



# **UNCONTESTED PHYSICAL FEATURES**

## CHAPTER I

### UNCONTESTED PHYSICAL FEATURES

The basic choices adopted in the National Physical Master Plan of the Lebanese Territories (NPMPLT) are the result of a coherent analysis of two imperatives:

- Physical data (constraints and advantages) that characterize the Lebanese territory; and
- Challenges of the future, in terms of economic and social perspectives.

The present chapter explains the imperatives followed by physical features.

#### I.1 THE SIZE OF LEBANON AND ITS GEOGRAPHIC LOCATION

The first unavoidable feature or reality of Lebanon is its small surface area. With less than 11000 km<sup>2</sup>, it is the second smallest country in the Middle East and the Arab World (after Bahrain). Its territory represents 1 / 1000<sup>th</sup> that of large countries such as the USA or Canada and 1 / 100<sup>th</sup> that of Egypt.

Despite the fact that it is densely populated<sup>1</sup>, it is ranked 125<sup>th</sup> worldwide for its populations, with four million inhabitants<sup>2</sup>.

Its well-known and exploited natural resources consist practically of water resources, soil and vegetation, as well as climate and landscapes.

The small size of the country, its population density and the modesty of its natural resources generate a series of perennial consequences, the most important being the vital necessity for Lebanon to be open to the whole world in order to import resources and consumption goods on one hand, and export goods and services, on the other.

This tendency of openness to the outside world, an objective to every small country, is an old reality for Lebanon, where it has taken different shapes with time: trade with cities of the Mediterranean basin, business with Egypt and Greece, demographic expansion towards fertile hinterlands, and exchanges with cities of Syria, Palestine, Iraq and the Gulf States. It has also led to numerous emigrations since the mid-19<sup>th</sup>

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<sup>1</sup> Among countries of more than one million people, Lebanon comes on the 11<sup>th</sup> position as far as population density is concerned (number of inhabitants per km<sup>2</sup>).

<sup>2</sup> Source: Central Administration for Statistics (CAS), 1997

century that has resulted in a large Diaspora throughout the entire planet... This openness of the country has been facilitated by its geographic location, at the threshold of Europe, Africa and the Middle East.

The sea and the air connect Lebanon with the entire world. On the other hand, its terrestrial pathways go necessarily across Syria, ever since the closure of the southern border in 1948.

Intense trade, economic dynamism as well as cultural activities highlight Lebanon's international openness.

In the future, this openness will progressively increase because of an inexorable movement of globalization and collapse of custom barriers, integration of local economies into regional and international economies, as well as decrease of transportation costs for people and goods.

This openness as well as recent emigration flows lead, among other things, to important financial flows coming from abroad in the form of deposits in the Lebanese banks.

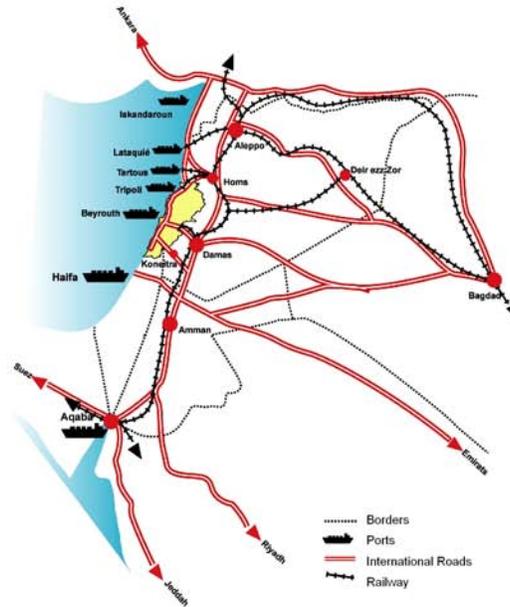
One of the major challenges for Lebanon is to maintain control over capitals, without losing its interior productive capacity. This balance is hard to maintain while external income (when spent to finance local consumption) has the side effect of raising internal prices and production costs, reducing local products competitiveness and hindering exportation. The solution resides probably in the capacity of Lebanon to re-orient the surplus of these incomes more in productive investments and less in consumption.

## Lebanon in the World and the Middle East

n°1.1 : Lebanon in the World



n°1.2 : Lebanon in the Middle-East



## I.2 TOPOGRAPHY, AN IMMUTABLE FACT

Topography is an unavoidable, distinguished and at the same time restricting feature of Lebanon. The mountains of Lebanon have shaped its climate, water resources, landscapes and extremely rich biodiversity. They had always played a decisive role in the history of its settlements and still are to date.

A place to live: It has always been difficult in Lebanon to settle beyond an elevation of 1500 meters, and all kinds of permanent dwellings are absent beyond 2000 meters. Settlement densities in Lebanon will remain in disparity according to elevation, with consecutive levels roughly at 400 meters, 1000 meters and 1500 meters. Topography generates more or less steep slopes as well: constructions rarely set up on slopes higher than 30%, and practically never on slopes higher than 40%.

Agriculture: Topography is a determining factor – besides nature of soils, irrigation and water availability – for possible crop types and agricultural techniques. Elevation levels avail Lebanon of the possibility to develop an extremely diverse agriculture, from quasi-tropical produce in coastal plains up to orchards in high altitude, with a full range of possible intermediary products in between. Physical configurations of terrains (vast plains, narrow plains, basin, slopes, etc.) determine the possibilities for automation (mechanization) and industrial and semi-industrial exploitation.

Biodiversity: Elevation levels – together with slope exposure – provide Lebanon with exceptional biodiverse conditions that are a great richness not only for the country, but also to humanity. Preservation and protection of biodiversity is in fact an essential equilibrium for life and nature, as well as for research projects, especially in the medical field.

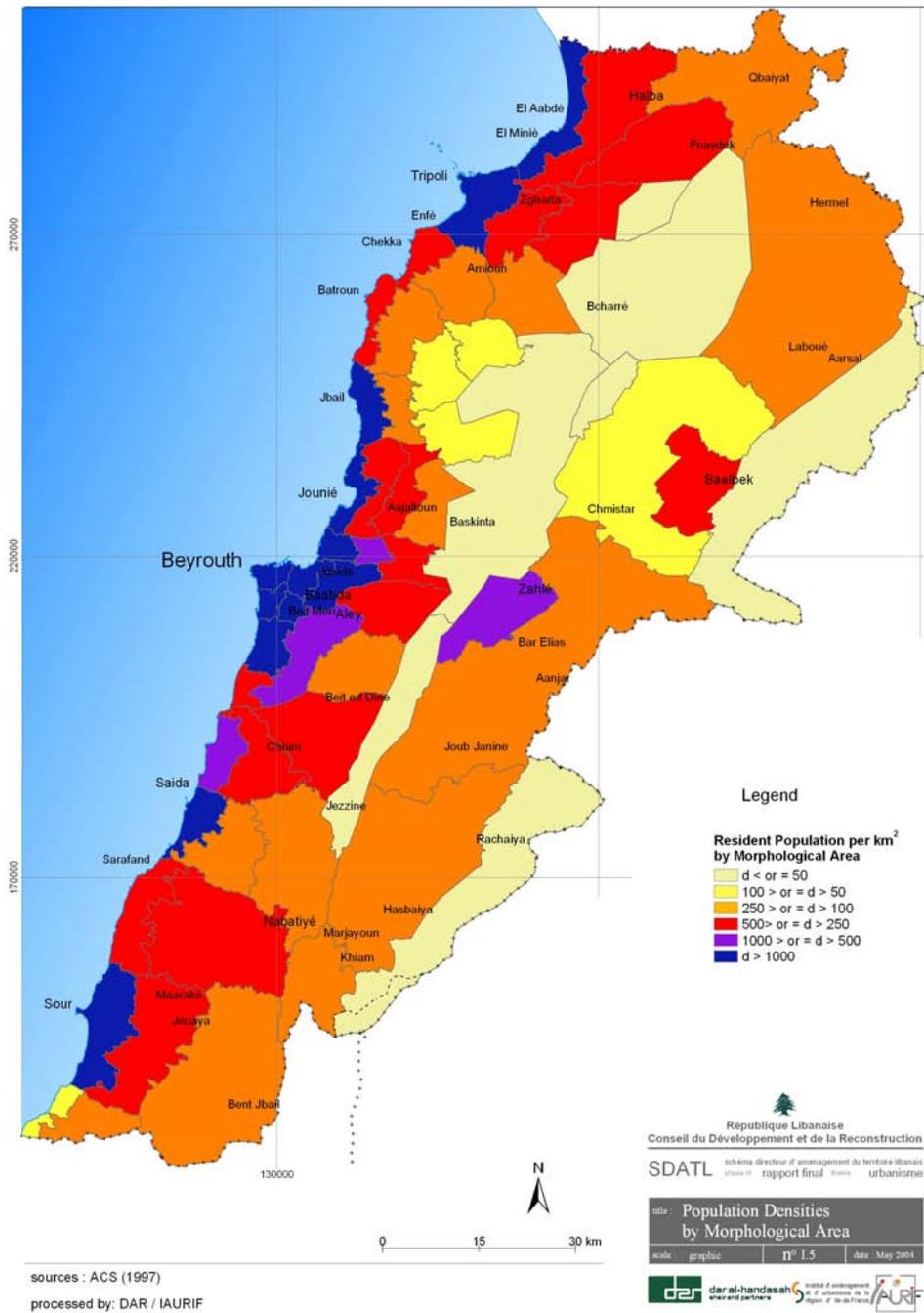
Landscapes: Topography has granted Lebanon its magnificent landscapes (mountains, valleys, cirques, plains, etc.), which constitute a main element of its touristic potential and its distinguishing quality of life. Besides these great scenes of landscape, there are other features created due to geomorphological accidents (cliffs, peaks, canyons, etc.) that are also outstanding and impressive.

Compartments: Topography splits the territory into geomorphological regions, separated by valleys and mountains. It enhances, thus, diversity of the environment, but does constitute physical obstacles to the regions at the same time.

Constraints and infrastructures: Topography imposes its constraints on construction and infrastructure. Contraventions have a high cost and inflict eyesores, such as road embankment fills and dumping or multi-level quarries of high altitude, on the openly visible landscapes.



Figure I.5: Population Densities per Morphological Zones



### **I.3 FAVORABLE AREAS FOR AGRICULTURE**

One of the immutable realities of Lebanon is its agricultural resources, developed successively by thousands of generations in concordance with continuously advanced techniques.

Until the mid-19<sup>th</sup> century, agriculture techniques remained rudimentary, and soil productivity was hardly enough to feed a basically rural and deprived population. Peasants in Lebanon have cultivated every land they could (except those necessitating efforts out of reach of men and animals), including lands with poor productivity and lands located on steep slopes. During the 20<sup>th</sup> century, the agricultural sector faced successive moments of crises, mainly due to decrease of produce values (prices), whether it is natural silk, wheat or more recently apple produce.

Today, techniques have improved, productivity has increased, but once again Lebanese agricultural production suffers from international competition, in front of which, it is facing a series of handicaps: high cost of imported inputs, undersized exploitations, high prices of land, disorganization of production and marketing, weak in innovative research, modesty of agricultural training and extension, poor irrigation techniques, lack of irrigation water in some regions, etc.

In fact, the portion of agriculture and livestock farming in Lebanon's GDP barely exceeds 6 % (national accounting, 1997), which is equivalent in global value to slightly more than US\$ 1 billion. The output per hectare is around US\$ 3000.

But current difficulties should not lead to condemning any promising future for the agricultural sector in Lebanon. Future generations will surely need agricultural lands for their economy and for their own consumption.

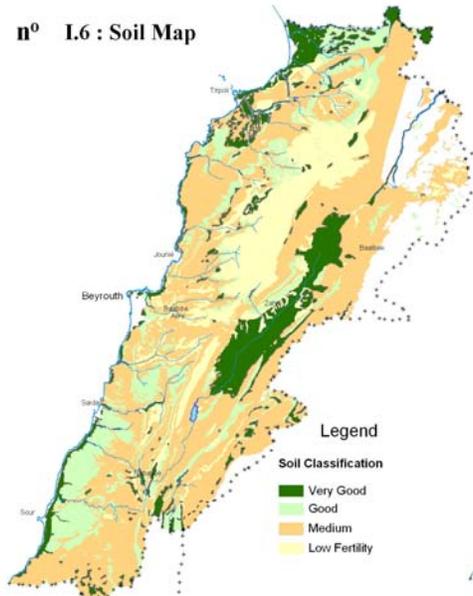
Lebanon is endowed with a significant capital of valuable lands for agriculture. Agricultural value of lands depends on the nature of soils, depth, content of organic material, acidity, water-retaining capacity, landslide and erosion hazards exposure and slope – which determine how easy soils are cultivated with quasi-industrial techniques.

Almost half of Lebanon's total surface could be cultivated, although with different productivity. The country's real wealth resides in some large entities, representing altogether around one third of its total surface.

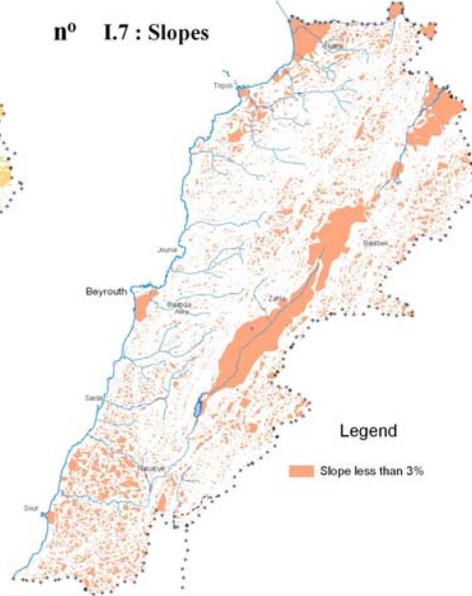
The most productive and important entities have been plotted on maps. They represent practically all the plains (Beqaa, Akkar, Koura, coastal plains, Sour plain, Sarafand, Saida, Marjayoun plain, etc.); higher Shouf fertile lands, corridors of Hasbaya and Rachaya, basin sites of South Lebanon and orchard levels of Mount Lebanon.

## Major Agricultural Domain Mapping Method

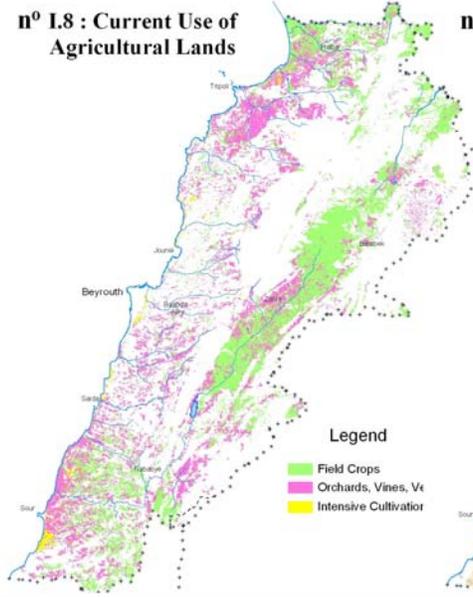
n° I.6 : Soil Map



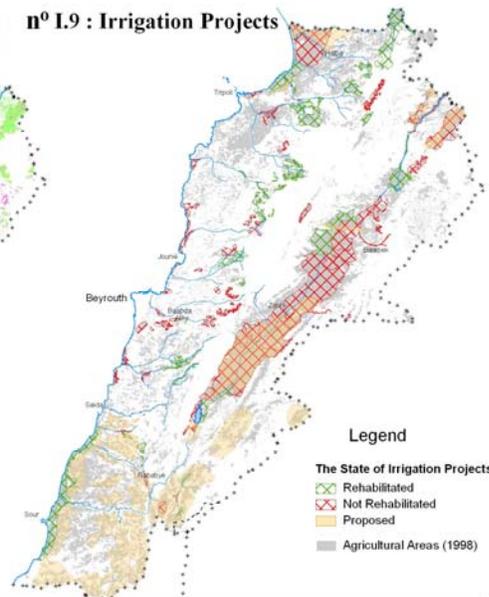
n° I.7 : Slopes



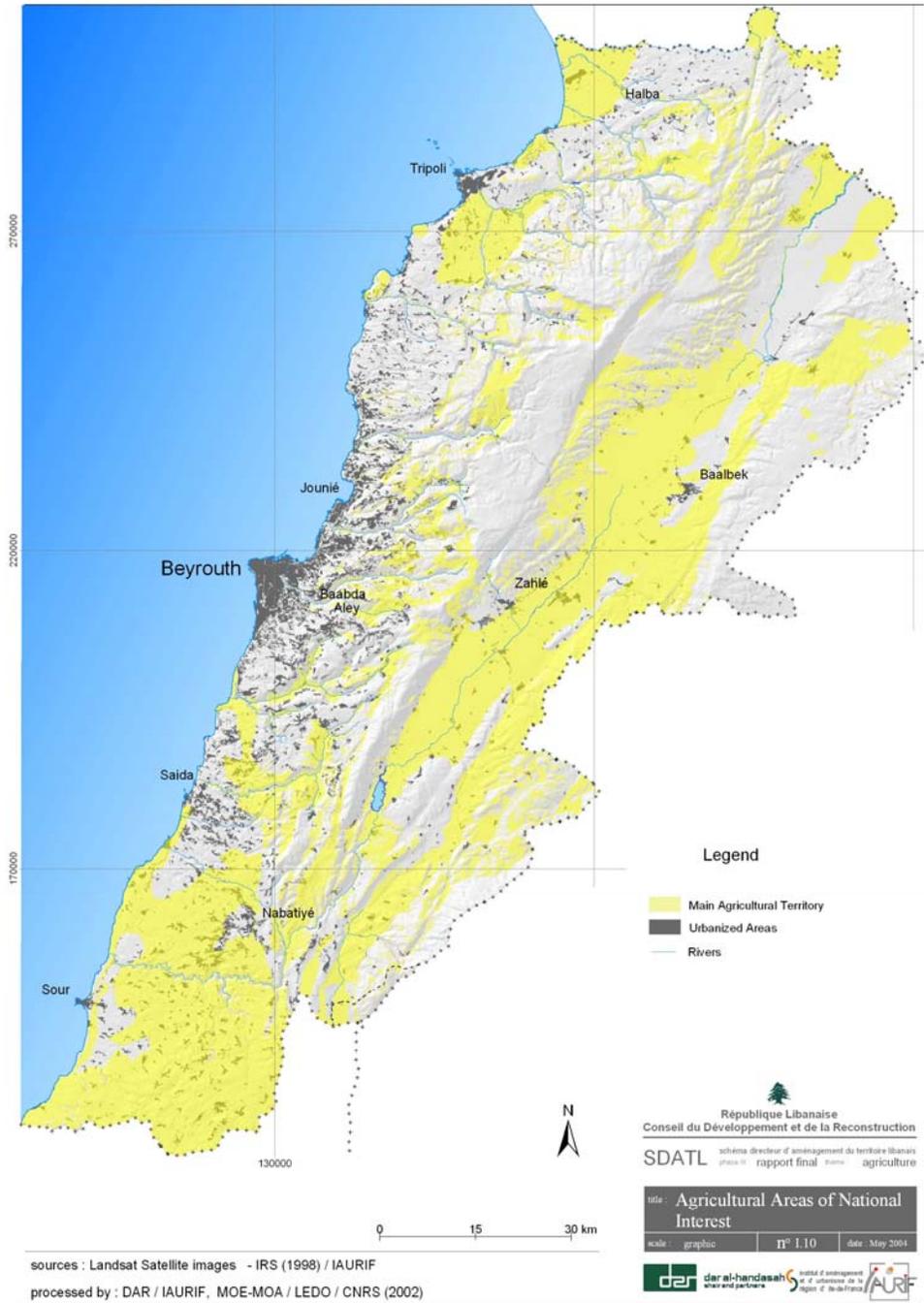
n° I.8 : Current Use of Agricultural Lands



n° I.9 : Irrigation Projects



**Figure 1.10: Agricultural Domain of National Interest**



## **I.4 DISTINGUISHED NATURAL AREAS AND LANDSCAPES**

Topography, waterways and climatic zones have constituted massive landscapes that form Lebanon's identity. They have played a determining role for the biodiversity that characterizes the country and created extraordinary sites as per aspect and scarcity.

### Ecological heritage

Lebanon is characterized by its large diversity of ecosystems, due to its variety of environmental conditions (climate, elevation, slope, sun exposure, soil, etc.). A small country such as Lebanon is lucky to have such a large diversity of fauna and flora.

Biodiversity conservation is a major issue for the protection and survival of every species, because of interrelations between ecosystems (no isolated system can survive indefinitely). Mankind benefits from this, whether directly through a better environment quality and nature based tourist activities or indirectly through scientific use of fauna and flora species in medical and pharmaceutical research.

Pollution and sudden ruptures in the environment therefore threaten the ecosystem biodiversity in Lebanon. Hence, it becomes more vital and urgent to restore natural continuities between the different ecosystems by creating a true national ecological network.

### Major landscapes in Lebanon

Landscapes are an important factor of tourist attraction in Lebanon and to the quality of life. They represent therefore an economic as well as a social asset.

Among the most important landscapes of Lebanon, some are visible with all its grandeur from a distance: peaks (Qornet es-Saouda, Sannine, Barouk, Hermon), agricultural large plains (Beqaa, Akkar, Koura, etc.), great deep valleys (Abou Moussa, Qadisha, Ibrahim, Litani at Khardali, etc.), picturesque valleys (Jaouz, el-Kalb, Beirut, Barouk – Bisri – Awali, Aassi, Hasbani, etc.), important bays (Jounieh), forests of the North and pine forests of the Cazas of Kesrwan, Baabda, Matn and Jezzine, hills of the South, Qaraoun lake.

Others are visible from a closer range: outstanding coastal sites (Salinas of Enfeh, Ras ech-Shaqaa, Grotte aux Pigeons, Ramlet el Bayda, Damour plain, gorges and mouth of Litani, seashore of Sour, cliffs of Bayyada and Naqoura), Cedar forests (Sir, Jaje, Becharre, Tannourine, Laqlouq, Falougha, Barouk, Chouf), smaller valleys and interior plains (Kfarhalda, Safa, Qammouaa...), etc.

Main landscapes should be a part of a general policy. In some cases, these big landscapes could be turned into "regional natural reserves" (environmentally friendly

regions) to be managed and preserved, and economically developed within a long-term plan of action.

### Geologic heritage

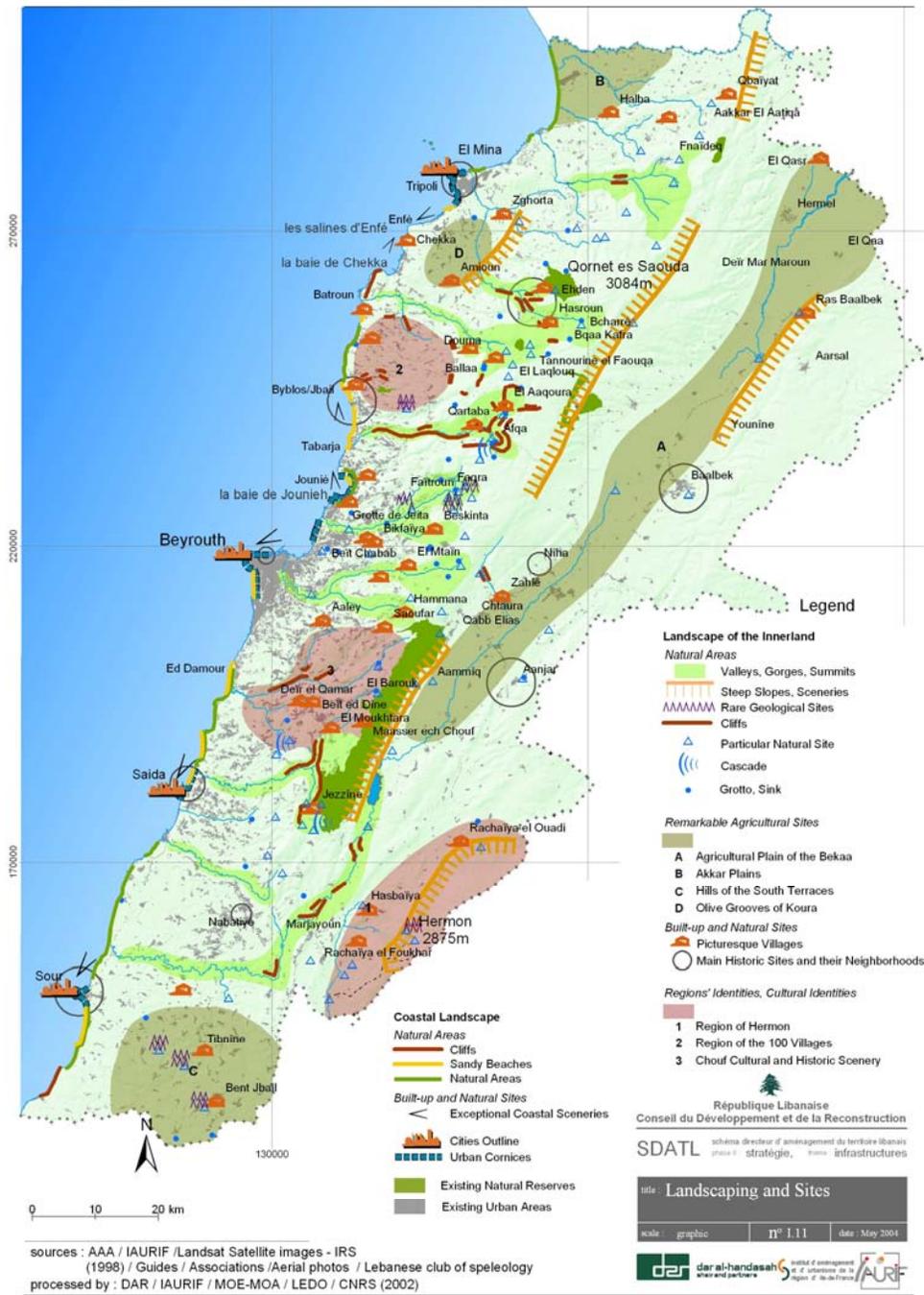
Moreover, Lebanon has a remarkable geological heritage of karst formations and valuable fossil deposits.

Cenomanien fossil deposits (- 100 million years) of Jbayl offer numerous relics of significant conservation of fishes and invertebrates of international scientific interest. There are, as well, other fossil deposits of minor importance.

Karst morphology is rich and diverse: striated sculpture relief of Feytroun, artesian springs of Afqa, or underground rivers and grottos such as Jeita or Antelias. There are many more amazing sites: Tourza folds, Faqra natural bridge, Balaa gorge, Jeita grotto, etc.

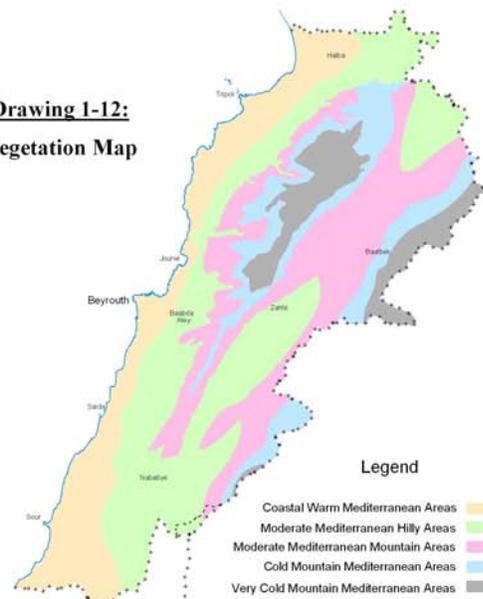
These sites must be subject to gradual measures of protection, having a primary perimeter (severe protection) and secondary perimeter (prospect preservation, etc).

Figure 1.11: Sites and Landscapes

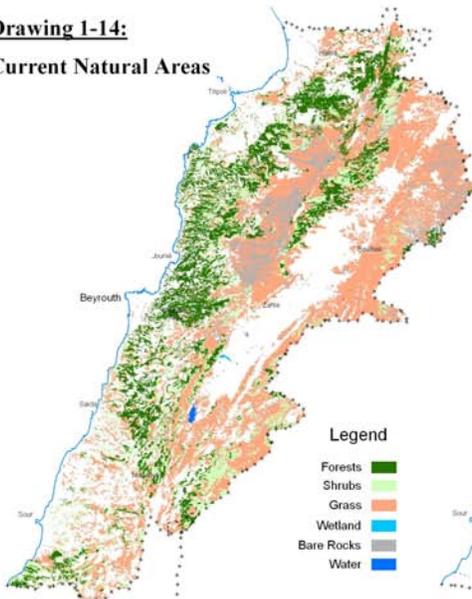


## Methodology for Mapping Areas of Natural Vocation

**Drawing 1-12:**  
**Vegetation Map**



**Drawing 1-14:**  
**Current Natural Areas**



**Drawing 1-13:**  
**Main Rivers**

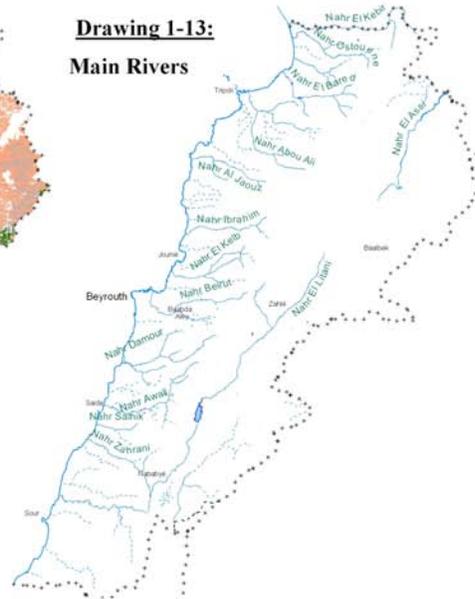
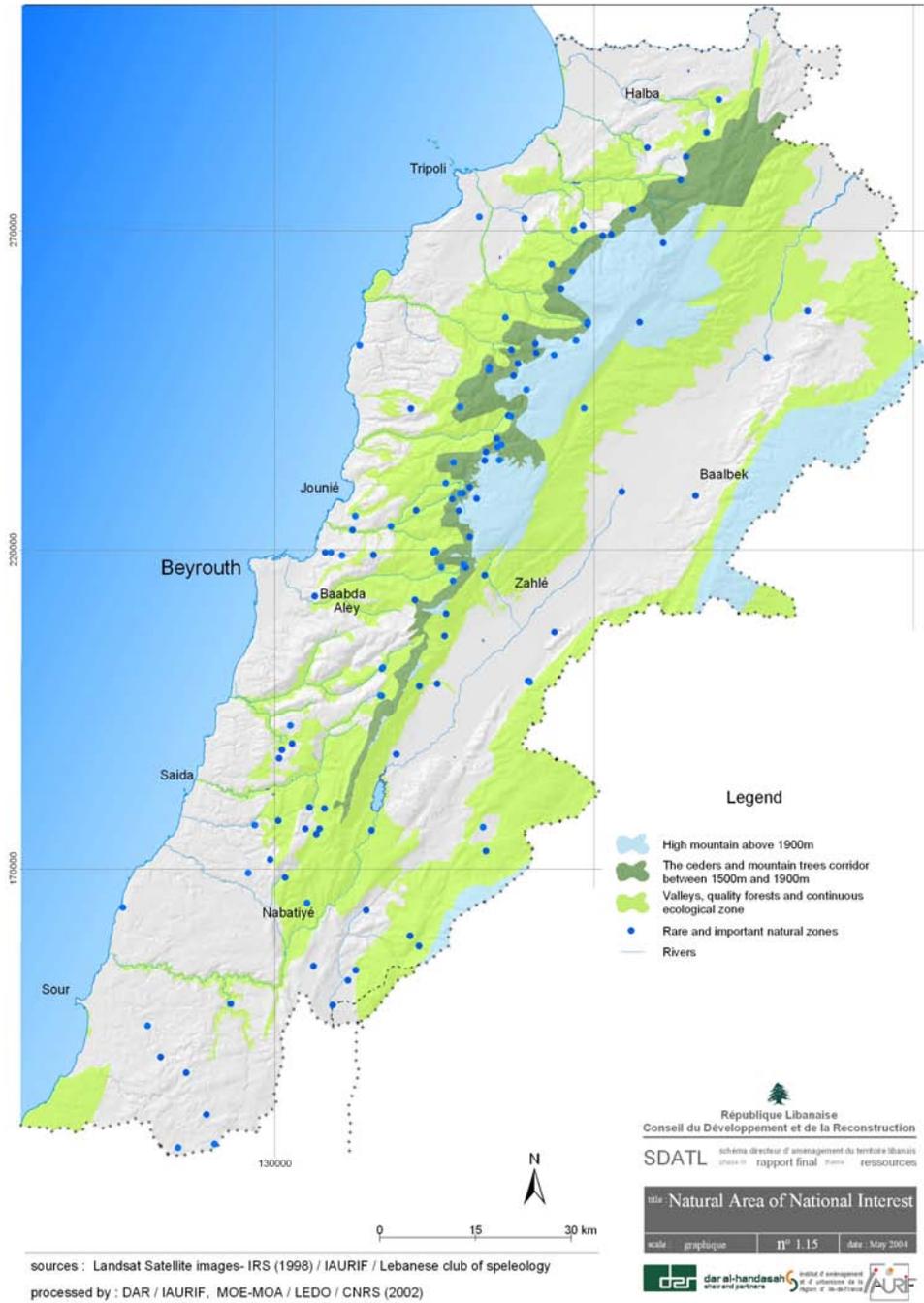


Figure 1.15: Natural Domain of National Interest



### **Protected natural sites in 2003**

Present protected natural sites are composed of 7 categories:

1- Sites protected by Decree n° 343 dated March 28, 1942 (amended by Decree n° 836 of 09/01/50), based on the Law of July 8, 1939 related to the protection of natural landscapes and sites. 8 sites are protected by this decree: Becharre Cedars, Deir el-Qalaa, Bois de Boulogne, Sindiane el-Mrouj, Horsh Beirut, Yammouneh lake, natural bridge of Nabaa el-Laban and the antique ruins of Baalbeck. Protection consists of a zoning regulation on construction rights as well as prospect regulations.

2- Sites protected by the Laws voted by the Parliament between 1992 and 1999 in the framework of “*Mahmiyyat*” (protected natural reserves). There are 7 sites protected by these laws: Machaa’ Horsh Ehdén; Palm Island – Ramkine – Sanai; Chouf cedars; Coast of Tyr; Tannourine cedars; Bentaël; Yammouneh. Altogether, they represent a surface area of around 200 km<sup>2</sup>, that is roughly 2 % of the Lebanese territory. The most important of them is that of Chouf, with a surface area of around 160 km<sup>2</sup>. In general, these sites are located on *M’shaa* lands, public domain or State owned lands, and protection consists of forbidding construction, quarries, cutting of trees and grazing.

3- Sites protected by Decisions from the Ministry of Environment (MoE), based on the law on natural sceneries and sites of 1939, Decree 9501 dated November 7, 1996 and Article 12 of Law 667 dated December 29, 1997. Sites protected by these decisions are: first, river beds (Nahr Ibrahim; Nahr Jaouz; Nahr el-Kalb and its tributaries Sannine-Salib-Msann; Nahr ed-Damour and all its tributaries starting from Nabaa es-Safa; Nahr Beirut and its tributaries in both valleys; Nahr Awali – including Barouk and Bisri; Nahr Aarqa and its tributaries; Nahr el-Aassi); second, forests located mainly in Chouf (Aïn el Haour, Darayya, Debbiyeh, Bourjein, Sheikh Osman, Deir Moukhales, Aïn ou Zayn, Dalhoun, Wadi al-Mal, Kafra, Wadi Aghmid, Wadi Aïn Baal); then the highland site of Jabal Makmel with its peak Qornet es-Saouda starting from 2400 m up until the peak and finally a series of remarkable natural sites (Karm Shbat, valley of Qadisha, Qammouaa plateau, valley of Qaraqir, Baatara gorge). River protection consists in general of a 1000 m wide zone following the centerline of the river, within which all activities are subject to MoE authorization. This zone extends to 3000 m for the authorization of quarries. The perimeter of protection of forests forbids construction, quarries, cutting of trees and grazing.

4- Sites protected by Decisions from the Ministry of Agriculture prior to 1996 law on forested zones: protected natural zones on public lands and *M’shaas* of Maasser esh-Chouf, Barouk, Aïn Zhalta and Aïn Dara in 1991, protected marine area of Batroun in 1991, protected zone of Kherbet Silm – Zaïdani – Wadi el-Hajair (*caza* of Bent Jbayl) in 1992, and protected zone of Kfar Zabad (*caza* of Zahle) in 1992. Protection of these zones is limited to forbidding cutting of trees and camping, and includes programs for reforestation, preservation and management of these zones.

5- Sites protected by Decisions from the Ministry of Agriculture prior to 1996 law based on Law 558, dated July 24, 1996, protecting coniferous woods and forests on

the *M'shaa* and public properties. Sites protected by these decisions are: Bezbina (Akkar), Qammouaa (Akkar), Soueyssa (Hermel), Cedars (Besharre), Tannourine, Hadath el Jebbe, Jaje, Karm Shbat (Akkar), Qnat, Merbyn Wadi Jhannam, Qariet es-Safina (Akkar), Jurd en-Njas – Jabal el-Arb'ine – Danniyeh, Aïn Qlailat – Karm el-Mahr, Qornet el-Kaïf, Mashaa, Shalout, Danniyeh (North), and Bkassine-Jezzine (Jezzine). Protection consists of preserving forests from construction, cutting of trees, grazing, excavations, camping, etc. within a radius of 500 m.

6- Sites protected by Decrees related to urban planning. These decrees are proposed by the General Directorate of Urban Planning (GDUP) after notification by the Higher Council for Urban Planning (HCUP). Protection consists of severe regulations on construction, in the frame of a land use master plan or a specific urban planning document. Most of these general plans, especially those decreed recently, stipulate zones with limited constructability. Among the specific decrees, the decree for the protection of Nahr Damour valley is worth mentioning.

7- Natural sites protected by registration on the World Heritage record of UNESCO: Valley of Qadisha and Cedars of Besharre, both registered in 1998. This registration does add to the protection provided by the local legislation. It has a moral commitment and motivates creation of plans for protecting and benefiting from these zones.

### **Unprotected or Poorly Protected Natural Sites**

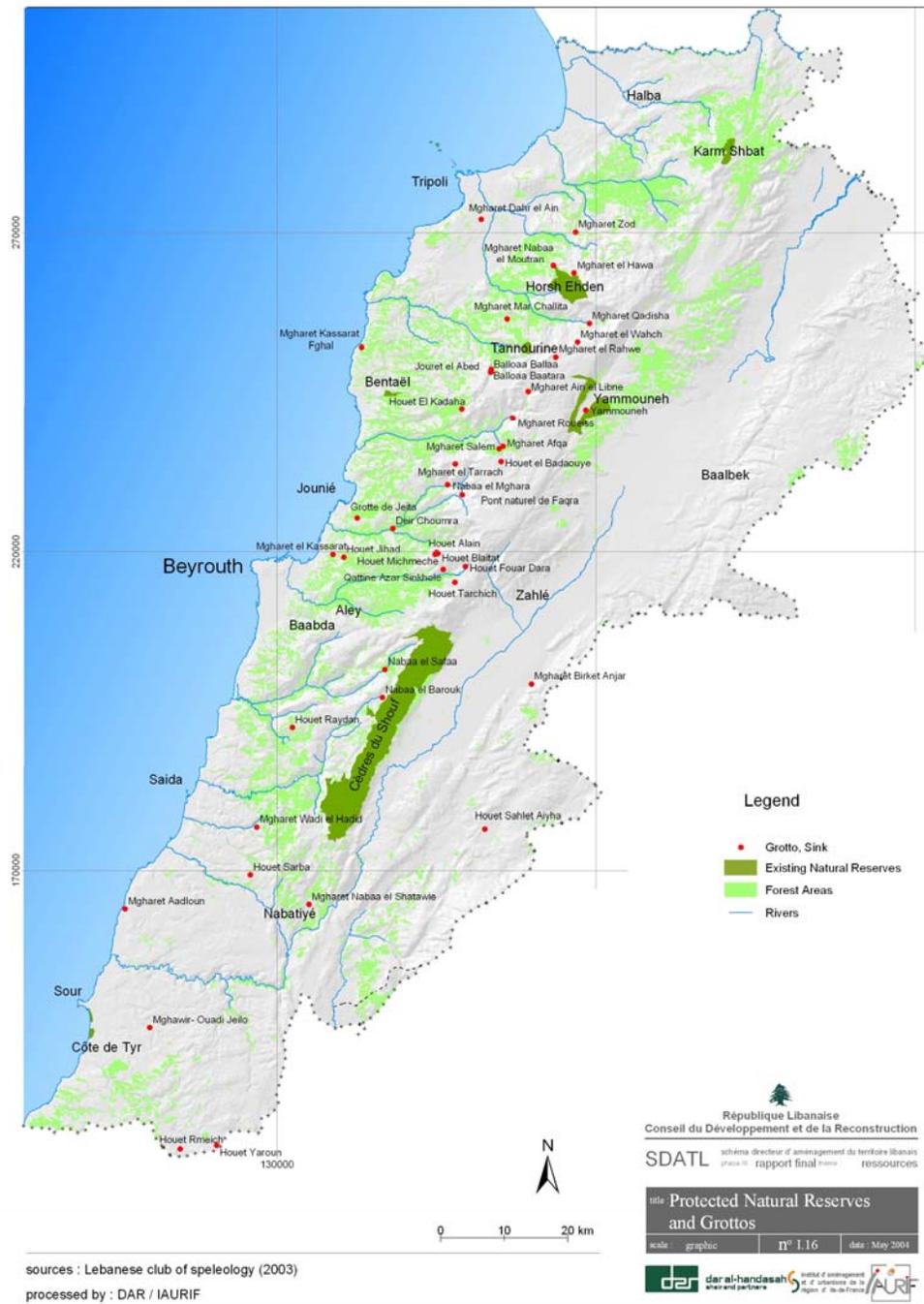
Many sites, with insufficient protection, could be integrated in the “*Mahmiyyat*” regime. For example, Karm Shbat and Qammouaa. Other remarkable sites, such as Ras Shaqaa, are deprived of any protection and should be integrated in the “*Mahmiyyat*” category.

Swamp sites should be protected as well under the Ramsar Convention, which is ratified by Lebanon. Aammiq marshes (protected at present by the owners of the site) and Ras el-Aïn are future sites to be included under this convention.

Other decisions of protection of Cedar, Juniper, Cyprus and Oak forests of *M'shaas* and public properties (Law 558 dated July 24, 1996) could be considered as well, when delimitation on cadastral plans is completed.

It is also necessary to protect remarkable geologic heritage, particularly grottos, caves, fossil fields, natural bridges, etc.

Figure 1.16: Protected Natural Reserves and Grottos



## I.5 THE LEBANESE COASTAL ZONE: POTENTIAL AND CHARACTERISTICS

The Lebanese coastal zone, in its scientific meaning, comprises almost one third of the territory, including the west side of Mount-Lebanon between 0 and 800 meters in altitude, as well as vast zones of North and South Lebanon. But in the context of this study, it is only a narrow sea-land corridor with an altitude between 0 and 50 m.

A narrow coastal plain characterizes this zone, except in the North and South. The coastline is excessively cut and is marked with a series of rocky promontories (*Ras*), the most important of which is Ras Beirut. Linear parts of the coastline are divided between sandy or pebbly beaches and rocky micro-cliffs. Dune ecosystems have nearly disappeared, except in the south of Sour.

The seashore is subject to local massive erosion, due to strong winter storms. This type of hazard is increased because of sand dredging during the war period and especially because of sediment-load decrease subsequent to the construction of Assouane dam. Recent land reclamations (Northern coast of Beirut, airport new runway in the sea) and sand dredging activities are major causes of coastal hydrodynamic modifications.

Coastal zone is considered to be the richest but at the same time the most endangered area of Lebanon. The majority of industrial, commercial and financial activities of the country as well as the largest cities are concentrated in this area. In a corridor of 500 meters wide along the coastline, 40 % of the surface is absorbed by urbanization and 41 % by agricultural uses, while 19 % remain natural areas (beaches, dunes, etc.). The main industries are located along the coast for easier and a better supply of raw material (including oil through *ad hoc* terminals) and a faster export of their products to major cities.

However, agricultural and natural zones are not absent in the coastal area. The largest agricultural areas are the southern plain from Saïda to Naqoura, the Akkar plain and the valley of Abou Ali (Koura). As for the most important natural features, these are located between Batroun and Jounieh on one hand, and Sour and Naqoura on the other. Moreover, there are other relatively smaller areas in the hinterlands of Saïda and Damour.

These areas, natural or agricultural, are exposed to permanent pressure of urban sprawl, due to reallocation of rural zones or dense extensions of cities.

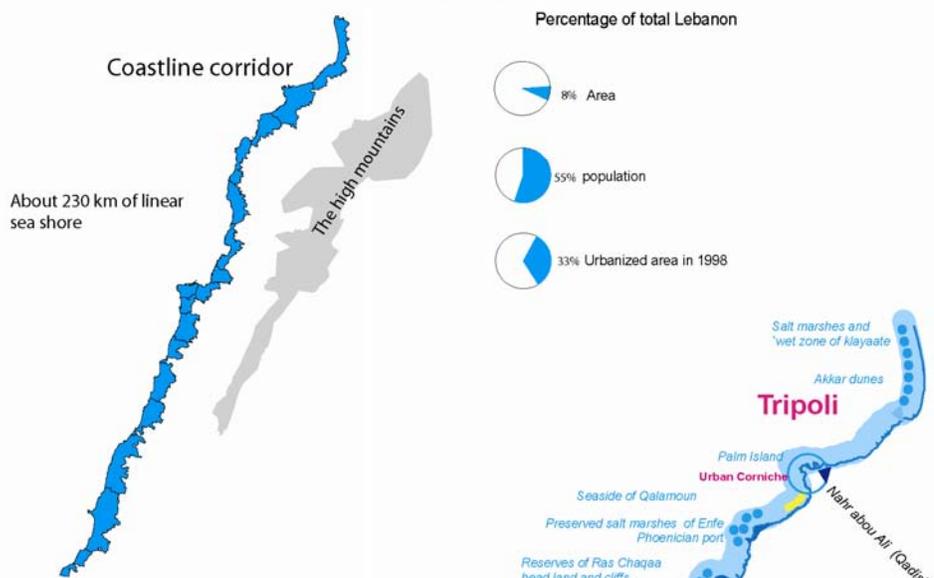
Lands located along the seashore are in extremely high demand for their touristic importance and consequently for the output they can generate through classical real estate operations or tourist and seaside resorts. This pressure results in reclamation activities, marina projects for leisure and other maritime public domain violations<sup>3</sup>.

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<sup>3</sup> Seafront public domain is defined in Lebanese legislation by the order 144/a dated 10 June, 1925 as being the shore up to a distance where winter tides can reach, as well as sandy and pebble beaches. Ponds and salty water marshes linked to the sea are also a part of the public domain.

## Assets and Sensible Sectors of the Coastline

**Figure 1.17 : The Coastline, a tight space**



**Figure 1.18 :  
The Coastline, Fragile Assets**



## I.6 WATER RESOURCES AND MAJOR WATER VULNERABLE AREAS

### A Vital Resource

Despite Lebanon's geographic location in the Middle East, its water resources provide it with a comparative advantage vis-à-vis the surrounding Arab countries. Water management, which represents a major priority for the country, seeks to exploit a maximum of water resources capacity in a sustainable way. Lebanon is determined to improve the quality of domestic water by reducing the pollution of water resources to decrease risks on health.

Although rainfall and river flows had previously been measured until the mid 1970's, available water balance and water exploitation data is unreliable. The measurements have partially been resumed few years ago; however, data on ground water is limited. Water Authorities may have some records on the amount of ground water used for domestic supply from public wells. However, some 45,000 private wells serving buildings have been reported in 1996 for which no data is available. The same applies to uncontrolled irrigation wells spread throughout the country.

*Table 2: Components of Water Balance in Lebanon*

Components	Average annual volume (Mm <sup>3</sup> )
Input: Rainfall + Snow	+ 9 300 <sup>4</sup>
Losses from evapo-transpiration	- 4 500 <sup>5</sup>
Surface flow in streams (springs excluded)	- 1 800 <sup>6</sup>
Groundwater	- 3 000 <sup>7</sup>
– Losses outside the national boundaries, into the sea and to neighboring countries: 570 Mm <sup>3</sup>	
– Un-exploitable groundwater and sea springs: 600 Mm <sup>3</sup>	
– Natural springs flow: 1 145 Mm <sup>3</sup>	
– Stored and pumped amounts for domestic and irrigation uses: 685 Mm <sup>3</sup>	

Source: Mudallal (1989)

<sup>4</sup> Annual inputs are estimated according to different sources between 8600 and 9700 Mm<sup>3</sup>, including snowmelt water quantity estimated to around 1000 Mm<sup>3</sup>.

<sup>5</sup> Evaporation and evapo-transpiration losses are estimated to 45-50 % of inputs according to different sources.

<sup>6</sup> The part of surface water from direct precipitation and snowmelt (springs excluded) is estimated between 1400 and 2200 Mm<sup>3</sup> according to different sources.

<sup>7</sup> The part of groundwater is estimated between 2000 and 3000 Mm<sup>3</sup>.

### Resources Prone to Pollution

Provision of water of adequate quality is quite delicate in Lebanon, considering the geological specificities, which often facilitate pollutants infiltration into water tables and streams. Lebanese aquifer-bearing formations are exceptionally extensive and are generally located underneath extremely permeable and karst formations. These formations have great storage capacities due to intense fractures, fissures and karst networks. Water in these layers often reappears as surface water in the form of springs.

The fractures and karst networks facilitate point and non-point sources pollutants to percolate and infiltrate deep into the ground, thus making groundwater more prone to pollution. Pollutants infiltrated into the ground may reach groundwater within several hours and reappear in the springs and wells used for domestic consumption.

Human activities are likely to generate pollutants that can cause serious consequences on ground water quality. Toxic materials, even if used in small doses, can turn water unconsumable for long periods; while human and animal wastes (domestic wastewater) can cause serious illnesses to users.

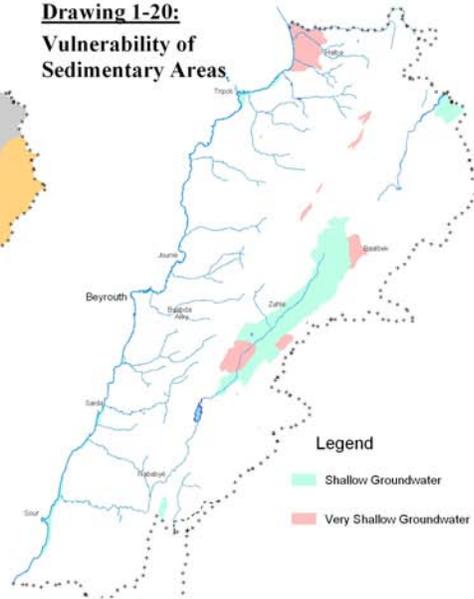
Areas of major groundwater-pollution risks had been identified and plotted on maps in the frame of the NPMPLT. Some are within areas already built or cultivated and others are within areas of natural zones. It is crucial to develop a preventive and curative policy for managing pollution of groundwater. Implementing pollution prevention measures will prove less costly on health as well as on public and private finances.

## Methodology for Mapping Water Resources Vulnerability

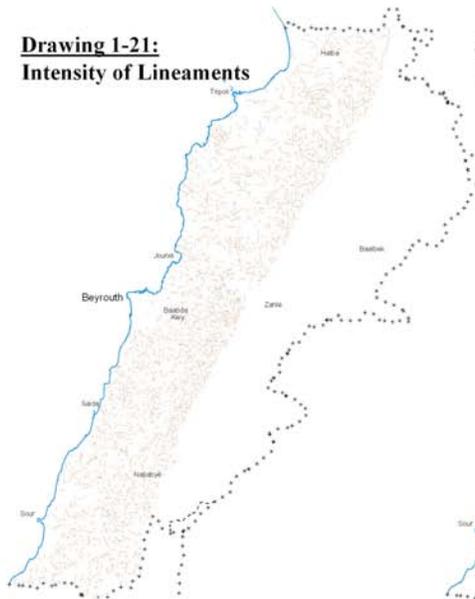
**Drawing 1-19:**  
**Geology**



**Drawing 1-20:**  
**Vulnerability of Sedimentary Areas**



**Drawing 1-21:**  
**Intensity of Lineaments**



**Drawing 1-22:**  
**Main Faults**

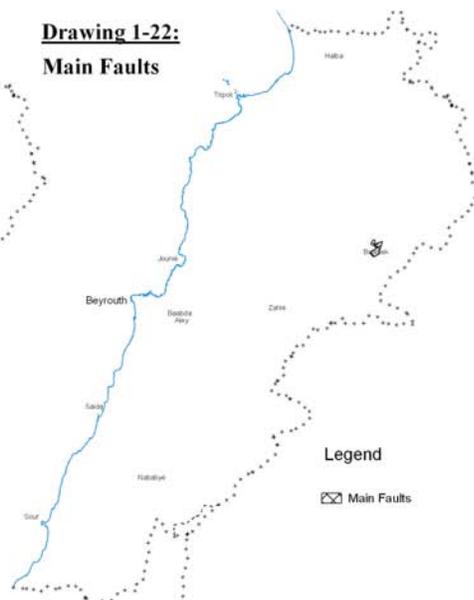
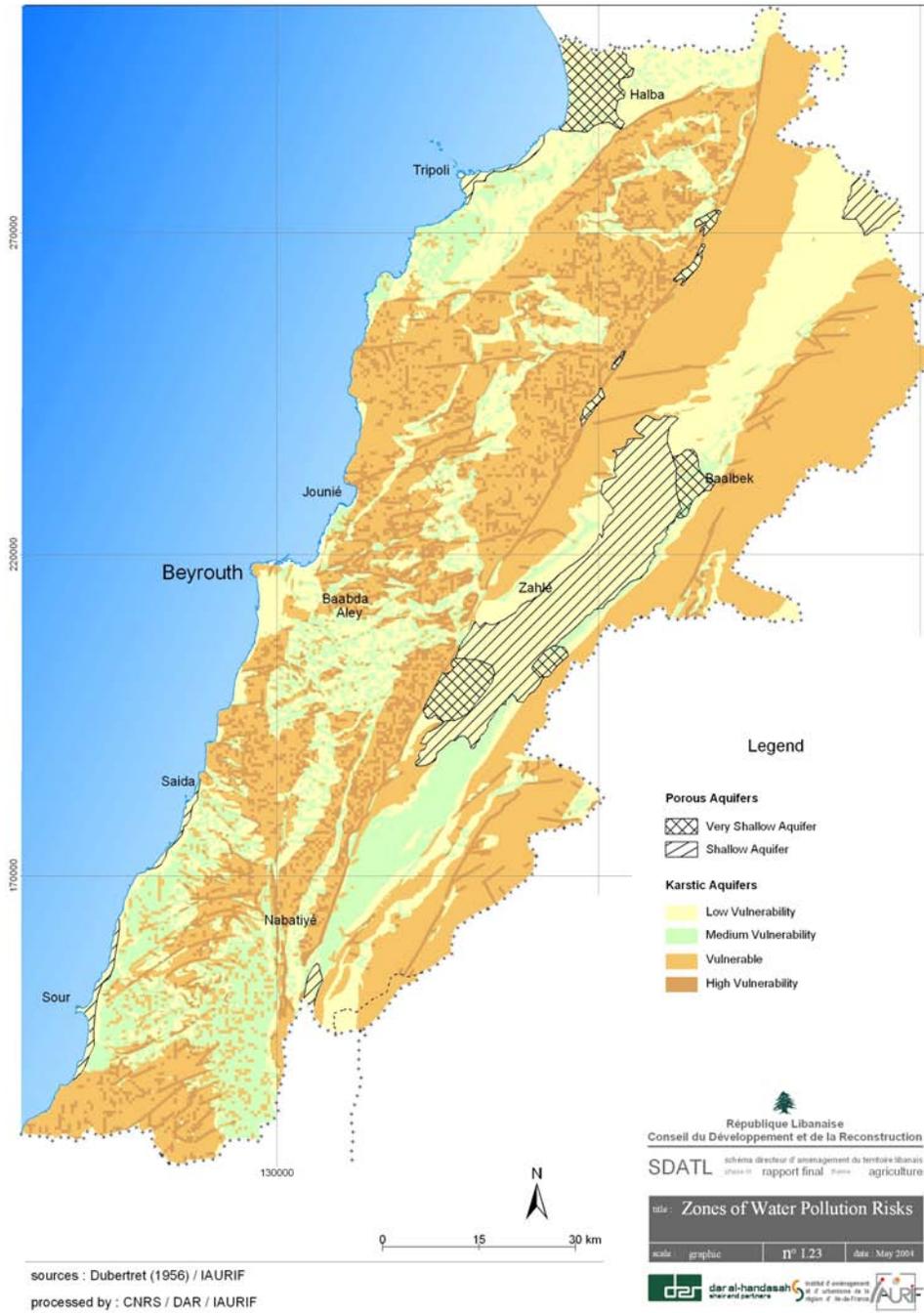


Figure 1.23: Map of Water Resource Vulnerability



## **I.7 AREAS PRONE TO NATURAL HAZARDS**

Natural hazards in Lebanon expose some of the population and their activities, their resources and Lebanon's heritage to serious risks. Some of these natural hazards have been identified.

It is essential to take into account the risks emerging from these hazards in any urban planning and land management approach, to help minimize catastrophic consequences that a natural disaster may often generate.

Natural hazards are numerous: landslides, floods and torrential rain events, desertification, soil erosion, forest fires, earthquakes, tidal waves, etc.

In a land management approach, it is important to deliberate on two of the above-mentioned hazards, floods and landslides, which occur in cycles or short frequencies (year and decade). Most of the time, it is possible to avoid their catastrophic effects by adopting adequate regulations.

### Floods

Torrential floods prone areas have been identified by cross analysis of streams and irrigation channels (flood risk), rock nature and structure in riverbeds (degree of permeability), topography of riverbeds (basin effect), and previously observed events, including those of 2003.

A map for flood prone areas has been produced. It corresponds to areas reported to be at flood risk by several resident generations. These areas are Central Beqaa, plains of Aassi, Wadi Khaled, Akkar and Koura, coastal plains of Sour, Qasmiyeh, Saida and Damour, coastal zone of Chekka, Batroun and Khaldeh, etc.. In North Lebanon people reported that Nahr Abou Ali experienced exceptionally violent torrential floods.

While wisdom of our ancestors had led people to avoid building in flood prone agricultural plains, modern time negligence has pushed people to build parts of cities in such zones. Losses generated from a single flood are far more than virtual losses of the value of land that would have resulted from banning their construction.

In the majority of these regions, floods are the result of soil saturation – usually barely permeable – that leads water level to rise. In some areas, however, they are due to torrential floods of rivers (Qadisha – Abou Ali). In other areas (coastal plains), sea storms create huge tides that “invade” lands and accentuate floods caused by river saturations and rainfall.

## Landslides

Landslide hazards prone areas have been identified by crossing data related to unstable rock constitution zones, steep slope (>40 %), previous events marked on the geology maps, faults and more recent landslide events.

A map for landslide prone areas has been produced. High risk zones are those with steep stream basins of Nahr Abou Moussa, Nahr Qadisha, Nahr el-Jaouz, Nahr Ibrahim, Nahr Kalb, etc. High risk zones also include places with steep slopes often located along faults, especially those of Yammounneh (Jbab el-Homr, Yammounneh and west side of West Beqaa) and Wadi et-Taym, but also Ras Shaqaa in the *caza* of Batroun. The same degree of risk characterizes areas of less steeper slopes, such as the plain of Boqayaa at Wadi Khaled or west side of Koura.

This is surely not an exhaustive inventory. Other areas omitted here for scale reasons (the surface area of these zones were too small to be integrated in the present NPMPLT) should be considered in local urban planning plans.

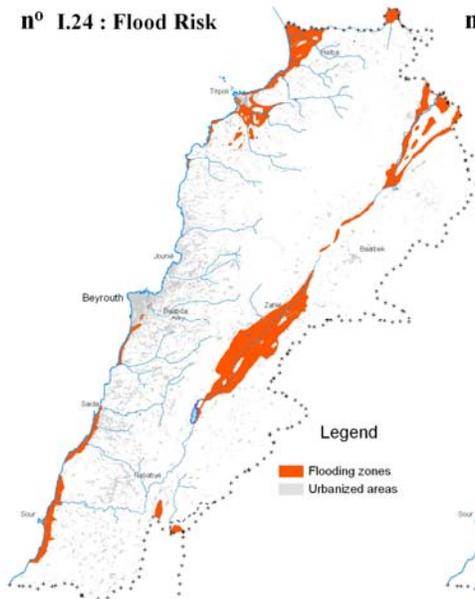
## Other natural hazards

NPMPLT takes into account other risks as well, without however making any specific recommendations of urban planning regulations.

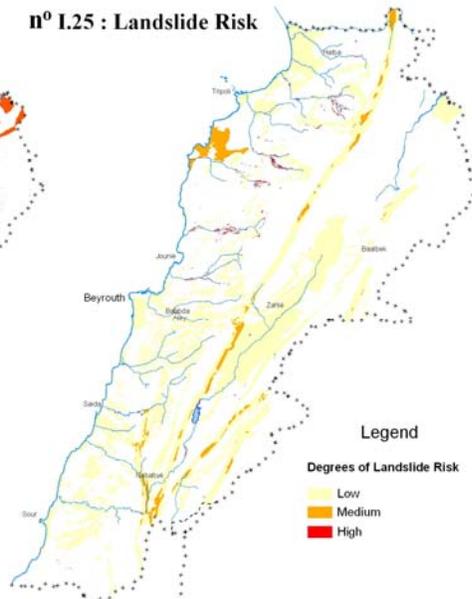
Desertification hazard threatens the arid regions of the Northeast (Hermel and Aassi regions) that are already suffering from economical and social hardships. This threat requires control on urbanization rate, careful management of irrigation and grazing, as well as reforestation efforts. This region should benefit from a development policy, based more on quality (production and service) than quantity improvements. Urban pressure should be oriented, if possible, towards southern agglomerations, Baalbeck and Zahle-Chtaura.

Seismic hazard is omnipresent in every region of Lebanon as a result of its geographical position over two tectonics plates (represented by the two mountain ranges of Lebanon and Anti-Lebanon) that slide facing each other and induce readjustment faults, such as the Roum fault. Hazards are maximal around active faults, but more or less strong tremors could threaten the entire country. Anti-seismic construction regulations are the best solutions to diminish damages and losses. Special attention should be given on Jbab el-Homr, Minyeh, Becharre, Chekka, Ras Chaqaa, Khaldeh, Damour, Wadi Jezzine, Ayshiyeh, Wadi et-Taym and the western part of West Beqaa.

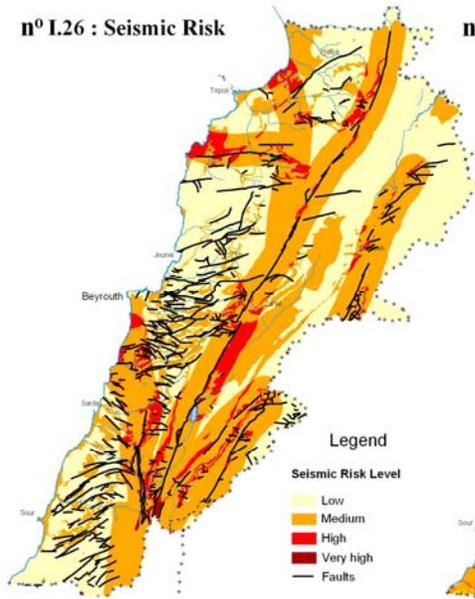
n° I.24 : Flood Risk



n° I.25 : Landslide Risk



n° I.26 : Seismic Risk



n° I.27 : Desertification Risk

