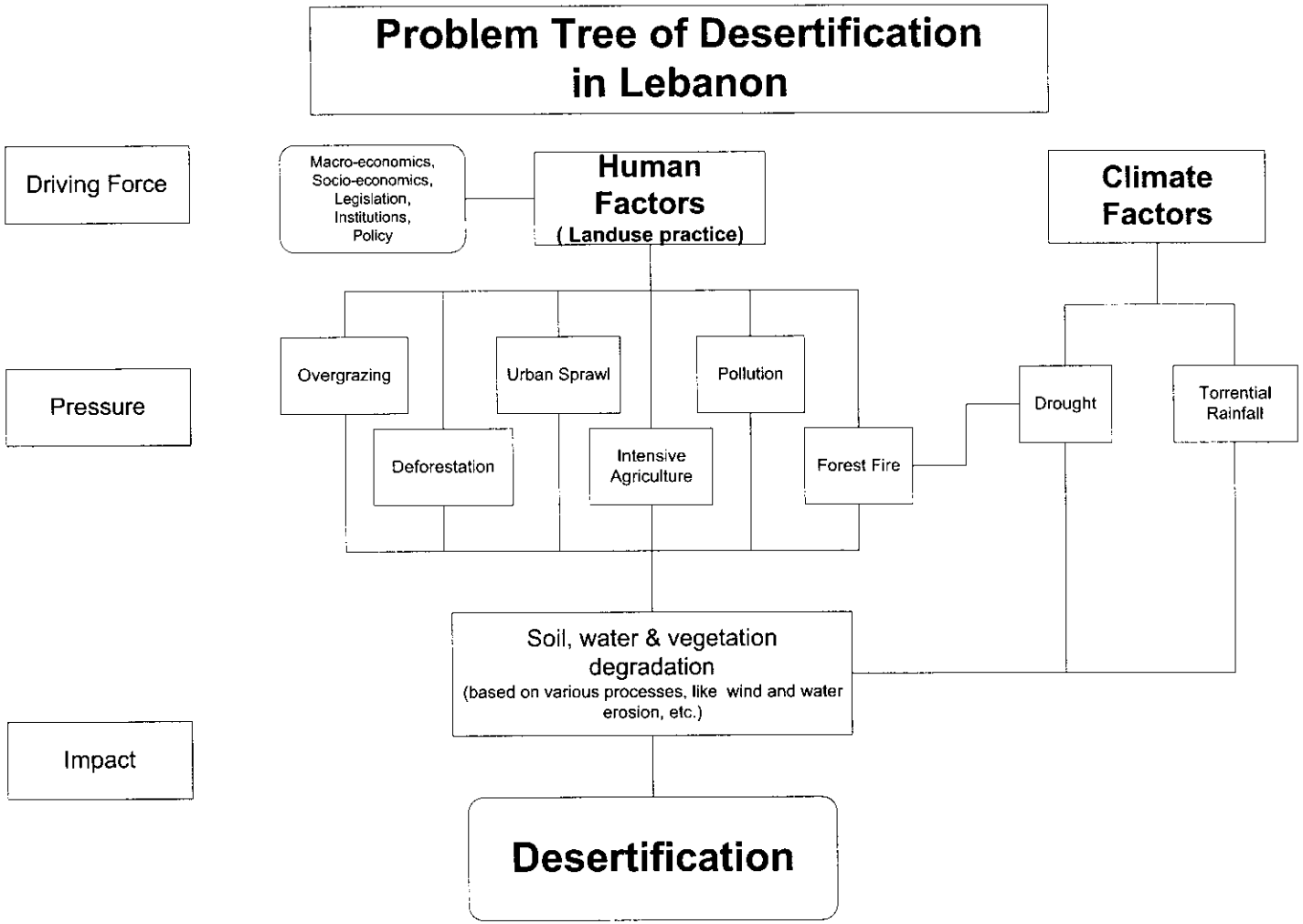
The soils of Lebanon are relatively young and highly fragile and prone to desertification especially on the mountain and hilly lands, which form around 70% of the country. Relief, rainfall intensity and runoff quantity contribute to the intensification of water erosion especially where the protective vegetative cover is lost. Comprehensive studies on soil water erosion in Lebanon are not available. The rate of soil erosion varies with slope intensity, soil type and land cover. Bare lands with Rendzic leptosols and Lithic Leptosols on the hilltops and mountains peaks have an erosion rate exceeding 50 tons/ha/y (WRB, 1998). Wind erosion, is restricted to the sandy shores and to the arid lands in Northern Bekaa (Zurayk, 1994).

5.2.1.4 Natural vegetation

The Mediterranean basin, including Lebanon, has been the cradle of successive civilizations. Hence, human activities have shaped the past and

present of the landscape. Much of the vegetation today consists of a mosaic of patches or remains of natural forests once covering the Lebanese Mountain chains. In recent years, deforestation rate was accelerating so that the forest cover has been reduced by 33% between 1963 and 1990. Today dense forests cover only 7% of the total Lebanese area (FAO, 1990) and are under permanent threat from forest fires. The remaining natural vegetation is increasingly threatened by intensive agriculture, urban sprawl and pollution. This leaves large areas exposed to desertification processes with little protection.

The flowchart below attempts to visualize the relevant pressures and driving forces (including human and climatic factors) leading to land degradation.


Problem Tree of Desertification in Lebanon
Driving Force
Pressure
Impact
Macro-economics, Socio-economics, Legislation, Institutions, Policy
Human Factors
(Landuse practice)
Climate Factors
Overgrazing
Urban Sprawl
Pollution
Deforestation
Intensive Agriculture
Forest Fire
Drought
Torrential Rainfall
Soil, water & vegetation degradation
(based on various processes, like wind and water erosion, etc.)
Desertification

5.2.2 Human activities and driving forces

Human activities that cause desertification in Lebanon are mainly:

- Agricultural encroachment and cultivation of soils that are fragile, or exposed to erosion by wind or water;
- Overgrazing - often selectively - of shrubs, herbs and grasses;
- Deforestation and overexploitation of woody resources, in particular for fuelwood and charcoal;
- Uncontrolled use of fire for agricultural and forest clearing
- Unsustainable agricultural practices
- Poor irrigation practices and inefficient water use
- Chaotic urban sprawl on fertile lands and forests
- Pollution (Solid waste dumping, wastewater effluents, industrial wastes).

The driving forces for these activities are complex and varied. They include:

At the local level

- Poverty and lack of basic security
- Lack of awareness
- Unsustainable land use practices
- Inadequate extension service
- Lack of technical know-how
- Absence of agricultural credit schemes

At the national level

- The civil war (1975-1990) and its consequences including displacement, migration and lack of enforcement of regulations
- Absence of a comprehensive strategy for the sustainable use of natural resources

- Land fragmentation due to inheritance laws and the high transactional costs
- Disabling land tenure system
- Absence of land use planning
- Absence of policies and plans for water and agriculture

At the institutional level

- Centralized decision-making
- Sectoral solutions for multidisciplinary problems
- Weak inter-departmental and inter-ministerial coordination and cooperation, duplication of efforts, and overlap in the mandate of public institutions.
- Absence of regional structures for comprehensive natural resource management
- Weak institutions at the local level

At the legislative level

- Absence of a comprehensive legislative framework leading to reactive and inadequate legislation
- Weak enforcement of existing legislation

At the macro level

- Foreign debt
- Unfavorable terms of trade
- Unfair competition from subsidized imports

5.3 What are the main consequences of desertification?

Desertification should be viewed as a breakdown of the fragile balance that allowed plant, human and animal life to develop in arid, semi-arid and dry sub-humid zones. The breakdown of the equilibrium and of the physical, chemical and biological processes that sustain it, represent the start of a process of self-destruction for all elements of the life system. Thus soil vulnerability to wind and water erosion, the lowering of the water table, the impairment of the natural regeneration of vegetation, the chemical degeneration of soils - themselves all immediate results of desertification - worsen the situation. Desertification feeds on itself.

Consequently, the effects of desertification are extremely serious and often dramatic for the poor. By limiting natural potential desertification reduces production and makes it increasingly precarious. Forced to attend to the most urgent things first, populations resort to survival strategies that unfortunately make desertification worse and prevent any development. The most immediate and generally widespread of these survival strategies is to intensify over-exploitation of the most readily available natural resources, but at the cost of enormous effort. The second strategy is increasing rural migration: this may simply involve men and young people leaving for a seasonal or longer-term job in other areas of the country, particularly the towns, or going to other countries; or the migration may take on the proportions of a population exodus in search of better living conditions. These survival strategies are often accompanied by breakdowns in the integrity of communities and sometimes of families. When survival is difficult, people become withdrawn and sometimes strongly individualistic; this leads to ethnic, family or individual conflict.

Examples on the first survival strategy in Lebanon, namely, the overexploitation of available natural resources, are many and varied including agricultural encroachment of fragile land, overgrazing of shrinking rangelands, clearance of forests for agriculture and firewood and improper urban and quarrying activities.

The second survival strategy can clearly be noted by looking at table 5.2 below, which shows the increase in the Lebanese urban population from about 2,120,000 in 1985 to about 3,000,000 in 2000.

Table 5.2 Actual and projected rural and urban populations between 1985 and 2025 in thousands.

DEMOGRAPHY	1985	1990	1995	2000	2005	2010	2015	2020	2025
Total population	2,668	2,555	3,009	3,289	3,535	3,742	3,961	4,193	4,424
Urban population	2,119	2,151	2,632	2,951	3,224	3,448	3,668	3,902	4,136
Rural population	549	404	376	338	311	295	293	291	289
Urbanization level (%)	79.4	84.2	87.5	89.7	91.2	92.1	92.6	93.1	93.5

Source: original data are from United Nations Human Settlement Program

This resulted in land abandonment in rural areas leading to the neglect of terraces and other soil and water conservation measures in many places. Moreover, this migration trend has put tremendous pressure on the existing urban infrastructure resulting in many cases in chaotic urban sprawl.

Chapter Six

Areas Prone to Desertification Processes

6.1 The "Desertification Prone Areas" Model

6.1.1 Introduction

Success in combating desertification will require an improved understanding of its causes and impacts and especially the linkages between desertification and climate, soils, water, land cover and socio-economic factors.

Desertification is a condition of human-induced land degradation that occurs in arid, semi-arid and dry sub-humid regions (where precipitation/potential evapo-transpiration or P/ETP lies between 0.05-0.65) and leads to a persistent decline in economic productivity of useful biota related to a land use or production system. Climatic variations intensify the decline in productivity, restorative management mitigates it. The following definition has been adopted by the UNCCD:

> **"Desertification" means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.**

The model used to define Desertification Prone Areas in Lebanon was developed following an approach based on results of Mediterranean European research projects like MEDALUS and DeMon. The approach has been adapted to suit local conditions and needs.

6.1.2 Factors contributing to desertification

Land degradation involves a complex set of processes or factors, which interact in space and time leading to a decrease in land productivity. Thus, it is necessary to identify the various indicators, which will provide the relevant information to define the desertification prone areas.

The following guiding principles have been followed in the choice of indicators, which were considered in order to develop and apply the model:

- Their relative importance in contributing to degradation phenomena;
- Data availability;

The factors (also referred to as indices in this document), which have been selected, are presented in Table 6.1 below:

Table 6.1 Information layers used in evaluating DPA and related sources

Index	Layers	Source
Climate	Precipitation, Evapotranspiration	Published data at various scales from different climatic maps and data.
Soil	Soil textural class, Soil structural stability, Soil organic matter, Soil Depth, Slope gradient	Published data at 1/200000 scale for soils and geology and 50m contour lines.
Vegetation	Fire risk, Erosion protection, Drought resistance	Land cover map 1/50000 scale (1990; FAO)
Land use intensity	Land use, grazing intensity	Land use map 1/100000 scale (1997) and socioeconomic data
Demographic pressure	Population density, Household satisfaction index	Published socio-economic data

A qualitative classification scheme with values ranging from 1-2[1] has been applied throughout the model for individual indices as well as the final classification of Desertification Prone Areas. The value "1" is assigned to areas least prone to desertification while "2" is assigned to areas which are most prone. The range between 1 and 2 reflects relative vulnerability.

The individual indices are described below:

6.1.2.1 Climate

[1] In order to make use of GIS operations and express the results in a final map, figure had to be assigned to the relative qualitative classiication.

It is assessed on the basis of how it influences water availability to the plants. Consideration has been given to the amount of rainfall and potential evapotranspiration. In particular the selected information layers are:

- Annual precipitation
- Annual potential evapotranspiration

The climate index is the ratio of the yearly precipitation over yearly potential evapotranspiration (P/ETP).

The climatic index is classified as follows:

Climate Index (P/ETP) CI	Model classification (qualitative) MC
CI >= 1	MC=1[2]
CI <=0.1	MC=2[3]
0.1<CI<1	1<MC*<2

**The MC value is automatically generated based on the CI value (linear correlation)*

6.1.2.2 Soil Index

Soil water retention capacity and erodibility are important properties, which influence soil degradation phenomena. Therefore, the model incorporates these properties as part of the soil index, which is based on the following characteristics

- Slope gradient
- Soil texture in relation to both erosion and salinization
- Soil structure in relation to erosion
- Soil depth in relation to erosion and biomass production
- Organic matter in relation to erosion and biomass production.

The soil index was calculated using information layers describing the above characteristics. Table 6.2 shows the different information layers used and their relative scores in the model.

[2] Least prone to desertification

[3] Most prone to desertification

6.1.2.3 Vegetation Index

The vegetation index is calculated based on the various functions and roles played by the vegetative cover with regard to degradation processes:

- Fire risk and regenerative ability
- Soil erosion protection
- Drought resistance

These functions were translated into information layers (based on the Lebanese land cover map, FAO 1990), which were used in the calculation of the vegetation index. Table 6.3 represents the legend of the Lebanese land cover, and Table 6.4 lists the three information layers and their relative scores.

Table 6.2 Soil layers and relative scores

Layer	Classes	Scores
Soil texture	Coarse	1.00
	Medium	1.25
	Medium-fine	1.50
	Fine	1.75
	Very fine	2.00
Soil structure	Stable	1.00
	Intermediate stability	1.25
	Low stability	1.50
	Very low stability	1.75
	Unstable	2.00
Soil depth, cm	>150	1.00
	100 – 150	1.25
	50 – 100	1.50
	10 – 50	1.75
	< 10	2.00
Soil organic matter content, %	> 3.0	1.00
	2.0 – 3.0	1.25
	1.0 – 2.0	1.50
	0.5 – 1.0	1.75
	< 0.5	2.00
Slope gradient, %	< 6	1
	6 - 18	1.33
	18 - 35	1.66
	> 35	2

Table 6.3 Classes of the Lebanese land cover/use map 2002

	Class	Description
1	Urban areas	Built up, industrial, airports, quarries, etc.
2	Horticulture	
3	Field crops & fallow land	Irrigated and non-irrigated
4	Trees and perennial crops	Olive, vineyards, deciduous fruit trees, citrus and bananas
5	Grassland (unimproved land)	Grassland and forbs from open to closed, or abandoned fields or old fallows in agricultural areas, sparse grassland and forbs in mountains or desertic areas
6	Forests and other wooded areas	Deciduous forest, coniferous forest, scrubland and other types of degraded forest
7	Unproductive land	Barren rocks, highly dissected and eroded land, beaches
8	Swamp	
9	Water bodies	

Table 6.4 Vegetation index layers and relative scores

Layer	Classes*	Scores
Erosion protection	Deciduous forest, horticulture	1.00
	Coniferous forest	1.20
	Citrus and banana	1.40
	Scrubland	1.50
	Olives	1.60
	Vineyards, deciduous fruit trees	1.80
	Field crops and fallow land, grassland, unproductive land	2.00
Drought resistance	Deciduous forest, coniferous forest, scrubland, olives	1.25
	Vineyards, deciduous fruit trees	1.50
	Grassland	1.75
	Horticulture, field crops and fallow land, citrus and bananas, unproductive land	2.00
Fire risk	Horticulture, field crops and fallow land, olives, vineyards, deciduous fruit trees, citrus and bananas, unproductive land	1.00
	Deciduous forest, scrubland, grassland	1.33
	Coniferous forest	2.00

* Urban areas, swamp and water bodies were excluded.

6.1.2.4 Land use intensity

The "Derived Land Use Map of Lebanon" (1997) was used to describe land use intensity. It is based on the following legend:

1. Horticulture
2. Irrigated temporary cropping,
3. Non irrigated temporary cropping
4. Permanent cropping, which is subdivided into olive, grape, fruit trees and citrus and banana cultivation
5. Pastures
6. Forests for re- and afforestation
7. Recreational forests
8. Forest for pine kernel production
9. Non used forests
10. Non usage
11. Residential, industrial, mining, ...

The grazing intensity on pastures was calculated separately and added to the land use index. Table 6.5 shows the different land uses and their respective relative scores:

Table 6.5 Land use and relative scores

Land use classes*	Scores
Non used forests	1.00
Forest for pine kernel production, forests for re / afforestation	1.13
Recreational forest	1.25
Non irrigated temporary cropping, olive cultivation	1.50
Grape cultivation	1.63
Fruit trees	1.75
Horticulture, citrus and banana cultivation	1.88
Irrigated temporary cropping	2.00
Pastures (depending on grazing intensity)	1.25 – 2.00

*The residential, industrial and mining class is excluded.

6.1.2.5 Demographic pressure Index

The demographic index has been calculated on the basis of:

- Population pressure assessed by the means of population density;
- Poverty assessed using household satisfaction index published by UNDP.

The assessment of the demographic index was done at the Caza (district) level because of data availability. The value "2" has been assigned to areas with the highest density and highest rate of unsatisfaction, and "1" to areas with the lowest. Intermediate areas were assigned values between 1 and 2.

6.1.3 Methodology, combining indices

The integration of the various indices was accomplished by using GIS technology. The various information layers for each index were prepared in a suitable format and then overlaid in order to calculate the index as described below:

$$Index\_x = (layer\_1_x * layer\_2_x * layer\_3_x * ..... * layer\_n_x)^{(1/n)}$$

Where x is the index in consideration and n is the number of layers used for a specific index.

The various indices were combined to derive Desertification Prone Areas (DPAs) according to the formula below:

$$DPA = (CI * SI * VI * LUII * DPI)^{(1/5)}$$

Where:

- DPA is Desertification Prone Areas
- CI is the Climatic Index
- SI is the Soil Index
- VI is the Vegetation Index
- LUII is the Land Use Intensity Index
- DPI is the Demographic Pressure Index

DPA provides a satisfactory approach for the identification of prone areas, which need to be considered in the National Action Programme.

The following chart (Figure 6.1) visualizes the model approach, which was used for the designation of DPAs. It is followed by the final map showing desertification prone areas in Lebanon (Map 6.1).

It should be noted that the final map was produced based on relevant available data. It shows the overall picture but there is scope for minor improvements whenever more recent data is available.

Maps showing the individual indices, which were developed and used in the model, are shown in Appendix I.

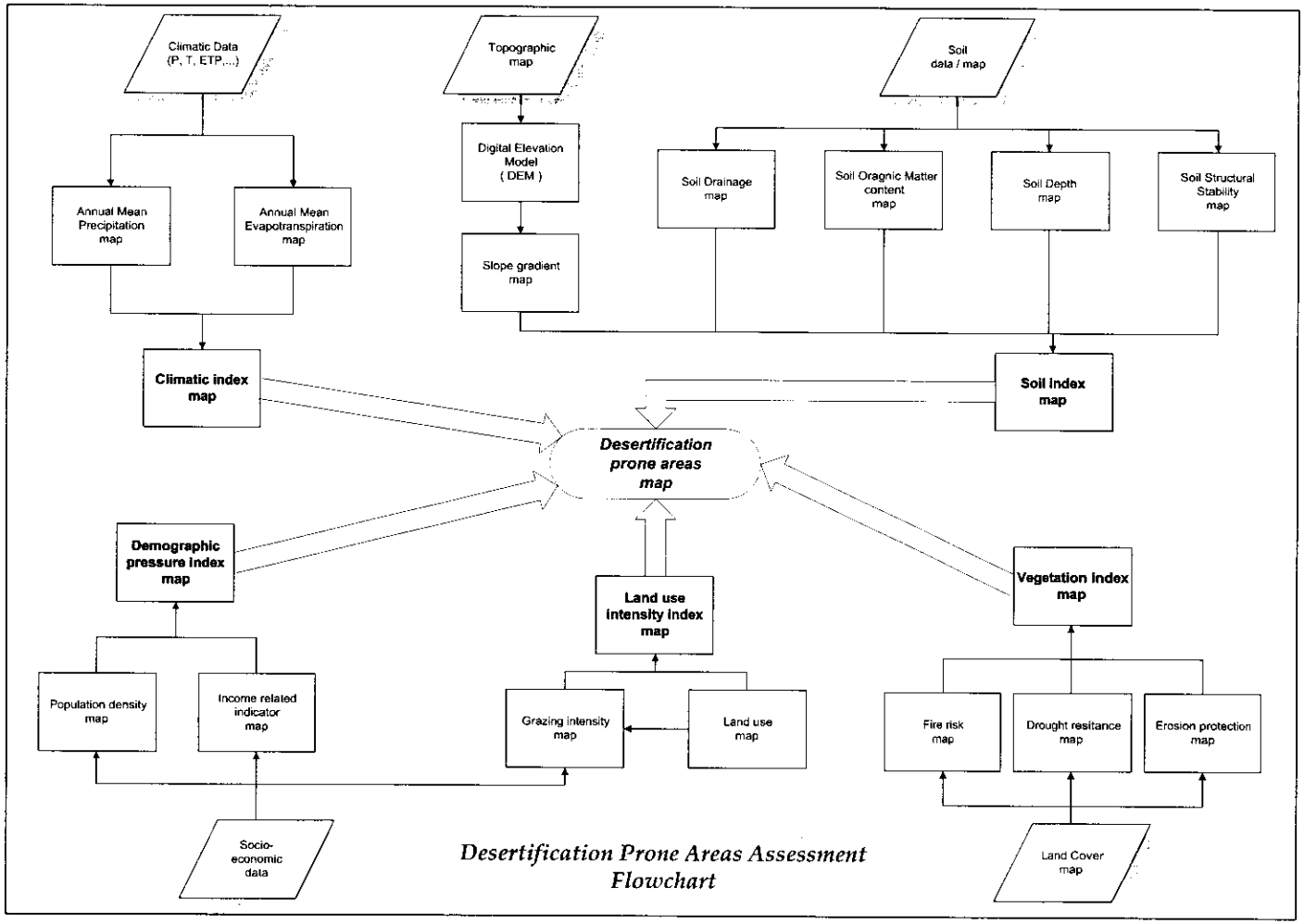


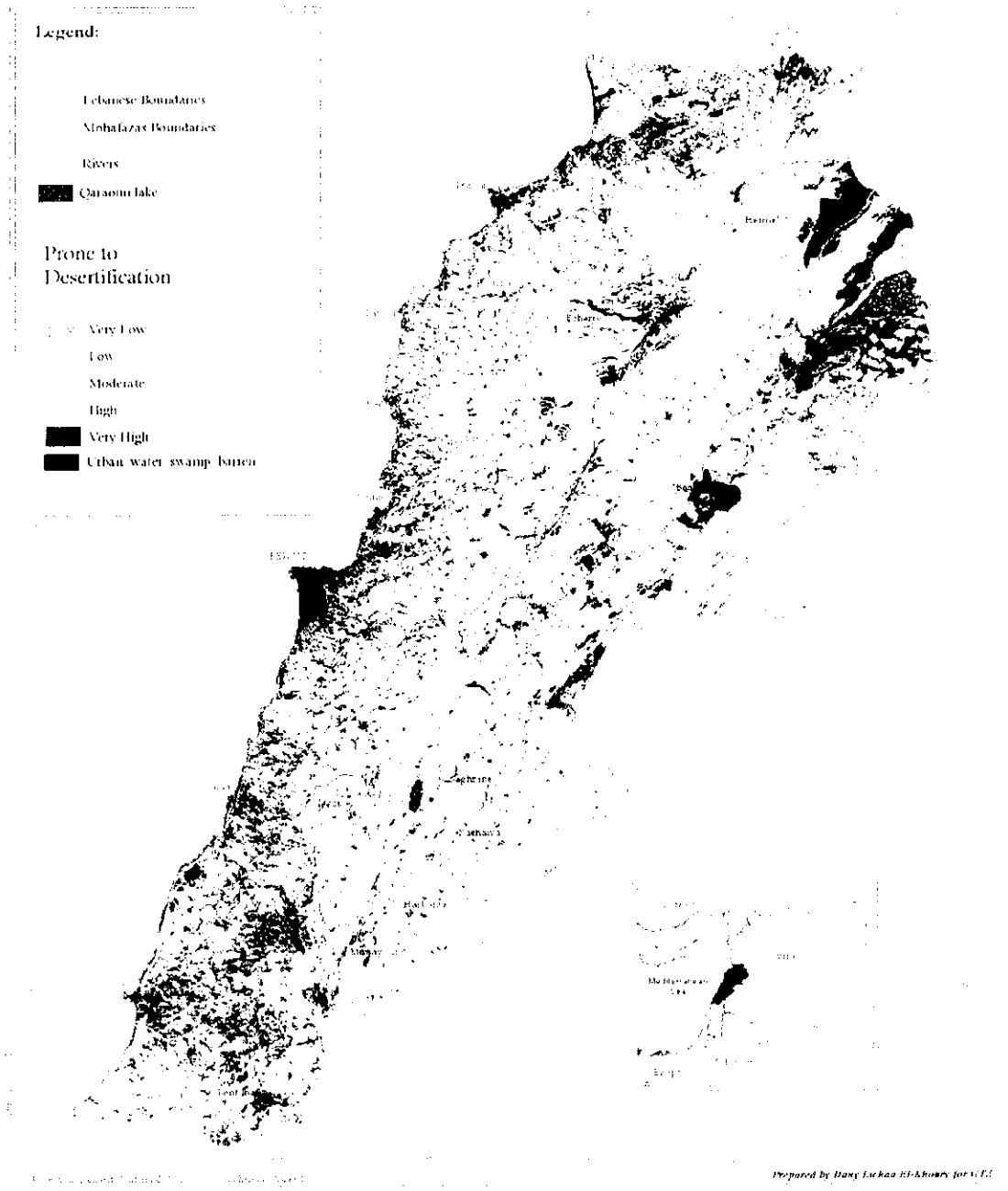
Figure 6.1 The model used for the designation of Desertification Prone Area

Ministry of Agriculture - LEBANON

Combating Desertification in Lebanon

CoDeL

German Technical Cooperation



Map no. 6.1

Source:

Elaborated from the different individual indices CoDeL, 2001

Title:

Desertification Prone Areas

N

10 0 10 20 30 Km

6.2 Desertification Prone Areas

Article 1 of the UNCCD, states that areas of concern include arid, semi-arid and dry sub-humid areas in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65.

Taking this into consideration, approx. 60% of Lebanon falls within the range defined by the UNCCD as described in table below:

Table 6.6 Area extent of the different climatic zones in Lebanon

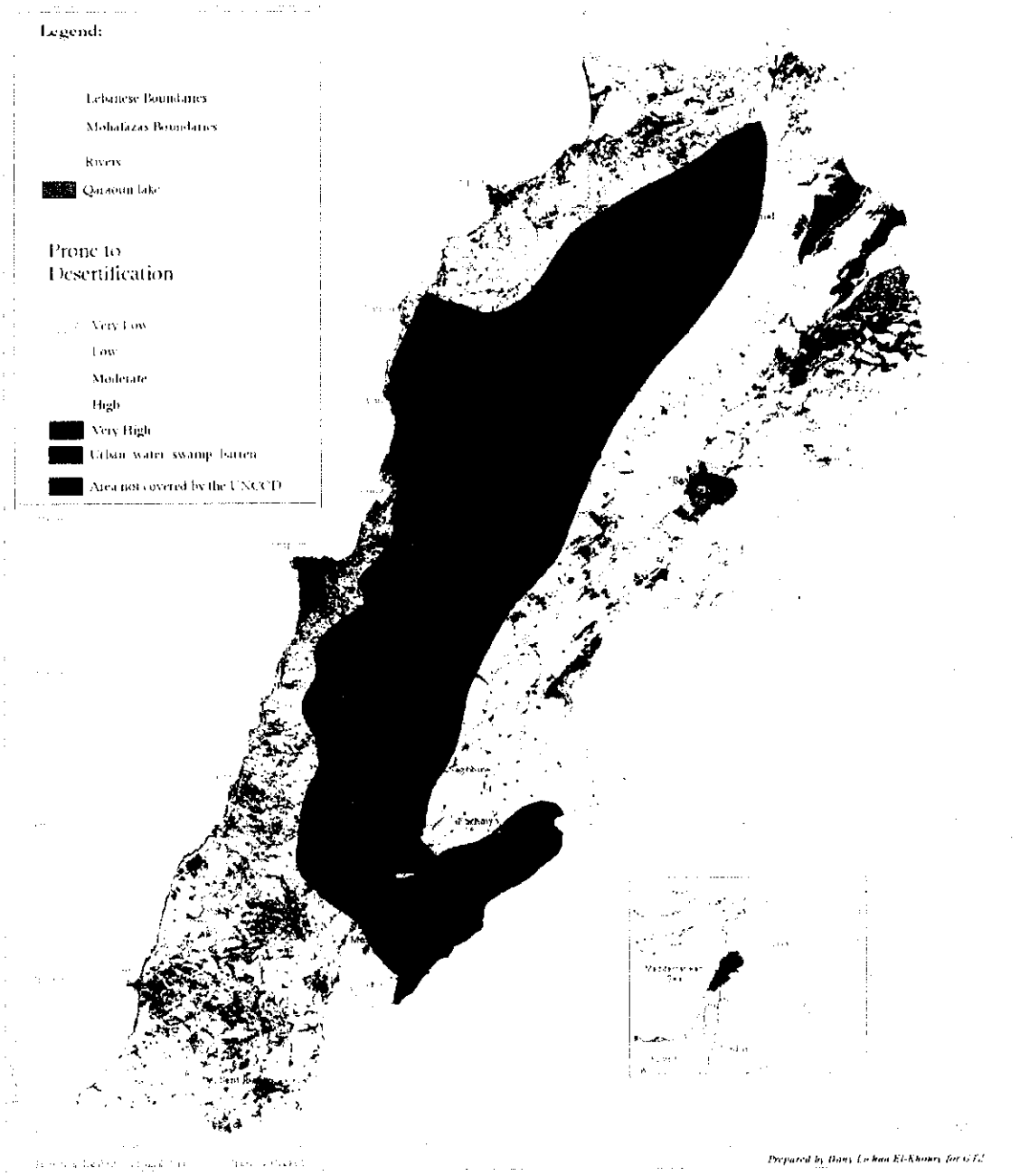
Zone	Area (km^2)	Area %
Arid	705.95	6.75
Semi-arid	3481.30	33.31
Dry sub-humid	2187.09	20.93
Sub-humid & humid	4077.66	39.01

The map below represents a modified DPA map masking areas, which are not of concern to the UNCCD.

Ministry of Agriculture - LEBANON

Combating Desertification in Lebanon

CoDeL



Map no. 6.2

Source:

Elaborated from the different individual indices CoDeL, 2001

Title

UNCCD Desertification Prone Areas

N

10 0 10 20 30 km

Table 6.7 below shows the desertification risk of the various cazas (the entire country has been taken into consideration and not only the areas considered under the UNCCD see map 6.2)

Table 6.7 Desertification risk of the various cazas and the entire country (as % of total Caza)

CAZA[4]	Urban/ unproductive	Very low	Low	Moderate	High	Very high
Zgharta	7.3	0.0	9.1	44.3	35.8	3.5
West Bekaa	5.8	0.0	2.8	31.0	59.4	1.0
Jezzine	7.3	0.0	13.3	60.5	18.3	0.6
Nabatieh	14.2	0.0	0.5	5.2	60.6	19.5
Beirut	99.8	0.0	0.0	0.0	0.1	0.1
Metn	25.1	0.0	18.8	46.5	7.9	1.7
Kesrouan	18.6	0.1	34.2	43.0	3.9	0.3
Jbeil	11.8	0.1	22.6	59.1	6.0	0.4
Batroun	12.9	0.0	17.2	59.7	9.6	0.6
Tripoli & Dannieh	13.3	0.0	12.6	48.8	21.9	3.4
Akkar	4.5	0.0	0.1	19.9	55.0	20.5
Hermel	3.4	0.0	0.5	19.0	60.6	16.5
Baalbeck	3.9	0.0	0.1	5.7	67.5	22.8
Zahle	7.0	0.0	0.4	22.9	60.4	9.3
Rachaya	1.8	0.0	0.2	19.7	77.7	0.6
Marjayoun	7.0	0.0	0.1	6.7	75.5	10.7
Bint Jbeil	7.3	0.0	0.0	6.3	61.0	25.4
Sour	6.6	0.0	0.1	10.6	62.7	20.0
Saida	15.2	0.0	0.3	5.7	63.3	15.5
Chouf	12.8	0.0	8.8	52.8	23.8	1.6
Aley	19.8	0.0	11.4	55.2	12.4	1.2
Baabda	23.2	0.0	17.4	31.9	22.7	4.8
Koura	12.6	0.0	3.2	45.5	36.4	2.3
Bcharre	10.8	0.0	14.1	60.2	14.7	0.2
Hasbaya	2.0	0.0	2.7	34.1	60.7	0.5
LEBANON	***8.6***	***≈ 0.0***	***5.7***	***26.4***	***48.1***	***11.2***

[4] Map 3.1 outlines the cazas of Lebanon.

Taking into consideration the scope of the UNCCD and the derived DPA map, the high-risk areas can be identified as follows:

- The North mainly Akkar, Koura and Zgharta
- Bekaa mainly Baalbeck-Hermel and partly West Bekaa and Rachaya
- The Southern part mainly Saida, Sour, Nabatieh, Bint Jbeil and Marjaayoun

Following is a brief situational analysis of some of the most affected areas. Relevant remedial and preventive measures should be carried out based on the environmental and socio-economic context in the area under consideration. Sectoral guidelines for combating desertification should be followed. These are outlined in chapter 7.

6.2.1 North Bekaa

6.2.1.1 *Situational analysis*

The North Bekaa[3] region (2,640 km²) covers approximately a quarter of the total area of Lebanon and almost two thirds of the Bekaa valley. The climate of the region is arid to semi-arid with a continental and mountainous influence.

The region is located on a relatively flat plateau running from the north to the south of the country. It is situated parallel to the coast but separated from it by the Mount-Lebanon range and limited to the east by the Anti-Lebanon Range. The North Bekaa is predominantly an agricultural area, with few urban areas. A side effect of the civil war was a semi-urban sprawl along the main Beirut-Damascus road, cutting across the center of the valley. This process is still on-going and is leading to the loss of large areas of prime agricultural land.

[3] The information is based on project reports of the UNIRDP, 2001

Table 6.8 below shows the coverage in ha of the major agricultural activities in the area (Agricultural statistics, FAO-MoA 2000)

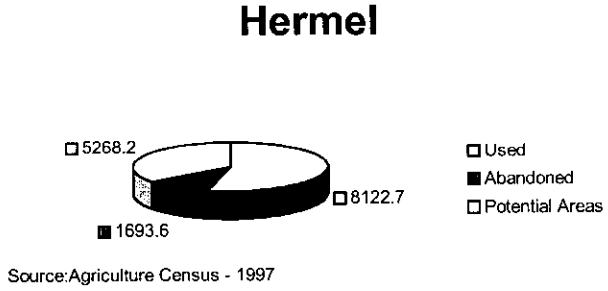
Table 6.8 Coverage (ha) of the major agricultural activities in North Bekaa (Agricultural statistics, FAO-MoA 2000)

Caza	Cereals	Fruit trees	Olives	Industrial crops	Vegetables
Baalbeck	17,280	13,777	900	5,650	12,388
Hermel	3,500	634	438	156	2,800

Agriculture, commerce and, to a lesser extent, construction and enrollment in the army are the main sources of income in the region. 24,000 families are involved in agriculture.

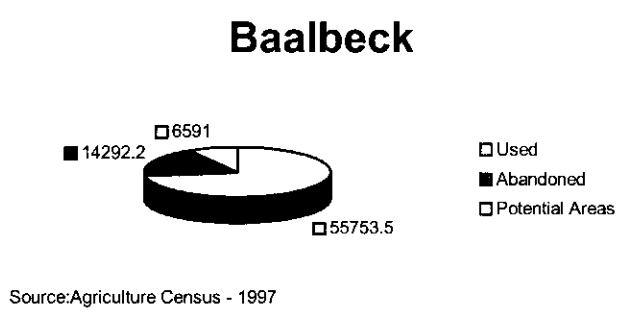
The figures below show the used, abandoned and potential agricultural areas in Hermel and Bekaa respectively.

Figure 6.2 Used, abandoned and potential agricultural areas in ha of Hermel



Source:Agriculture Census - 1997

Figure 6.3 Used, abandoned and potential agricultural areas in ha of Baalbeck



Source:Agriculture Census - 1997

The total used agricultural area was estimated in 1997 at about 64,800 ha of which 37,800 ha are rain-fed and 27,000 are irrigated. Land fragmentation due to traditional inheritance laws is problematic and hinders proper agricultural development. Almost 50% households own less than 1 ha and only 11% own more than 5ha.

It is estimated that the total population of the region is around 250,000. Within the region, the population is relatively scattered with up to 50% reported as non-residents. They have immigrated to other parts of the country, or abroad, in search of livelihoods.

Baalbeck and Hermel are classified as deprived Cazas (according to UNDP, Mapping Living Conditions in Lebanon, 1997). Hermel is considered to have the second and Baalbeck the sixth lowest level of needs satisfaction. They have 65.9 and 49.2 percent of households respectively living below the threshold of the index of basic needs satisfaction.

Growing illicit crops was a major source of income for the population during the period of the civil war. The sudden massive eradication campaign in the early 1990's caused great hardship and resentment. Since then, farmers have shifted to a range of other traditional crops, such as wheat, potatoes, tomatoes and watermelons. These crops are vulnerable to the vagaries of the

market and could not provide for the basic needs of farmers. In addition, recent drought events have worsened the situation.

6.2.1.2 *Threats*

Major threats in the North Bekaa region contributing to land degradation include:

- Drought
- Wind and water erosion
- Flash floods
- Improper water management
- Overexploitation of groundwater resources
- Overgrazing
- Quarrying
- Unsustainable agricultural practices
- Unplanned urban sprawl
- Poverty and limited off-farm opportunities

6.2.1.3 Recommendations

Interventions in North Bekaa should focus on water harvesting and water demand management in order to alleviate the water scarcity problem in the region; regional rural development to alleviate poverty and create sustainable livelihoods; the promotion of sustainable agriculture practices including proper water, fertilizer and pesticide use; rangeland management in order to promote soil and water conservation and to provide adequate feed resources for animal production.

6.2.2 Akkar

6.2.2.1 Situational analysis

Akkar is situated in the North and covers approx. 80,000 ha. It can be divided into 3 major zones:

1. "**Al-Sahel**" (the plain): is the area located below 200m a.s.l. and occupies around 25% of the total area of the Caza of Akkar. It receives 700 to 800 mm of precipitations per year, which places it in the semi-arid to the dry sub-humid climatic zone. The area is characterized by very gentle slopes, good soils and is mostly used for agriculture.

2. "**Al-mantika al-wousta**" (Middle area): is located between 200 and 800 m a.s.l. and receives up to 1000 mm of precipitations per year, which places it in the sub-humid climatic zone. The eastern slopes of this area receive less precipitation down to 500 mm per year placing it in the semi-arid zone. This ecozone is characterized by rough terrain with discontinuous soils. This area covers approx. 50% of Akkar and is used for agriculture pastures and forests.

3. "Al-Jurd" (Highlands): It is the area located above 800 m a.s.l. and occupies the remaining 25% of the total area. It receives 700 to 1200 mm of precipitations per year in the tops of the western slopes, and is, therefore, in the humid zone and not considered under the scope of the UNCCD.

Table 6.9 below gives an overview of the major Land uses (in ha) in Akkar based on the agricultural statistics, 1997.

Table 6.9 Major Land uses (in ha) in Akkar (Agricultural statistics, 1997)

Rain-fed Lands	Irrigated lands	Greenhouses	Forest lands	Grazing lands	Other lands	Total
23,114	21,611	475	4,275	20,700	661,2	79,787

Agricultural areas (field or perennial crops) cover approx. 50% of the total area with irrigated crops mainly in the plain. Perennial crops include citrus (located in the plain mainly), olive trees (concentrated in the southwestern part of Akkar), and fruit trees or orchards.

Another important production system in Akkar is livestock production, which can be summarized as follows:

Table 6.10 Animal production in Akkar

		Heads	Farms
Cattle		15,300	5,300
Sheep		23,000	690
Goats		27,000	600
Pigs		120	4
Equine		580	11
Poultry	Layers	95,000	
	Broilers	1,700,000	500
	Breeders	78,000	
Bees	traditional	561 hives	680
	modern	10,800 hives	

The human population in Akkar is estimated at around 250,000 (10% of which are Palestinians and Syrians). The active human population is estimated at approx. 56,500.

The district of Akkar was and still depends on agriculture as a main activity for its resident population, 29.6% of the total active resident population work in agriculture

The average family size is about 6.1 (compared to 4.8 in Lebanon). Active women represent 5.2% (compared to 14.8% in Lebanon). The illiteracy rate is 25.1% (compared to 17% in Lebanon).

In Akkar 62.1% of the households are classified as poor. In 16.6% of the Akkar families, the average monthly income per capita is 60,000 LBP compared to 180,000 LBP in Lebanon. Approximately 51% of the households in Akkar depend solely on agriculture as a source of income compared to 38%

in Lebanon. Other sources of income in the area include: trade, industry, construction and education.

6.2.2.2 Threats

The major threats leading to land degradation in Akkar include:

- Poverty
- Forest fires
- Unsustainable charcoal production
- Excessive fertilizer and pesticide use

6.2.2.3 Recommendations

Akkar didn't benefit from recent development initiatives. This has led to the degradation of the situation with Akkar now being classified as the poorest Caza (according to UNDP LCI). Poverty is a crushing weight on the rural poor and is a major driving force leading to land degradation. Interventions in Akkar should focus on alleviating poverty and creating alternative sustainable livelihoods (Regional Rural Development). In addition, proper natural resource management practices including sustainable charcoal production, soil and water conservation and forest fire prevention are critical issues, which should be promoted within the scope of combating desertification.

6.2.3 The South

6.2.3.1 Situational analysis

The topography of South Lebanon consists primarily of a succession of hills and plateaus varying from 200 to 800 meters inland. The maritime front and the coastal plain have permitted the development of trading, cultivation, fruit

and fishing whereas the interior has witnessed the development of non-irrigated agriculture founded essentially on the production of cereals, tobacco and olives.

Areas prone to land degradation in Southern Lebanon include the coastal zone, and the Central-Eastern zone including Bint Jbeil, Nabatieh and Marjaayoun. Jezzine and parts of Hasbaya are not considered under the scope of the UNCCD although they are also facing serious land degradation processes.

The population lives in precarious economic conditions: In Tyr and Nabatiye, 54% families are deprived of basic needs (to 32% nationally), 17% of households are very deprived (compared to 7% nationally). 40% of families do not have assess to safe water, 78% of households are not connected to sewer networks.

The illiteracy rate is higher than in the other part of Lebanon. Illiteracy rates among the household heads ranges from 18% (Marjaayoun) to 33% (in Jezzine) compared to the 17% national average. Illiteracy is generally twice as high among women, particularly among those who are over 40.

The economy of the area is dominated by agriculture, crafts and light industry. During the conflict and occupation period, families were engaged in activities generating a higher level of income including: The enrolment in the South Lebanese Army (SLA), the permanent and seasonal work in the occupied territories and activities related to the UNIFIL. Table 6.11 presents potential, used and abandoned agricultural areas in selected cazas.

Table 6.11 Potential, used and abandoned agricultural areas in selected cazas in ha (Agriculture statistics,1997)

Caza	Used	Abandoned	Potential Areas	Total
Tyre	14248	1291	1642	17181
Saida	12382	1403	1215	15000
Marjaayoun	7747	3351	1123	12221
Bint Jbeil	6098	2768	1195	10061
Nabatieh	8028	2587	1309	11924

Tobacco is a major pivot crop in the region. It is mainly concentrated in the southeast primarily in the Bint Jbeil Caza (where it provides up to 85% of the income) in addition to Marjaayoun and the elevated region of the Tyre Caza.

The livestock production in South Lebanon and Nabatieh amounts to 12,600 cattle, 27,800 sheep and 117,800 goats (agriculture census 1997).

The South was heavily affected in its resources by the war and 22 years of occupation. The 5 cazas mostly affected by occupation include Tyre, Marjaayoun, Jezzine, Hasbaya and Bint Jbeil. They host approx. 270,000 inhabitants (54,400 households); about 60 % of the total population of the 2 Muhafazats of the South and Nabatiyeh (estimated at 433,000 inhabitants). The social problems, which resulted from the conflict include: displacement, widows and orphans, handicapped detained and ex-detained. Mines, left over after the liberation, constitute a major obstacle today for any type of development.

The South carries the traces of the war that has been going on for 30 years. This is clearly apparent through:

- Areas recently burned, which includes about 78km² along he demarcation line, especially in the cazas of Tyre, Marjaayoun, and Nabatieh;
- A stretch of mined areas, all around the occupied zone, covering about 200km², mostly steep ravines and valleys, in addition to the mountainous massifs in Toumat-Niha and in Hermon;
- A stretch of uncultivated areas generally corresponding to possibly mined zones;
- Deforestated areas, especially reaching mount Amel and the gorges of Litani and other regions, in addition to olive groves destroyed by fire.
- Abandoned agriculture lands, bordering the demarcation and the frontier, as in the region of Wazzane, and terraced cultivation;
- Barren land on mountain sides and hills, due to fires, deforestation, and over-grazing by small ruminants;

- The desolate region of about ten villages and localities bordering the demarcation line, some of which are totally destroyed, others mostly abandoned, with ruins, wrecked cars, and fields flattened by bulldozers.

6.2.3.2 *Threats*

Major threats in the South can be summarized as follows:

- Mines
- Over-grazing by small ruminants
- Deforestation
- Soil erosion
- Absence of land use planning including urban development
- Pollution
- Poverty, Handicapped, Ex-detainees
- Limited economic opportunities

6.2.3.3 Recommendations

Because of the low population pressure and the lack of development initiatives during the 30-year conflict period, the human contribution to land degradation is still limited and confined. To preserve the richness of the environment and its potential for tourism, there is an urgent need to guide further development based on a comprehensive land use plan including proper urban development planning. Demining is an essential pre-requisite. Moreover, interventions in the South should focus on:

- Provision of basic infrastructure (drinking water and sewage networks)
- Rural development including the promotion of eco-tourism
- Soil and water conservation
- Proper groundwater usage to prevent seawater intrusion
- Capacity building for municipalities

Chapter Seven

Interventions and Operational Guidelines

7.1 Lines of Action

Combating desertification is an overarching task to which contributions are made by measures from the different sectors as well as by measures relating to the political dimension. The Lebanese government will make efforts to keep combating desertification as a priority task within the framework of sustainable development of the country.

Priority actions were defined based on participatory consultations between the various stakeholders including the conduction of focused group meetings (bringing together scientists, decision makers and NGOs with solid field experience). Causes and effects of land degradation were discussed and proper mitigation measures were formulated. Priority actions were defined under two categories as follows:

Category A: National Framework

I. Institutional framework for NAP implementation
II. Legislative framework
III. Land use planning
IV. Socio-economic frame conditions

Category B: Natural Resources

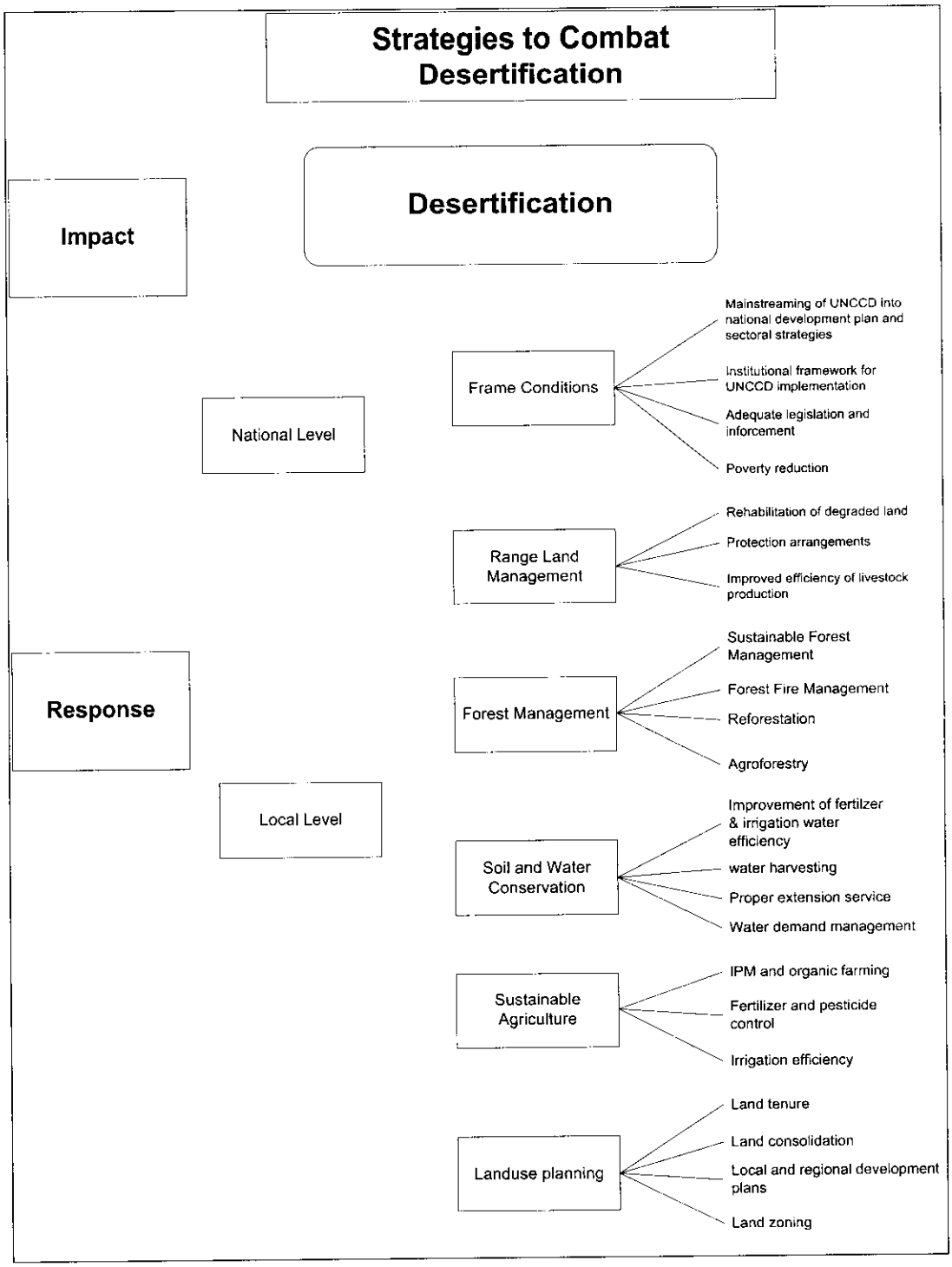
V. Water management
VI. Forest management
VII. Sustainable agriculture
VIII. Rangeland management
IX. Soil conservation
X. Protected areas

Moreover and in relation to the above lines of action, the Lebanese Government undertakes to support research activities that contribute to increased knowledge of

the processes leading to desertification and drought and the impact of causal factors with a view to combat desertification and achieving improved productivity as well as sustainable use and management of resources. In cooperation with the relevant research institutions, the National Coordination Body (NCB) will highlight the knowledge gaps and the needed research areas. Research activities would respond to well defined objectives and support the implementation of the desertification mitigation measures.

Combating Desertification Framework

Taking into consideration the causes and effects of desertification in Lebanon as summarized in the "problem tree" (see chapter 5), combating desertification necessitates actions at both the local and national levels as outlined in the following flowchart.


Strategies to Combat Desertification
Desertification
Impact
Response
National Level
Local Level
Frame Conditions
Mainstreaming of UNCCD into national development plan and sectoral strategies
Institutional framework for UNCCD implementation
Adequate legislation and inforcement
Poverty reduction
Range Land Management
Rehabilitation of degraded land
Protection arrangements
Improved efficiency of livestock production
Forest Management
Sustainable Forest Management
Forest Fire Management
Reforestation
Agroforestry
Soil and Water Conservation
Improvement of fertilzer & irrigation water efficiency
water harvesting
Proper extension service
Water demand management
Sustainable Agriculture
IPM and organic farming
Fertilizer and pesticide control
Irrigation efficiency
Landuse planning
Land tenure
Land consolidation
Local and regional development plans
Land zoning

7.2 Objective and Guiding Principles

The objective of the NAP is to outline measures needed to combat desertification and mitigate the effects of drought and the misuse of land through effective action at all levels supported by international cooperation and partnership arrangements, in the framework of an integrated approach contributing to the achievement of sustainable development of affected areas.

The NAP involves long-term integrated strategies that focus simultaneously, in affected areas, on improved productivity of land and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level.

A successful implementation of the National Action Programme (NAP) can only be achieved in an environment where the following are key guiding principles:

- Capacity building
- Coordination
- Partnerships
- Participation

Capacity building

The NAP is part of the sustainable development strategy of the country and therefore, it entails field level interventions and appropriate policy development in the different relevant sectors. This requires adequate institutional capacities for planning, implementation, monitoring and ensuring community mobilization and participation.

Coordination

To improve efficiency and achieve greater impacts, coordination is needed. Coordination mechanisms need to be established at various levels: between

different departments within an involved Ministry, between individual Ministries and between different development actors including government agencies, UN agencies, donor countries, the private sector, NGOs and affected communities. Coordination would help facilitate information sharing, avoid duplication, pool resources and synergize efforts. Ideally, a comprehensive development plan should be prepared and then available resources, financial and human, are pulled together for its implementation.

Partnerships

Combating Desertification is a long-term task in which many actors at different levels need to work together including affected communities, local authorities, national government, the private sector and the donor community. No one individual actor is able to combat this problem on its own. Partnerships at all levels are required.

Participation

Participation of communities of affected areas is an essential ingredient in the strategy. They are the ones most affected and they are the ones able to reverse the process if given the choice. Ensuring participation of affected communities requires much more than their mere involvement in workshops and assemblies. It requires actions aimed at poverty reduction, empowerment, capacity building, and awareness raising.

7.3 Resources needed for NAP implementation

Lebanon's remarkable decade of reconstruction following a devastating 15 year war saw strong economic growth gradually slide to a halt by 1999. The cost of rebuilding highways, schools, airports, seaports, housing, power stations, and

government buildings pushed public debt to about 180% of GDP (2001) and led to chronic budgetary problems. The challenge for Lebanon is to carry through the reforms while reconstructing the economy. This limits the options available for the government to invest in environmental protection.

A second challenge is to tackle poverty and income disparities. The UN estimates that one third of Lebanese lack basic needs. Weak agricultural productivity and a widening gap between rural and urban incomes have led to accelerated urbanization, environmental degradation and social imbalance.

However, The Lebanese Government is well aware of the importance of environmental protection and sustainable natural resource management for the future development of the country and will therefore make available internal resources as much as possible for the implementation of the NAP.

Given the current economic situation and the investments required for large-scale implementations, Lebanon would not be in the position to fully serve the costs required for adequate NAP implementation and would therefore be seeking for assistance from the international community.

7.4 Enabling Environment: Actions at the national level

7.4.1 Institutional aspects

In order to ensure an efficient long-term implementation of the UNCCD, a clear institutional and legal framework for the NAP by involving all concerned stakeholders and defining their role in planning, implementing, monitoring and evaluation will be put in place building on existing institutional bodies. The institutional framework will accommodate both local and national needs and requirements and allow for adequate local level participation in the planning, implementation and evaluation phases.

Additionally the institutional framework will provide for a feedback system, which consists of the following components:

1. **Local level feedback system**: Information from the local level on threats, needs and the impact of interventions is transmitted to the national level to ensure a more informed decision making regarding remedial measures and adjustments.
2. **National level feedback system**: A monitoring system that will provide information on on-going desertification processes, progress in UNCCD implementation and the impact of mitigation measures. Indicators would be available to highlight positive and negative trends and allow for adequate planning.

7.4.2 Land tenure issues

Land tenure problems are a key factor in land degradation in Lebanon. Registration and transaction costs are enormous. Roles and responsibilities for managing the common lands are not clear leading to their over-exploitation for grazing, quarrying and agriculture. Land fragmentation due to inheritance laws paralyses efficient land use. Absence of land use planning leads to prime agricultural land being lost to urban development while enormous costs are being put for land reclamation nearby.

A comprehensive solution for land issues promoting security of access including resolving land disputes, removing barriers for efficient transactions, consolidation of fragmented land and proper land use planning need to be elaborated as an essential ingredient in the strategy for combating land degradation.

7.4.3 Decentralization

The United Nations Convention to Combat Desertification (UNCCD) is based on a democratic, bottom-up approach. It clearly emphasizes that the people who

bear the brunt of desertification and who best understand the fragile environments in which they live must be fully involved and be allowed to participate in the decisions that will shape their lives. The first principle of the treaty, commits Parties to 'ensure that decisions on the design and implementation of programmes are taken with the participation of populations and local communities and that an enabling environment is created at higher levels to facilitate action at national and local levels'.

The existing regional inequalities in Lebanon have multiple consequences on balanced development. Economic and productive sectors are concentrated in or near large cities (Beirut, Tripoli, Zahle and Saida), where manpower, labor and markets are found. Efficient local level participation could only be achieved if the regional imbalance in Lebanon is remedied by equilibrating development towards a better territorial distribution of opportunities, facilities and resources.

In Lebanon, administrative decentralization has been recognized as a priority by the Taif Agreement and a special ministry has been set up to galvanize municipal development. The Taif agreement has acknowledged the urgency of establishing elected regional councils (majlis qada's). Such actors would be specialized agencies aiming at developing their region comprehensively. They would also contribute to assert regional identities that would help promoting private investments in economic activities.

Properly planned decentralization would involve multi-centered governments doing local things locally, regional things regionally and national things nationally. Resources and decision-making powers would be available at the local and regional levels. This would greatly enhance efficient natural resource management making the users of the resource directly responsible for their choices.

7.4.4 Capacity building for cooperatives and municipalities

Municipalities, as local authorities, have a key role to play as a mediator in reaching consensus for local level development based on a participatory

approach accommodating the needs and requirements of the different socio-economic groups in the locality.

In Lebanon and as a result of many years of conflict, municipalities became more marginal and lack the capacity (financial and human) to adequately fulfill their roles. Moreover, the system is still over-centralized and does not enable municipalities to raise the needed revenues, which would allow them to play a major role. Efforts at decentralization and strengthening of municipalities (USAID, EU) have started and would improve the current situation.

7.4.5 Awareness raising

Combating desertification needs concerted action at different levels and between different groups. At the international level debt for nature swaps, removal of subsidies and fair trade agreements need to be reached. At the national level an enabling environment need to be in place: proper institutional and regulatory framework for natural resource management, comprehensive policies promoting sustainable land and water use, diverse economic options and alternative livelihoods in rural areas. At the local level, communities need to be aware of the impacts of their practices and should be assisted to find the technical and economic resources needed to stop the land degradation process.

People at different levels need to be aware of the problem of desertification and the national and international efforts that are in place to combat it. Once this awareness is reached, networking would be possible and a favorable framework would be in place for attitudes to change and solutions to be reached.

The UNCCD National Coordination Body will be responsible to elaborate an adequate awareness raising strategy targeting the following:

- Decision makers

There is still little awareness among decision-makers in Lebanon about the problem of desertification and the obligations of Lebanon as an affected country party that has signed the United Nations Convention for Combating Desertification. Politicians need to be aware in order to give due priority to combating desertification and provide an enabling environment by strengthening existing relevant legislation, enacting new laws and establishing strategies, policies and action programmes within the framework of sustainable development plans.

- The general public

The public at large should be aware of the problem of desertification and of the international and national efforts that are in place to combat it. Awareness is a prerequisite for responsible behavior, which is an essential element of the strategy for combating desertification. Special attention should be given to the young generation.

- Communities of affected areas

Desertification cannot be effectively tackled unless the people most affected are fully involved and committed. Awareness is a pre-requisite for involvement and commitment. Commitment can only be ensured if the overall context in which people live and make their decisions is taken into consideration.

It is proposed to draw on existing available resources. For example the awareness and education unit at the Ministry of environment can assist in awareness raising activities.

7.4.6 Resource mobilization

Unlike its sister conventions on climate change and biological diversity, the Convention to Combat Desertification does not establish a new financial

"mechanism" to administer funds for Convention-related projects and activities. Instead, it emphasizes the need to mobilize substantial funding from existing sources and to rationalize and strengthen their management.

In order to mobilize the financial resources necessary for combating desertification, Lebanon will:

(a) Rationalize and strengthen the management of resources already allocated for combating desertification and mitigating the effects of drought by using them more effectively and efficiently, assessing their successes and shortcomings, removing hindrances to their effective use and, where necessary, reorienting programs in light of the integrated long-term approach adopted pursuant to this Convention;

(b) Seek the assistance within of multilateral financial institutions, facilities and funds, including regional development banks and funds.

(c) Examine ways in which regional and sub-regional cooperation can be strengthened to support efforts undertaken at the national level.

Moreover, the Government of Lebanon will establish and strengthen, national coordinating mechanisms, which would ensure the efficient use of all available financial resources. It will also utilize participatory processes involving non-governmental organizations, local groups and the private sector, in raising funds, in elaborating as well as implementing programs and in assuring access to funding by groups at the local level.

7.4.7 Mainstreaming

It is of vital importance that the NAP is reflected in national investment programmes, programmes for social and economic development, national sustainability strategies, poverty reduction strategies and in consultations and government negotiations. Unless it is reflected in the aims and strategies of poverty reduction (PRSP), it will be difficult to justify the place of desertification control as a priority area for bilateral co-operation. The National Coordination

body, being made up of decision makers from the various line ministries and government institutions will assist mainstreaming of the NAP into the development plans of the various ministries.

7.4.8 Measures taken to assist the implementation of the CCD

Lebanon recognizes that UNCCD is an instrument for improved resource management. In other words, it can be a successful instrument only if a conducive environment for improved resource management is established and if major impediments are overcome. Therefore, Lebanon will put special emphasis on the following:

- Strengthening the role of the national Focal Point: to be capable of successfully performing the functions of mainstreaming and co-coordinating.
- Improving co-ordination between the line ministries involved in desertification control and promotion of the integration of NAP-related activities within geographical areas.
- Creating synergies between the environmental conventions: mainly biodiversity and climate change
- Including civil society by involving it in planning processes for local program and increasing co-operation with NGOs and also by involving it in financial management.
- Using monitoring instruments: to monitor and analyze the extent to which the NAP is implemented and the impact measures are having. Benchmarks and indicators will be used for this purpose.
- Creating financial incentives for resource users, which would help to achieve area-wide and broad-impact desertification control extending beyond projects and programs.
- Improving the flow of information between the players by using information and communications technologies and other means of communication.

Action Plan

I. Institutional Framework for NAP Implementation

In order to ensure an efficient, long-term implementation of the UNCCD, and to comply with its requirements, Lebanon will put in place an adequate institutional framework building on existing institutional structures. The framework will establish linkages between the local and the national levels and will facilitate a bottom-up approach.

1. At the local level, **Local Focal Points (LFPs)** will be assigned (from within the existing administrative structure). LFPs will act as catalysts and will be responsible for the organization of local discussion platforms bringing together the different stakeholders (municipalities, cooperatives, NGOs and other CBOs) to discuss relevant environment issues and develop remedial and local development plans. These will be used for local level decision making and would be communicated to the National Coordination Body (NCB) through yearly reports. This will ensure that environmental considerations are taken into account at the local level and that a bottom-up communication channel is established. LFPs will also coordinate their efforts to deal with more regional aspects.

2. At the national level, a **National Coordination Body (NCB)**, will be assigned and will be made up of representatives of the different line Ministries and relevant government institutions and research centers. The NCB is in charge of steering the UNCCD implementation process. In particular, it is responsible of the following tasks:

   - Identify regional needs and requirements based on LFP reports.
   - Prioritize actions needed at the local and national level in the short, medium and long terms.
   - Communicate relevant information to the various line Ministries and propose joint activities and coordination mechanisms to act on cross-sectoral issues.

- Communicate relevant information to the Ministry of Agriculture, which is hosting the process and which will then be responsible for communicating issues which need to be acted upon to the council of ministers.
- Liaise with the Higher Council for Environment once it is operational.
- Involve the various LFPs in the planning of interventions at the local level in order to ensure a real bottom-up approach.
- Plan and implement a comprehensive awareness raising strategy.
- Closely coordinate with MoE, which is the focal point for the committee of the facilitation programme to combat desertification in Arab countries. (The Minister of Environment is a member of the Council of Arab Ministers of Environment, which follows up on the implementation of international conventions at the regional level).
- Monitor desertification processes and implementation of the UNCCD including the implementation of the NAP and the impact of the various measures.

In order to ensure full representation of all stakeholders, and an adequate technical backstopping on the various lines of action (water management, sustainable agriculture, socio-economics, etc.), the NCB would be supported by **Technical Advisory Groups (TAG).** These would be made up of researchers, development actors and NGO's. The NCB would act on the recommendations from the local level and from the technical advisory groups to define priorities and action plans. These would be communicated to decision making levels at the relevant Ministries and the Council of Ministers.

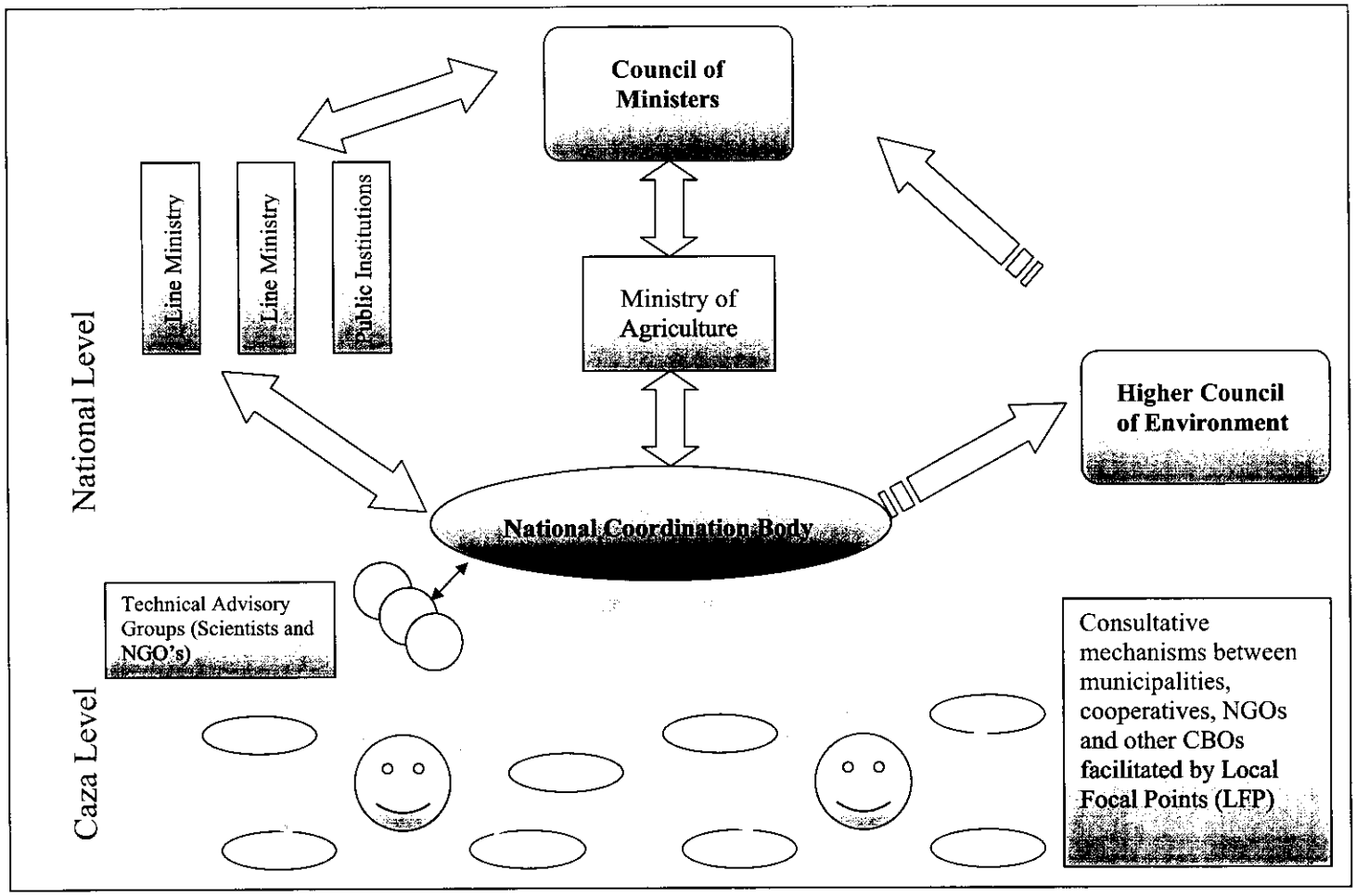
The proposed institutional framework will ensure an efficient long-term implementation of the UNCCD and enhance horizontal and vertical linkages between the national and local levels and the different governmental and research institutions.

Action Plan

The Lebanese Government is well aware of the importance of a proper institutional framework for implementation of the NAP. Therefore, it will initiate the following:

- Assign Local Focal Points (LFPs) within the administrative structure at the local level (Caza).
- Provide adequate training for LFPs on issues related to land degradation and its driving forces.
- Promote the elaboration of regional and local (municipality) development plans based on local context, needs and requirements.
- Designate a National Coordination Body made up of representatives of the different relevant government institutions.
- Assign Technical advisory groups made up pf researchers, development actors and NGO's to assist the NCB.
- Develop clear Terms of Reference for the NCB, the LFPs and the TAGs.
- Define relevant reporting structures for the various communication channels (LFPs to NCB, NCB to decision-makers) based on the needs required by the target audience.
- Establish a monitoring and evaluation system adapted to the local context and based on the UNCCD requirements.
- Coordinate with the national bodies of the other related UN Conventions to ensure synergies in planning and implementation.

Figure 7.1 Suggested Institutional Model for the Implementation of the UNCCD



II. The Legislative Framework

Situational analysis

There is better recognition in Lebanon that sustainable natural resource management requires a collaborative and concerted effort from all actors. Working within the framework of an evolving legal and regulatory framework, government agencies at the national and local levels are becoming more aware of the need to consider the environmental impacts of their policies and actions, and are gradually building their capacity to manage the environment. Environmental NGOs and the media have assumed increasingly important roles in raising public awareness and supporting grassroots activities. Research institutes and consulting firms are playing a larger part in improving the understanding of the environment. International donors and funding institutions are also contributing to the environmental management process. Although the various pieces of the institutional and legal puzzle are slowly taking shape, it will take a long time before they fall into place (SOER, 2002)

A number of laws, decrees, and ministerial decisions govern environmental management in Lebanon. They are outlined below:

Land and soil

- Decree no 69, September 6, 1983: Protection of agricultural land
- Law, November 9, 1951: Defines the authority of MoA for the protection of forests and pastures from grazing
- Decree no10659, September 21, 1970: Defines the mechanism for the control of the import, production and sale of chemical fertilizers
- Decision 1/77, August 1998: Gives guidelines for the exploitation and conservation of medicinal and aromatic plants

Conservation of natural sites

- Decision, July 8, 1939: Defines measures to conserve and manage natural views and sites
- Decree no434, March 28, 1942: Protection of the following areas: Bekat el Arz, Deir ei Kalaa, Forest of Bologna, El Mourouj oaks, Hoursh Beirut, archeological sites of Baalbeck, Yammouneh lake, the natural bridge of Nabaa el Asl,
- Law 19, October 20, 1990: Ratification of the UNESCO Convention for the protection Natural and Cultural Heritage.

Protection of forests

- Forest Law , January 7, 1949: Defines and organizes the protection and exploitation of the forests in Lebanon
- Law 85, September 17, 1991: bans and defines penalties for cutting, exploitation and manufacturing of resinous trees
- Law 558, July 24, 1996: Classifies protected forests, define protection mechanisms and penalties

Reserves

- Law 121, March 9, 1992: Declares Horsh Ehden and Palm Islands as nature reserves
- Decision 1/71, May 13, 1992: Declares a site in Kfarzebid protected
- Decision 1/127, October 1991
- Law 532, July 24, 1996: Declares Al- Shouf Cedar as nature reserve
- Law 718, November 5, 1998: Declares Tyr Coast as nature reserve
- Law 9, February 20, 1999: Declares the Cedar Forest of Tannourine as nature reserve
- Law 11, February 20, 1999: Declares Bintael as nature reserve
- Decrees 19/1, 22/1, 21/1 all dated 11/3/2002 declare Kammoua, Dalhoun forest and Wadi al Karakir respectively as natural sites for protection.

Water management

- Decision no144, June 10, 1925: outlines the legal framework for water use and conservation in Lebanon
- Decision no320, May 26, 1926:
- Decree 14438, May 2, 1970: organizes issues relates to groundwater use
- Article 26 of decree 69/83, 1983: outlines the legal framework for water use and conservation in Lebanon
- Decree No. 680 of September 5, 1990
- Decree 5616, September 6, 1994: outlines the legal framework for water use and conservation in Lebanon
- Law No. 221of May 29, 2000
- Law No. 241 of August 7, 2000
- Decision 8/1, March 1, 2001: Sets maximum permissible limits for the concentration of pollutants in discharges from classified establishments.
- Decision 24, October 18, 2001: Establishes a special ministerial committee responsible for the revision of decree 5616
- Law No. 377 of December 14, 2001
- Decree No 8122 of July 3, 2002

Mineral extraction activities

- Decision 325, November 8, 1935: outlines the legal framework for quarrying activities.
- Decree 8803, October, 4, 2002
- Decision 2, 77th session of the council of Ministers made the following amendments:

  -Localization of quarries in the eastern mountain chain.
  -Mandatory rehabilitation of quarried sites at the expenses of the owners by terracing and replanting.

Code of the Environment

- Law 444, August 8, 2002.

Other related legislation is listed in appendix 3.

Constraints facing the legislative framework

Several laws and decrees aim at protecting the environment and the natural resource base as outlined above and in Appendix 3. However, these laws and decrees are not organized into a coherent legislative framework. Problems include:

- Lack of a comprehensive legislative framework for the management of natural resources.
- Roles and responsibilities of the different government institutions are not clearly defined.
- Gaps in legislation.
- Conflicts between existing laws and decrees. For example, some ministerial decrees disconcert the execution of several laws related to forest management and protection.
- Weak enforcement of existing legislation especially with regard to forest management and fertilizer and pesticide issues.
- All-or-non nature of existing legislation with little regard to the livelihoods of affected communities; this leads to encroachment and harmful reactions by these groups.
- Unclearly defined boundaries of protected areas and nature reserves.

Action Plan

The Lebanese Government is well aware of the importance of a proper legislative framework for the sustainable management of natural resources. Therefore, it will emphasize the following:

- Revise existing laws related to management and protection of natural resources, identify gaps, conflicts and remedial measures (in particular laws related to water, fertilizer, pesticide, forest, nature reserves, rangelands and waste disposal)
- Decree laws that define the responsibility and authority of relevant institutions as related to natural resource management
- Use a normative mix of positive and negative enforcement to ensure the protection of natural resources
- Establish protected areas in vulnerable ecosystems.

Project proposal

Elaborate a comprehensive legislative framework for the management of natural resources

Activities

- Revise relevant existing laws and legislation
- Identify gaps in existing legislation
- Compare the existing legislation with the obligations under the environmental conventions(UNCCD, UNFCCC, UNCBD)
- Identify the necessary steps to ensure the domestication of the Conventions
- Prepare a comprehensive legislative framework
- Revise laws accordingly

III. Land Use Planning

Land-use planning is the systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adopt the best land-use options. Its purpose is to select and put into practice those land uses that will best meet the needs of the people while safeguarding resources for the future. The driving force in planning is the need for change, the need for improved management or the need for a quite different pattern of land use dictated by changing circumstances.

There is bound to be conflict over land use. The demands for arable land, grazing, forestry, wildlife, tourism and urban development are greater than the land resources available.

Two conditions must be met if planning is to be useful:

- The need for changes in land use, or action to prevent some unwanted change must be accepted by the people involved;
- There must be the political will and ability to put the plan into effect.

Land-use planning can be applied at three broad levels: national, district and local. These are not necessarily sequential but correspond to the levels of government at which decisions about land use are taken.

Lebanon has a liberal economy and has suffered from many years of conflict. This allowed types of development without any prior assessment of land potential, alternatives for land use, economic and social conditions. Prime agricultural land was lost to urban and industrial developments, Forests were cleared for agricultural purposes, roads were constructed and quarries and touristic centers were operated without adequate consideration of social and environmental impacts leading to severe land degradation in large areas of Lebanon.

This trend however is starting to change. Decision makers are becoming more aware of the need for proper land use planning for the sustainable management of natural resources.

Constraints facing Land Use Planning

- Institutional problems, for example, the absence of a Ministry of Planning
- Lack of clear and consistent policy for sustainable land use
- Inadequate or ineffective regulation of land use
- Lack of funds
- Lack of access to information, tools or training to make informed decisions
- Lack of well targeted incentives, or inappropriate incentives
- Land fragmentation due to inheritance laws
- The legal confusion in land tenure issues and traditional land use rights
- Mines, left over after the war, constitute a major hindrance for any Land Use Planning in several regions (South-Lebanon ...)
- Absence of an inventory of forest resources and unclear boundaries of many declared nature reserves. Currently, the on-going government project on land-use planning will provide basic information regarding these issues.

Action Plan

The Lebanese government today is well aware of the need for an integrated planning of land resources and of the need to initiate actions at many levels. It has already commissioned the Council for Development and Reconstruction to formulate an updated land use plan in close collaboration with concerned ministries and public services.

The Government of Lebanon recognizes that this is only a first step in a long process necessary for implementing an integrated planning approach for sustainable resource management and will therefore support:

- Effective institutions at local, sub-national and national levels which are linked
- An enabling environment and regulatory policy
- A platform for negotiation between the different stakeholders
- The recognition of all stakeholders and their differing objectives
- Bottom-up planning and the development of local land-use plans at the municipality level
- Land consolidation
- An accessible and efficient knowledge base

Project Proposal

Project title

Encourage land use planning at the local level within the framework of regional and national plans.

Project objectives

- Promote popular awareness of land-use problems and opportunities;
- Address local constraints, whether these are related to natural resources or socio-economic problems;
- Feed better information upwards for higher levels of planning

Specific activities

1. Choose one pilot area for implementation
2. Define the planning area
3. Establish goals and terms of reference
4. Initiate a platform for negotiation between all stakeholders:
    - to identify the problems and the opportunities for change
    - Evaluate land suitability
    - Appraise the alternatives: environmental, economic and social analysis
    - Choose the best option
    - Prepare the land-use plan
    - Implement the plan
    - Monitor and revise the plan

Project area

Selected municipalities

IV. Socio-economic Frame Conditions

Situational analysis

Poverty in Lebanon is mainly a function of geographical and socio-economic disparities. Widening gap between rural and urban incomes has led to accelerated urbanization, environmental degradation and social imbalance. The absence of basic planning or macro-economic and sectoral policies (social, agriculture, industry, tourism, etc.) deepened the crisis of these sectors having problems of low productivity, the size of enterprise, the lack of appropriate technologies and the lack of investment.

The continuous degradation of the agricultural sector has been one of the major causes behind the impoverishment of the population of rural areas, and is partially behind their migration. Changing policies and initiatives that apply to a productive economy and to social development is needed so that quick sustainable progress is achieved.

According to the Ministry of Social Affairs (MOSA) and UNDP, (UBN[1] method, 1998), the following was revealed: Bint-Jbeil is considered to have the lowest level of needs satisfaction with 67.2% of household living below the threshold followed by the cazas of Hermel (65.9%), Akkar (63.3%), Marjaayoun (60%), El-Minieh (54.2%), Baalbeck (49.2%), and Tyre (45%) and the least is in Kesrouan (13.5%).

On the other hand, the Desertification Pone Areas (DPA) model pointed that special consideration need to be given to the following areas: Baalbeck, Hermel, Akkar, and Southern Lebanon especially the newly liberated areas. Accordingly, a specific action plan was formulated based on the needs and requirements of each locality. The activities in the plan are divided into those

[1] The unsatisfied basic needs (UBN) method is an alternative approach to the measurement of poverty. It measures poverty based on the extent to which the population is deprived of one or more of the basic needs

that need to be taken at the national level and those which need to be taken at the local level.

Ongoing poverty reduction initiatives

CDR hosts many projects aimed at poverty alleviation that are either on-going or in the pipeline (Appendix IV). Under the Integrated Rural Development umbrella, whose aim is "improving public services in certain rural areas that have limited economic development and lack basic services and developing their agricultural, industrial and handicraft production in the framework of balanced development", the following projects are on-going: Support to the Integrated Rural Development Program for Baalbeck-Hermel, Post-Conflict Socio-Economic Rehabilitation of the South, Reintegration and Socio-Economic Rehabilitation of the Displaced, and Local Community development in the Arab Rural Areas-Lebanon.

Projects under preparation include: Support to the Regional Development of Akkar, Community Development Project, and the Economic and Social Fund for Development.

Based on the situational analysis and DPA model (Chapters three and Six) and given the considerable amount of ongoing projects that would highly contribute to poverty alleviation and improvement of the livelihood of the rural population and in view of the lack of a clear socioeconomic development plan on the national level, the action plan for enhancing the socio-economic frame conditions has to be viewed in light of the following:

- This plan of action requires the collaboration of all entities mainly, CDR, Ministry of Social Affairs and Ministry of Agriculture as being the hosting public institution of the UNCCD. This is to be elaborated and agreed upon within the NCB.
- The action plan can only be successful if implemented within a context of a favorable environment as is mentioned in chapter 7 (see 7.4) on enabling environment. This is mainly with regard to mainstreaming of

NAP implementation, awareness raising and capacity building programs (at all levels, from decision making level including the NCB to the grass root or affected population level).

- Many of the activities suggested in the action plan have already been initiated but still constitute dispersed efforts which do not cover the entire area affected by desertification.

Action Plan

The Lebanese Government is conscious of the importance of providing an enabling environment for socio-economic revitalization and promoting the sustainable livelihoods in rural areas. It has already initiated many efforts aimed to this end and will, in particular:

At the National Level

- Explore through the NCB a linkage mechanism to ensure coordination and avoid duplication of efforts of the socioeconomic development and poverty alleviation initiatives within the country both at the national and local levels;
- Increase the allocation of public investment funds to rural infrastructure education, health care, and safe drinking water and sanitation with a focus on the poorer or most vulnerable regions and affected areas;
- Elaborate a well defined long-term social policy taking into consideration the basic elements of social development and poverty alleviation (education, health, housing) that will improve social security and safety nets;
- Formulate integrated rural development programs that are based on a decentralized and community driven approaches and through sustainable use of natural resources in the different affected areas;
- Facilitate job creation and employment opportunities for rural population especially for youth and women, giving importance to the rural-urban interfaces specifically through the following:
    - Build the capacity of the small and medium enterprises in agriculture and processing.

- Enhance the income of the farmer through efficient extension and transfer of suitable and economically viable alternatives.
- Support the diversification of agricultural activities and improve the marketing infrastructure.
- Promote and develop agri-tourism and eco-tourism.

- Conduct regional workshops to identify specific needs, priorities and requirements for the following:
  - Capacity building on the sustainable use of natural resources at all levels (decision makers and local authorities, LFP, public employees, NGO's, schools, affected population etc..).
  - Identification of projects that directly contribute to enhancing the livelihood and poverty alleviation in the affected areas.
  - Creation of economic incentives and alternatives that lead to the conservation of natural resources.
- Conducting awareness raising campaign at the different levels (decision makers, NCB, LFP, public employees, NGO's, schools affected population etc. on the close link between the sustainable natural resource use and poverty alleviation;
- Rehabilitate irrigation networks and promote the adoption of efficient systems, and the construction of water-harvesting schemes;
- Develop rural finance mechanisms and facilities.

At the Local Level

In addition to the actions suggested at the national level, and within a macroeconomic development plan, special consideration need to be given to each of the following desertification prone areas as follows:

Baalbeck-Hermel Cazas

- Resolving land tenure issues, as an essential prerequisite for sustainable agricultural and economic activities;
- Organizing groundwater use and implementation of water harvesting schemes;
- Promotion of profitable farming systems taking into consideration the sustainable use of natural resources;
- Efficient exploitation of the Assi river with proper irrigation schemes and water distribution networks;
- Establishment of industrial zones.

Akkar Caza

- Promotion of profitable farming systems taking into consideration the sustainable use of natural resources;
- Improving the fish farming sector;
- Development of infrastructure specifically connection to safe water and sewage system and public transport.

South-Lebanon

- Elaboration of a development plan (including a detailed land use plan) that considers the establishment of industrial zones and takes into consideration the sustainable use of natural resources especially in the newly liberated areas.
- Rehabilitation of services and basic infrastructure specifically in the newly liberated zones
- Land reclamation and De-mining operations completion to open up lands to increase cultivated areas and allow economic lands exploitations.

Project proposals

Project title

Determining profitability and competitiveness of agricultural crops and varieties

Project objective

Conducting feasibility studies for potential crops/varieties that could be suitable to the areas (climatic, physical) to determine their profitability and competitiveness, in the domestic and international markets and highlight crops where Lebanon has a comparative advantage

Project activities

- Analyze productivity and marketability of existing crops and varieties.
- Studying alternative crops and varieties that are best suited (drought tolerant, and higher productivity).
- Analyze causes of high costs of production and finding practical solutions
- Providing extension services and technology transfer on improved, marketable and competitive crops/varieties.

Project duration

3-4 years

Project area

Bekaa, Akkar and Marjaayoun plains

Project title

Promoting ecotourism through local community management in selected rural areas and rural-urban interfaces.

Project objective

The aim is to develop sustainable cultural and ecotourism models that preserve the region's environment and cultural heritage within an economically viable framework. This is through community-based ecotourism in which local communities themselves who plan and implement the activities.

Project activities

- Identify areas suitable for such models (forests, protected areas, valleys, and mountains areas) in connection with municipalities.
- Conducting environmental impact assessment in the identified areas
- Capacity building of the local communities on the management of ecotourism projects
- Conduction of tourist awareness raising campaigns
- Conducting awarness raising of local communities on the economic return of such models within environmentaly protected approach
- Development of infrastructure for ecotourism in the selected models

Project Duration

4-5 years

Project area

Northern Lebanon (potential sites: historic sites of Tripoli, Coastal areas of Batroun, Qadisha valley) Bekaa (potential sites : Qaraoun lake, Baalbeck city and Temple surrounding) ; Southern Lebanon (potential sites : emphasis on the newly liberated zones.)

V. Water Management

Situational analysis

The use of water resources in Lebanon is approaching unsustainable levels because of a lack of effective management policies coupled with increased consumption as a result of expansion of irrigated agricultural land and escalating uncontrolled exploitation of groundwater resources, population growth, and industrial development.

The average annual precipitation in Lebanon is estimated at about 840 mm/year. However, its use is limited by temporal and spatial disparities. Temporally, precipitation is received during a short period (about 80 rainy days between September and May). Spatially, it is not evenly distributed creating sharp regional disparities whereby the annual precipitation varies from a low of 200 mm/year in the northern inland extremes of the Bekaa Plateau to more than 1,500 mm/year at the peaks of Mount Lebanon.

Water demand has traditionally been shared between three principal sectors, namely, agriculture, domestic, and industry. Agriculture is by far the largest consumer of water in Lebanon accounting for more than two-thirds of the total water demand, reaching upwards of 85 percent in certain predominantly agricultural regions. Other activities that exert additional water demand include the generation of hydroelectricity (power plants), recreation (water parks and sports), and aquaculture.

Constraints facing the water sector

The traditional and future water demands vary widely because of different assumptions used in the estimation process, particularly in relation to available land for agriculture, average consumption per hectare, annual population growth, average per capita consumption, and future industrialization potential. While the numbers vary, the consensus is that there will be a deficit in the quantities of water required within the next ten to fifteen years as depicted in the Figure 7.2 below:

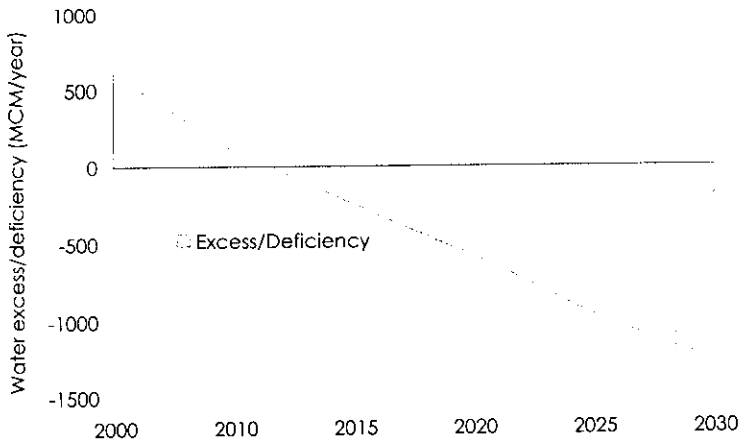


Figure 7.2 Water excess/deficiency between 2000 and 2030

The constraints facing the water sector can be summarized as follows:

1) Mounting relative water scarcity
2) Water quality deterioration
3) Inter-sectoral water allocation conflicts
4) Inefficient cost recovery and wasteful operational performance
5) Excessive government involvement and bureaucratic restraint
6) Weak institutional arrangements.

Action plan

The efficient management of water resources is crucial if the water imbalance in Lebanon is to be addressed. New management and planning policies are necessary to overcome the problems and constraints outlined above. The Ministry of Energy and Water instigated steps aimed at setting the general policy for the management of the Lebanon's water resources, through the formulation of the 10-year plan for the years 2001 till 2011 for water and wastewater management. This is a first step towards proper, sustainable, and comprehensive water management but this should be complemented by improvements in water efficiency, and alternative non-conventional water

resource usages such as wastewater reclamation and perhaps desalination to cope with the expected water shortage during the coming decade. The Lebanese government is committed to effective water resource management and therefore will:

- Update and consolidate outdated water legislation and its enforcement.
- Assess water resources, initiate or update inventories and project future demands.
- Study the feasibility of developing new water sources (including potential dam locations) and implement feasible projects.
- Install a normative mix of economic and regulatory instruments to promote water use efficiency (including irrigation water use efficiency and wastewater treatment and reuse).
- Encourage the use of water saving irrigation systems.
- Develop and implement water harvesting schemes.
- Control pumping of groundwater.
- Institute effective authorities and adequate coordination. (The government has already reorganized the division of water authorities according to hydrological regions)
- Initiate water pricing policy reform.
- Initiate procedures to protect and enhance water and adopt of the polluter pays principle.
- Develop a proper solid waste management strategy to prevent surface and groundwater contamination.
- Develop sewage networks and wastewater treatment plants to properly manage wastewater.

Specific activities

- Establish protection zones around water sources.
- Issue drinking and irrigation water quality standards.
- Regulate industrial effluent discharge and agricultural runoff into water courses, water bodies, and domestic wastewater networks.

- Introduce water metering and promote user payment.
- Establish a centralized water data management system including a network for hydrological monitoring.
- Rehabilitate water supply and distribution schemes and account for routine maintenance and leakage detection. Recognize the role of water user associations.
- Initiate flood control management schemes.
- Develop a comprehensive plan for improved irrigation efficiency including:
  - Proper water distribution and pricing
  - Sustainable groundwater use.
- Identify knowledge gaps and support needed research such as understanding the hydro-geological behavior of watersheds.
- Improve discharge measurements of perennial and temporary water courses including the suspended sediment load.
- Improve the existing climatological monitoring system to get better information on rainfall distribution including snow measurements.
- Expand the national coverage of aquifer monitoring regarding depth to the water table and groundwater quality.
- Initiate capacity building and training programs for employees of the water authorities.
- Organize Information dissemination and public education campaigns to alter consumer behavior.
- Enforce and monitor compliance with legislation regarding groundwater extraction, discharge flows from classified establishments, etc.
- Strengthen existing extension services to water users in order to promote water efficiency and sustainable water demand management

Project proposal

Project title

Promotion of irrigation water use efficiency

Objective

To conserve water resources and promote sustainable agriculture through the efficient use of available water resources.

Project activities

- Create and strengthen institutional frameworks for water resource management (water associations, cooperatives)
- Explore possible strategies for the introduction of water pricing
- Study crop water demand and promote suitable irrigation systems and practices

Project Duration

5 years

Project area

Agricultural plains in Bekaa and Akkar.

Project Proposal

Project title

A pilot study to use water seeping into the coastal areas as a substitute water source for coastal agriculture.

Objective

To tap the fresh water seeping into the coastal areas as a resource to be used in coastal agriculture.

Project activities

- Study of a major underwater freshwater source (seasonality, amount and characteristics).
- Develop a cost effective method of its recovery.
- Develop a partnership between private (agriculturists) and the public sector (the implementation and studies).

Project duration

3-5 years.

Project area

Central coastal Lebanon.

VI. Forest Management

Situational analysis

Forests in Lebanon constitute an important natural resource. The main forest types widespread in Lebanon are Oak (*Quercus calliprinos, Quercus infectoria*), Juniper (*Juniperus excelca*), Cedar (*Cedrus libani*), Fir (*Abies silicica*), Pines (*Pinus pinea, Pinus halepensis, Pinus brutia*) and Cypress *(Cupressus sempervirens)*. The bulk of the forest area consists of Oak and Pine stands. In addition, the Lebanese forests contain a wide range of aromatic, wild, and medicinal plants.

Forests were severely neglected during the period of the Lebanese civil war. Therefore, the woodland area of Lebanon has sharply decreased. In 1989, FAO estimated the forest cover at 7% of the total country area and suggested that this need to be increased to 20%. Deforestation was and still is basically due to the following factors: urban expansion in the mountain areas, encroachment by agriculture, illegal cutting, illegal grazing and overgrazing, forest fires and inadequate policies on forest management. Deforestation has weakened the soil structure, accelerated soil erosion and led to a general degradation of soil quality.

Constraints facing the forestry sector

- Inadequate Legislation governing the management of the forest
- Inadequate forestry policy.
- Lack of human, technical and financial resources needed for a proper protection and management of forests.
- The frequent incidence of forest fires.
- Over-grazing.
- Inadequate skills for the protection of forests against pests and diseases
- Limited public awareness.
- Rapid and unplanned urbanization.

- Clearance of forests for agricultural purposes.

ACTION PLAN

The Lebanese Government is well aware of the ecological, social and economic value of its forest resources. It is equally aware of the current threats on its forest resources and of the need for immediate action. It has initiated many actions aiming at protecting its forests resources. These include the designation of large areas of forests as nature reserves and the initiation of large-scale reforestation. These have slowed the rate of forest loss but still much is needed to be done before reaching the 20% forest cover goal. Therefore, the Lebanese Government will, in particular:

- Adopt and harmonize forest-related definitions.
- Adopt a participatory approach fostering negotiation with different stakeholders to ensure that local needs are considered in forest management.
- Update, revise and enforce the laws related to forest management.
- Empower and build the capacity of the forest management administration including the forest guards.
- Empower and build the capacity of municipalities and local authorities to engage in forest protection and management.
- Promote and enforce the protection and sustainable management of forests.
- Promote public awareness.
- Develop and implement a long-term reforestation plan in order to achieve a 20% forest cover within a period of 30-40 years.
- Ensure the protection of forests from overgrazing.
- Support pilot projects on forest management.
- Support forest fire management programs.
- Forbid and penalize wood cutting except according to previously agreed management plans.

- Promote the conservation of seeds of local species.
- Support efforts aimed at collecting information and knowledge gained and synthesizing the national experience on forest management.
- Prepare management plans for the protected forests.
- Promote forest research
- Support Non-Wood forest products
- Prepare a Forest Action Programme including a forest inventory and mapping.
- Implement a unit in the MOA to be in charge of forest organization and management

Project Proposal

Project title

Establishment of forest management plans in pilot areas.

Objective

Encourage the protection of forests through local participation and the development of local management plans under the supervision of MOA.

Project activities

- Identify a forest area
- Identify stakeholders and current uses of the forest by different user groups
- Establish a negotiation platform involving public authorities, experts, local authorities and user groups
- Develop a local management plan taking into consideration:
  - ⇒ the needs of the different groups and the provision of alternatives where necessary
  - ⇒ Reforestation and maintenance of the forest area
  - ⇒ Conservation and/or sustainable use of local species
  - ⇒ Protection arrangements by local authority and local user groups
  - ⇒ Socio-economic feasibility
- Analyze the experience, lessons learned and inform decision and policy-making.

Project Proposal

Project title

Monitoring the Effects of Drought on Vegetation Cover and Land Use through Eco-physiological Measurements on Some Forest Species

Objective

The proposed project represents an eco-physiological approach to give adequate responses of the vegetation adaptation mechanisms to drought in relation to climate experienced.

Activities

Observation of daily patterns over seasonal gradient of the most relevant eco-physiological parameters (leaf water potential; leaf stomata conductance; net CO_2 assimilation rate; chlorophyll fluorescence; soil moisture measurements; relative water content).

Budget

Capital cost: 100 000 USD
Running cost: 50 000 USD

Project area

Pilot fields in central and northern Bekaa Valley

Project Duration

3 years

Expected results

Development of a set of applicable guidelines. These will focus on the establishment of an effective mechanism to guide forest cover performance in water scarce and climate adverse environments.

VII. Sustainable Agriculture

Situation analysis

Historically, the Lebanese agriculture suffered from inadequate planning in a "laissez-faire" economy. Additionally, the civil war (1975-1990) led to the displacement of hundreds of thousands of people and increased pressure on many areas resulting in a large-scale unregulated urban sprawl. Large areas of fertile coastal plains and hills were transformed into urban and industrial zones. The Bekaa plain, the main agricultural plain in Lebanon, lost a substantial part of its fertile lands to urbanization. Moreover, the occupation of 15% of the country, for more than two decades, resulted in the abandonment of thousands of hectares of fertile land.

Until the late 70's, agriculture relied more on traditional practices. The increasing demand of a growing population on declining agricultural land enhanced the intensification of the agricultural production system. Problems such as salinity, pest and insect resistance, drop in the water table and depletion of soils are increasingly being observed with negative impacts on productivity which is compensated for by more inputs installing a vicious circle

Action Plan

People in Lebanon, farmers and consumers alike, are aware of the detrimental effects of current practices but lack the technical know-how and the opportunity to engage in sustainable agriculture practices. The Lebanese Government is conscious of the importance of providing an enabling environment for sustainable agriculture and will, in particular:

- Resolve land tenure and property rights issues;
- Carry out and implement a comprehensive Land use plan;

- Update and enforce the necessary laws and regulations regarding the import, the illegal introduction, the control and use of agro-chemicals;
- Develop a decision support system for farmers including adequate and timely information on markets, opportunities, trends and production techniques;
- Adopt a system approach to improve agricultural productivity and to identify needed interventions in terms of provision of necessary infrastructure, credit, training, post-harvest and marketing;
- Develop and adopt a legislative framework for integrated and sustainable agriculture practices including certification programs and procedures.

Specific activities

- Disseminate information to producers and other stakeholders on trade relationships with neighboring countries (including free trade and signed international agreements) and their expected impacts on the national agricultural sector;
- Establish a clearinghouse for agricultural information (production and processing techniques, markets) and the dissemination of applied research results;
- Review existing farming practices and evaluate their environmental impacts including monitoring water quality;
- Create and strengthen proper institutional frameworks to introduce water pricing and promote irrigation water use efficiency.
- Development of agricultural calendars (date of plantation, crop rotation and cropping patterns).
- Promotion of environmental friendly agriculture (organic farming, IPM and low external inputs for sustainable agriculture (LEISA).
- Develop and implement capacity building schemes for local communities and CBOs and strengthen the infrastructure for agriculture production, post-harvest and marketing.
- Put in place a mechanism providing rural and agricultural credit schemes to support small and medium size initiatives.

Project proposal

Project title

Promotion of sustainable agricultural practices.

Project Objective

To promote sustainable agricultural production through research and extension on suitable type and rate of agro-chemical application and training on organic farming and IPM techniques.

Project activities

- Identification of the main crops produced in the area
- Formulation of a suitable crop production protocol for each crop
- Training and extension on crop production protocols
- Training and extension on organic farming, IPM and IPP techniques
- Establishment of a cooperative for organic producers
- Link with organic production networks in the country

Project duration

3 years

Project area

Agricultural plains in Bekaa and Akkar and around protected areas where agriculture is practiced.

Other relevant activities

- Promotion of sustainable agriculture practices
- Assessment of existing farming practices and evaluation of their environmental impact (short term)
- Rehabilitation of an abandoned quarry: a study case (short term)
- Strategy for a sustainable management and rehabilitation of quarries and landfills (short term)
- Promotion of water efficient irrigation systems and improvement of water use efficiency (pilot project in different areas, on different crops, soils and climatic conditions).
- Development of a comprehensive land use plan: 1/20000 scale (medium term)

VIII. Rangeland Management

Situation analysis

Lebanon is a very mountainous country, characterized by the existence of two mountain chains Lebanon and Anti-Lebanon, oriented NNE-SSW, and separated by the Bekaa Valley, which has an area of 150,000ha. The mountainous region occupies almost 737,000ha (72%) of Lebanese territory.

The grasslands are classified into four categories: the hills and foothills above the coastal zone; the ranges facing the Mediterranean Sea; the slopes of the Bekaa Valley; and the Northern Bekaa Hills. These areas are used for livestock grazing (sheep and goats). Control of grazing is exercised by individual villages or group of villages and the grasslands provide communal grazing in spring.

Table 7.1 shows the land distribution by Mouhafazat between cultivated and non-agricultural areas (FAO, 1980). Non-agricultural areas cover 632,000 ha of which 520,000 or 52% of the total Lebanese area can be considered as rangelands, which include grasslands, mountains and nature pastures and scrublands.

Table 7.1 Land Distributions by Mouhafazat

Mouhafazat	Total Area (ha)	Cultivated Lands (ha)			Non Agricultural Lands (ha)
		Total	Irrigated	Non-Irrigated	
Beirut	1,780	-	-	-	1,780
Mount Lebanon	195,040	61,729	10,535	51,194	133,311
North Lebanon	198,117	64,146	17,636	46,510	133,971
South Lebanon	200,085	98,195	10,173	88,022	101,863
Bekaa	428,028	166,953	25,735	141,735	261,075
Total	**1,023,023**[1]	**391,023**	**64,079**	**326,944**	**632,000**

Source: Recueil de statistiques libanaises No. 9, 1973.

1 Due to geographical projection, this number deviates from the official figure

Livestock production especially of sheep and goats has traditionally been an integral part of the dry-land agriculture in Lebanon. The sheep and goats belonging to the Awassi and Baladi breeds respectively are very well adapted to local conditions and can survive on scarce vegetation. Sheep numbers have stabilized around 200,000 heads (1970-1990) while goat numbers have increased from 300,000 heads in the 70s to approx. 500,000 heads in the 90s.

Rangelands in Lebanon are shrinking due to urban sprawl and encroachment of agriculture. Moreover, they have suffered a continuous deterioration resulting from overgrazing and overstocking.

Marginal lands constitute a significant proportion (40%) of the total area of Lebanon. Converting marginal lands into crop production, combined breakdown of traditional grazing rights and the low productivity of the animals have all contributed to overgrazing due to the overstocking of the shrinking rangelands and accelerated the process of land degradation. The major driving forces include:

- Absence of a comprehensive framework for rangeland management
- Absence of land use zoning
- Insecure land tenure rights
- Encroachment of agriculture and quarrying activities
- Inappropriate policies
- Deforestation
- Lack of technical skills of livestock herders
- Inadequate extension service
- Limited understanding of rangeland dynamics and livestock production systems at the institutional level
- Limited participation of stakeholders in rangeland management efforts
- Lack of coordination between public and private institutions dealing directly or indirectly with rangelands issues.
- Breakdown of traditional grazing arrangements and limited experience of local authorities in managing the commons.

Action Plan

Rangelands have a direct use function as grazing lands for herds. In addition, they play an important role in soil conservation and groundwater recharge. In semi-arid areas, such as the Northern Bekaa intensive rainfall events on degraded rangelands result in flash floods with dramatic on and off-side effects. Range rehabilitation in these areas would greatly improve water infiltration and groundwater recharge while alleviating flood events. The Lebanese government recognizes the importance of proper rangeland management and rehabilitation and therefore it will, in particular:

- Develop a comprehensive legislative and policy frameworks with the active participation of all rangeland users
- Support the establishment of proper land tenure systems so that users have long-term stake in sustainable use
- Enhance biomass and vegetative cover of the rangelands
- Support sustainable livestock production through the introduction of improved stock, animal husbandry, stock management, alternative feed resources and health programs
- Support research activities to develop a better understanding of rangeland dynamics, rehabilitation and management techniques
- Support institutional strengthening of livestock herders
- Support an efficient extension service for rangeland management, rehabilitation and sustainable livestock production

Specific activities

- Revise relevant legislation and policies
- Develop a land tenure map
- Assess rangelands in terms of their current use and potential carrying capacity
- Develop a national strategy for management and sustainable use of rangelands

- Initiate pilot activities to identify suitable technical solutions for rangeland rehabilitation and management
- Develop and implement a participatory model for rangeland management in a pilot area
- Improve productivity and management of existing herds and matching stocking rates with rangeland carrying capacities
- Build national capacity in rangeland management and livestock production through technical training and develop an adequate extension service
- Build the organizational capacity of livestock herders through specialized cooperatives
- Upgrade existing nurseries of the Ministry of Agriculture to provide forage seeds and fodder shrubs for rangeland rehabilitation
- Implement a national rangeland strategy

Project proposal

Project title

Sustainable improvement of rangeland management in Lebanon, a model case

Objective

Develop a model case for sustainable rangeland management in Lebanon; with the participation of local authorities and rangeland users.

Project activities

- Identification of major grazing sites and routes in Lebanon
- Assessment of rangeland condition and intensity of use
- Selection of a group of villages along grazing routes
- Identification of stakeholder groups
- Exploration of current use right procedures including rights of access to resources
- Study of rangeland dynamics
- Institutional strengthening of livestock herders including the establishment of cooperatives and cooperative unions
- Consultations and negotiations between municipalities concerned, livestock herders and other rangeland users on possible rangeland management arrangements including rangeland rehabilitation and protection.
- Development of a mutually acceptable rangeland management protocol binding rangeland users and concerned municipalities.
- Implementation of the protocol
- Evaluation and feedback
- Policy guidance

At the technical level:

- Characterization and assessment of livestock production systems
- Identification of necessary and feasible technical interventions including improved feed and health programs
- Capacity building and training for livestock herders and extension officers on the new techniques
- Implementation of the technical interventions
- Evaluation and feedback

Project duration

5 years

Estimated cost

1,500,000 USD

IX. Soil Conservation

Situation analysis

Land resources in Lebanon, like other Mediterranean countries with a long history of human exploitation, have been subject to increasing pressure for thousands of years. The abundance of mountain rocky lands with shallow soils and bare rocks points to processes of severe erosion and land degradation. Many other problems like contamination, salinization, depletion and urban expansion threaten the limited soil resources. Soil conservation should be regarded in close connection with the sustainable agriculture and environmental protection. Several natural and human factors contributed to land degradation as described below:

Natura factors

- Intensive seasonal rainfall
- Complex landform
- Land sliding due to restricted natural drainage

Human induced factors

- Deforestation and depletion of vegetation cover
- Unsustainable agricultural practices
- Proper agricultural policy and fair terms of trade
- Lack of proper rangeland management
- Absence of a comprehensive land use zoning
- Urban sprawl
- Quarrying activities
- Road construction
- Poor extension service
- Pollution (industries, solid waste disposal, sewage water, etc.)
- Weak legislative framework and lack of enforcement
- Lack of coordination between concerned institutions

Action plan

Soil, like air and water, is essential to support life on earth. Over 90% of all human food and livestock feed is produced on the land, on soils (ISCO, Precious Earth, 1996). Soil is one of the most limiting factors of production in Lebanon. Current practices are leading to accelerated soil degradation including erosion by water and wind as well as chemical physical and biological degradation. Soil conservation is essential for any sustainable development plan in the country. This is why the Lebanese government will, in particular:

- Put in place a proper land use planning and zoning system in order to protect prime agricultural lands from further misuse
- Enhance coordination with concerned stakeholders especially research institutions and local authorities
- Develop a comprehensive legislative framework for sustainable agricultural production and ensure its enforcement.
- Provide an enabling environment for proper rangeland management including proper legislation, zoning and institutional setup.

Specific activities

- Identification of degraded land and formulation of proper rehabilitation schemes
- Promotion of soil conservation practices
- Development and implementation of water harvesting and management schemes.
- Development of a proper extension system
- Development of a strategy for relevant applied research in soil conservation and management issues
- Adopt soil conservation and management topics in agriculture schools and universities.

Project proposal

Project title

Soil conservation measures in northern part of Bekaa (Qaa- Hermel)

Objective:

To study the causes of land degradation and to plan and implement proper mitigation measures.

Project activities

1. Soil study and soil map at 1/20000 scale
2. Identify soil salinity and land degradation origin
3. Identify causes of soil erosion
4. Plan and implement proper mitigation measures

Project region

Northern Bekaa (Qaa- Hermel)

Project duration

3 years

Estimated project cost

$ 500,000 USD

Project proposal

Project title

Comprehensive watershed management

Objective

Develop and implement a comprehensive approach for soil and water conservation in an entire water catchment. The approach can then be used as a model for similar initiatives.

Project activities

- Support sustainable agriculture in the catchment including organic farming and IPM
- Promote irrigation water use efficiency
- Promote soil and water conservation including water harvesting
- Build the capacities of local communities (technical and institutional)
- Enhance livelihoods
- Disseminate lessons learned to inform decision-making

Project Region
Akkar and South

Project Duration
6 years

Project Cost
5, 000, 000 USD

Other relevant activities

- Soil conservation measures in saline and degraded soils of Qaa-Hermel area
- Comprehensive watershed management
- Data Bank for soil studies and projects (short term)
- Assessment of infrastructure for sustainable agriculture (short term)
- Impact of short and long term crop rotation on Nitrogen use and dynamics in soil and ground water ecosystems (short and long term)
- Terraces rehabilitation in the Lebanese mountains
- Afforestation of Akkar basaltic lands with Chestnut (medium term)
- Natural drainage structures (or channels) management (medium to long term)

X. Protected Areas

Situation analysis

Today, there are about 40 sites in Lebanon with various degrees of protection. Out of these, 7 are nature reserves authorized by law: The Palm Islands, Horsh Ehden, Al-Chouf Cedars, Tyre coast, Bentael, Tannourine Cedars Forest and Yammouni and more than 15 are protected by decree; in addition to Karm Shbat, which is proclaimed by a ministerial decree. Recently, the Ministry of Environment (MoE) declared by ministerial decree 3 natural sites: Kammouha, Dalhoun Forest and Wadi al Karakir.

Action Plan

Since many of the factors contributing to desertification in Lebanon are anthropogenic, the protection of some key areas could be a very plausible intervention for combating desertification. This is why the Lebanese Government will, in particular:

- develop a comprehensive legislative framework defining the status, role, responsibility and means of financing nature reserves and protected zones;
- endorse and adopt the proposed framework law for nature reserves and ensure the enforcement of existing legislation;
- define the exact limits of the protected areas;
- give continuing and increased support, including necessary funds, for the provision of an enabling environment to promote sustainable management of protected areas/nature reserves as part of a more comprehensive development plan for the area;
- promote activities, which will ensure that all stakeholder groups in the affected communities are adequately represented, and actively involved in the formulation of management plans for the protected areas;

- support the creation of new protected areas in order to protect fragile ecosystems and to improve inter-connectivity between natural habitats;
- Give increased support for the development of comprehensive land use plans taking into consideration the needs and requirements of environmental protection.
- Define clear roles and responsibilities for the different Ministries involved

Specific measures

- Increase the number of protected areas to ensure that all ecosystems are represented
- Give particular attention to wetlands
- Increase awareness campaigns
- Differentiate between productive and non-productive forest (especially within protected areas)
- Define the different protected areas before adopting the law on protected areas
- Encourage exploitation inside protected areas to the benefit of the protected area
- Impose protection on degraded and desertified areas
- Focus on appropriate research for decision making/taking