Food and Agriculture Organization of the United Nations
Regional Office for the Near East (RNE)
Oriental Near East Sub-Region (SNO)

Country Study on Status of Land Tenure, Planning and Management in Oriental Near East Countries

CASE OF LEBANON

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Foreword

Land tenure, planning and management gain increasing importance in view of accumulating problems related to natural resources degradation notably for the Oriental Near East Countries (namely the Arab Republic of Egypt, Lebanon, the Syrian Arab Republic, Jordan, Iraq and the Islamic Republic of Iran). Natural resources degradation constitutes an important threat for the human society especially in the Near East region. Land and water degradation is affecting and will affect agriculture and all dimensions of food security, such as food availability, food accessibility, food utilization and food systems stability. Scarcity and degradation of land and water have and will have an impact on human health, livelihood assets and food production as well as growing threat to food security.

The State of the World's Land and Water Resources for Food and Agriculture (SOLAW), recently published, notes that food production has been associated with inappropriate management practices that have degraded the land and water systems.
The global assessment of the state of the planet's land resources is showing that one quarter are highly degraded. Another 8 % are moderately degraded, 36 % are stable or slightly degraded and 10 % are ranked as "improving." The remaining shares of the earth's land surface are either bare (around 18 %) or covered by inland water bodies (around 2%). Some 40 % of the world's degraded lands are located in areas with high poverty rates. Around 30 % are in areas with moderate levels of poverty while 20 % are in areas with low poverty rates.

The Oriental Near East Sub-region (SNO) is one of the most affected regions by direct and indirect causes of land degradation that is remaining one of the main challenges of the twenty-first century. The threats are still present throughout all member countries and will likely worsen with important impacts on sustainable agriculture in general and food security in particular.
Over the last few years, FAO has: i) dedicated considerable attention to land issues and taken a wide range of initiatives and activities, particularly in the Near East Region; ii) promoted sustainable land management constitutes one of the main priorities in the agenda of FAO Regional Office for the Near East; iii) reinforced capacity in land management and tenure for sustainable agriculture in the Sub-region; and iv) helped in the identification of appropriate actions and developing capacities in land tenure, planning and management.

In response to requests from its Member Countries, FAO has also dedicated considerable attention to improve agricultural productivity and food security with special consideration to sustainable land management and natural resources conservation. FAO approaches land management by developing land degradation assessment methods and sustainable land management and decision support tools for national and local levels.

Presently, FAO is more focusing on:

- Land tenure and implications of climate change scenarios;
- Land tenure and implications of policy options in relation to the rapid growth of land use for bio-energy production;
- Land tenure in emergency and post-emergency work;
- Compulsory purchase of land and compensation;
- State land management;
- Low-cost land tenure security;
- Good governance in land administration; and
- Making land information accessible for the poor..

FAO/SNO produced this country study on the "Status of Land tenure, Land Management and Land use planning in SNO Countries" – Case of Lebanon to update information and data, and subsequently, identify issues and priorities for technical and policy support, both with a sub-regional dimension and needed recommendations. It aims at providing a highlight of the current situation regarding land tenure, planning and management and making and adopting potential recommendations on what needs to change at policy and institutional and ground levels to promote interdisciplinary and inter-ministerial/institutional processes.

FAO and its partners, in collaboration with member countries, will continue to cooperate and provide technical assistance with practical and feasible recommendations for promoting sustainable land

management and on what needs to change at policy and institutional and ground levels to promote interdisciplinary and inter-institutional processes on planning, tenure and management in the sub-region.

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Talal Darwish
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Executive Summary

The report deals with land tenure issues in Lebanon and analyzes major problems facing sustainable agriculture in view of natural setting, prevailing practices and existing legislation. Lebanon consists mainly of rugged mountainous regions with slopping and steep lands. The population of Lebanon in 2007 was 4 million with 407,362 residing in Beirut, the administrative capital of Lebanon. One of the main problems in land tenure and land management issues is the cadastre where a significant part of Lebanon is still outside the cadastre (North Bekaa, East Mountains).

Based on rainfall amount and land occupation, Lebanon was divided into five large regions and twelve agro climatic zones. Lebanese agriculture is divided into seven agro-climatic regions with 40 homogeneous agricultural areas (Lebanese Agricultural Atlas, MoA, 2005). The land use map of Lebanon published by CDR (SDATL, 2003) showed that the major agricultural areas are located in the Bekaa followed by the Akkar plain and South Lebanon. Agricultural land use in Lebanon might be represented by three main cropping patterns, vegetables monoculture, wheat potato rotation and land under permanent crops - fruit trees or grape production. The total cultivated land area in Lebanon in 2007 was 277,000 ha (27 percent of the total land area), of which about 50 percent was irrigated. Irrigation water in the country is still primitively managed. According to national irrigation experts, the majority of watered lands in Lebanon (67%) are irrigated by gravity feed systems (furrows).

The protected areas are Lebanon's threatened national living museums representing invaluable scientific treasure and economic security. This report will provide an overview of types of PAs in Lebanon and the institutions that are involved in the designation, protection and management of them. Lebanon has been designating protected areas since the 1930's. Existing classification of PAs includes 16 Protected Forests, 10 Nature Reserves, 24 Natural sites/Natural Monuments, 5 Himas (Ancient Arab system of ecosystem's community-based Management), 14 touristic sites, and a multitude of sites that are worth protection. At present, 8 nature reserves are declared: 6 terrestrial forest nature reserves, 1 marine and 1 coastal. The suggested national category system for PAs is consistent to the IUCN category system.

In 2002, Forests covered 139,376 ha while Other Wooded Lands (OWLs) covered 108,378 ha, 13.3 percent and 10.37 percent of the surface area of the country respectively. Lebanon has 10 nature reserves, 3 biosphere reserves, 16 protected forests, 16 protected natural sites/ landscapes, 4 Ramsar sites and 5 World heritage sites. The forest ownership in Lebanon is almost equally distributed between the private sector, the public sector and the religious communities under several tenure systems Waqf, Macha'a, Amiri and Mulk,

Land use planning identified the bekaa and North Lebanon as agricultural domain of national interest. It includes the best agricultural lands of the country where irrigation networks either exist or are planned. However, several problems face the implementation of land use planning projects first of all the chaotic urban expansion. There is a need for the Governmental institutions and NGOs to implement land capability and land suitability assessment for the whole Lebanese territory to conserve agricultural lands, river outlets, forests and natural sites to sustain healthy environment, maintain natural habitats, biodiversity and eco tourism. Lebanese need to reconcile land use planning laws and regulation set with the Lebanese concept of individual property and freedom.

The report reviews state policy in the management of soil and water resources, challenges, responses and assess the constraints and interventions for sustainable land management highlighting the best practices. Specifically, the report reviews works on how to promote water saving using drip irrigation, disseminate good practices like conservation agriculture, integrated pest management and organic farming. It presents the important role the green plan is playing to help farmers in land reformation, road building, land cleaning, water reservoirs construction, and discuss the promulgation of laws that protect agricultural land and encourage the construction on rocky terrains.

Despite Lebanon's adequate water supply, many skeptics and experts fear that the major water crises will hit Lebanon soon. In Lebanon, the responsibilities in the water sector are fragmented amongst several institutions. The MoEW is responsible for setting the general vision for water resources management and developing plans for expanding and improving service delivery and coordinating projects and monitoring services delivered by the private sector. Despite the recent reduction of water

establishments and orders on water protection, the concept of paying for environmental services and is not implemented.
The general objectives of agricultural development strategy in Lebanon consist of elaborating agricultural policies, improving the competitiveness of agricultural products, reducing physical expansion into agricultural land. This requires updating legislation and regulations (land leases, land fragmentation, transmission of inheritance, annexation of land) and accelerate the solution of legal issues and disputes over land ownership.

The MoA is responsible for forest conservation and development. Forest are threatened by fires, neglect and the lack of management, quarries developed within forested land, grazing and overlapping forest laws.
There is no central body that plans, coordinates and oversees activities on the Lebanese landscape, even though a national land use master plan exists. The MoA needs to develop an adequate legal and policy framework supporting and materializing the recently announced National Forest Program.

The lately adopted laws by the Council of Ministers concerning solid waste management and environmental impact assessment can allow for better protection of environment. Also, the adoption of law for the creation of Environmental Prosecutor and Environmental Police Unit which are given the power to impose and execute penalties to responsible in environmental deterioration require the fast action of the Lebanese parliament to implement these laws.

The report analyzes the chemical, physical and biological land degradation including water pollution and water scarcity, soil erosion, soil salinity, soil sealing and rangeland deterioration. It also discusses the direct and indirect causes of land degradation including the geomorphology of Lebanon, the mismanagement of fertilizer and water input in agriculture, current quarrying practices, deforestation, chaotic urban expansion on the account of productive soils, land use change, overgrazing. It also prospects the conservation practices and governmental control.

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List of Acronyms and Abbreviations

ACSAD	Arab Center for the Studies of Arid Zones and Dry Lands
AFD	French Agency for Development
AFDC	Association for Forest Development and Conservation
ALOA	Association for Lebanese Organic Agriculture
Amsl	above mean sea level
AREC	Agricultural Research and Educational Center
AUB	American University of Beirut
BGR	Federal Institute for Geosciences and Natural Resources
BMZ	German Federal Ministry of Economic Cooperation and Development
CA	Conservation Agriculture
CASA	Centre for Advancement of Conservation Agriculture
CBD	Convention on Biological Diversity
CDR	Council for Development and Reconstruction
CNRS	National Council for Scientific Research
COC	Code of Obligations and Contracts
CRS	Center for Remote Sensing
DDE	Dichloro-Diphenyl-Ethylene
DDT	Dichloro-Diphenyl-Trichloroethane
DEM	Digital Elevation Model
DGUP	Directorate General of Urban Planning
DRDNR	Directorate of Rural Development and Natural Resources
EC	Electrical Conductivity
ESCWA	Economic and Social Commission for Western Asia
EU	European Union
EIA	Environmental impact assessment
FAO	Food and Agricultural Organization
FFEM	Fonds Français pour l'Environnement Mondial
FiBL	Research Institute of Organic Agriculture
FRA	Forest and Tree Resources Assessment
GAC	Government Appointed Committee
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographic Information System
GTZ	German Development Cooperation
GMS	Groundwater Modeling System
GP	Green Plan
HCUP	Higher Council of Urban Planning
IAEA	International Atomic Energy Agency
IAM-Bari	Istituto Agronomico Mediterraneo di Bari
IDAL	Investment Development Authority of Lebanon
IFOAM	International Federation of Organic Agriculture Movements
IPM	Integrated Pest Management
IRS	Indian Remote Sensing
ISO	International Organization for Standardization
LADA	Land Degradation Assessment Analysis
LAG	Local Action Group
LARI	Lebanese Agricultural Research Institute
LBP	Lebanese Pound
LOAD	Lebanese Observatory for Agricultural Development
LUN	Local User Network
LRA	Litani River Authority
MECTAT	Middle East Center for the transfer of Appropriate Technology
MEEA	Middle East Economic Association
METAP	Mediterranean Technical Assistance Program
MHER	Ministry of Hydraulic and Electric Resources
MIC	Mediterranean Institute of Certification
MoA	Ministry of Agriculture
MoE	Ministry of Environment

MoEW	Ministry of Energy and Water
MoJ	Ministry of Justice
MOS	Mode d'Occupation des Sols
MSC	Management Support Consultants
NAP	National Action Plan to Combat Desertification
NDVI	Normalized Difference Vegetation Index
NGO	None Governmental Organization
NL	Lebanese Norms
NOWARA	National Observatory for Women in Agriculture and Rural Areas
NPMPLT	National Physical Master Plan of the Lebanese Territory
OM	Organic Matter
ONF	Office National des Forêts
OP/F	Organic Production/Farming
OWL	Other Wooded Lands
PAD	Protected Areas Department
PH	Potential of Hydrogen
RS	Remote Sensing
SDATL	Schéma Directeur d'Aménagement du Territoire Libanais
SEA	Strategic Environmental Assessment
SEEL	Supporting the judiciary system in the enforcement of environmental legislation
SELDAS	Strengthening the environmental legislation development and application system
SL	Soil Level
SLM	Sustainable Land Management
SISPAM	Stable Institutional Structure for Protected Areas Management
Sms	short message service
SNO	Sub-regional Office for the Oriental Near East
SPA	Specially Protected Areas
SPNL	Society for the Protection of Nature in Lebanon
Spp	species
TCP	Technical Cooperation Programme
TIS	Territorial Information System
UAE	United Arab Emirates
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
USAID	United States Agency for International Development
WADA	Women's Association of Deir el Ahmar
WB	World Bank
WUA	Water Users' Associations
WVL	World Vision Lebanon

Symbols and units

As:	Arsenic
Col/ml:	Escherichia coli per milliliter
Cd:	Cadmium
Cm:	centimeters
Co:	Cobalt
Col/ml:	Escherichia coli per milliliter
Cr:	Chromium
Du:	Dunum = 1000 m^2
DS/m:	Deci Siemens per meter
ECe:	Electrical Conductivity
g/ha :	Grams per hectares
Ha:	hectares
Kg:	Kilogram
Km:	Kilometer
km²:	Kilometer square
Km/hr:	Kilometers per hour
L/sec:	liter per seconds
m^2:	square meter
Mg/L:	milligrams per liter
Mm:	Millimeters
Mm^3/year:	Million cubic meters per year
m^3/sec:	cubic meter per second
N:	Nitrogen
Ni:	Nickel
NO_3:	Nitrate
O_2:	Dioxygen
Pb:	Plomb
PPM:	Parts per million
TC°:	Temperature in degrees Celsius
Zn:	Zinc
$:	American Dollar

PART ONE

I.1. Introduction

Land is considered to be one of the most prominent natural resources since it is the foundation of natural environmental systems. It is also the key factor responsible for the flow and storage of water resources and the source of mineral and mining resources. It is as well, the base on which human residential communities are built and economic activities are performed. However, the capacity of land to achieve these tasks depends on whether it enjoys the characteristics appropriate to these functions. Population growth as well as the spread of the humans' consumption pattern led to pressure on the lands exacerbating the problem of desertification, the degradation of the forest cover and the climate change. Soil and land degradation in several areas threaten the sustainability of natural and human systems on these lands and have a negative effect on soil productivity.

In order to address these pressures, countries agreed on the importance of adopting a comprehensive approach to planning and land-use management, as was mentioned in agenda 21 in the Earth Summit on Sustainable Development. The good organization of cities and villages and the good management of lands preserve the national wealth and natural resources ensuring countries' economic progress and prosperity, in addition to maintaining the integrity of the environment and the public health and safety.

The sustainable land management (SLM) approach integrates land, water, biodiversity, and environmental management to meet rising food and fiber demands while sustaining ecosystem services and livelihoods and assuring the long term potential of these resources (WB, 2006).

The land tenure and land management function is being newly established in the Sub-regional Office for the oriental Near East in view of the need for these countries to address land management and tenure issues stemming from the general limitations of agricultural lands in most of these countries and the problems resulting from the ways these lands are being managed. Lebanon is one of these countries suffering from this problem especially because the system of real property in Lebanon is based on the individual properties that can be transmitted to the individual respective heirs, leading consequently to land fragmentation, low input and low agricultural and financial outputs. The permission of absolute property ownership in Lebanon is one of the major problems in this field.

Laws and regulations are considered also to be a major condition supporting the process of planning and land management as well as the organization of its relation concerning the preservation of the sustainability and the safety of natural resources. In order to achieve these goals, legal texts should address the following aspects and topics related to this field:

1. Regulation of regions, cities, villages and rural areas and determination of land-use and land classification.
2. Utility Regulation (Factories, plants, mines, ports, airports, gas stations...).
3. Building and Infrastructure regulation (Construction Law, appropriation, annexation. and partition, servitude, exploitation and roads, irrigation, water and sanitation networks ...).
4. Regulation of natural sites.
5. Regulation of archaeological sites.
6. Management of public property and state-owned private property (rivers, beaches, archeological regions, historic buildings, Maritime Property, natural sites, valleys, Private State Property, etc. ...).
7. Regulation of the use of natural resources and national wealth (extraction of gravel and dust from rivers and from the sea, use of public property water, use of groundwater, use of quarries and rock breakers, oil exploration...).

The first part of this report, relative to the legal aspects, aims at presenting and analyzing the legal framework for the state of land tenure and land management of the Lebanese legislations pertaining to the urban planning and land management. It also discusses advantages, disadvantages and gaps in it.

I.2. Review of previous studies

Many studies have been conducted on the status of land tenure, land management and planning of land in Lebanon. We can divide the studies into two categories. The first category is related to various scientific studies on the analysis and management of land in Lebanon. The second category concerns the legal studies and legislation related to the use and management of land and natural resources. We will cite some studies as an example.

I.2.1. Scientific Studies

A study titled "Approach to assess soil contamination I: the EIKMANN and KLOKE concept for the assessment of heavy metal pollution in soil" was done by Muller and Darwish, 2004. This study showed the concept for the assessment of the heavy metal pollution of Damascus Ghouta, Syria and the Central Bekaa Plain soils. EIKMANN and KLOKE (1993) concept as a guideline standard to measure the state of soil contamination was used. Findings and recommendations resulting from this work were conveyed to the respective entities to enhance appropriate planning.

Hamadeh *et al.,* 2006 studied "the sustainable livelihood framework to understand land use dynamic in Arsaal, Lebanon". The study found that local people used the outcome from off-farm employment to invest in land management. Major issues remain unresolved like the fact that the sustainability of rural livelihoods does not necessarily imply the sustainability of all ecological systems that make up these livelihoods. However, the livelihoods showed that, without quarrying, the livelihood of many Arsaali would break down, and so would the agro ecological system.

Zurayk and El Moubayid, 1994 studied "Land degradation and mitigation in the Lebanese Mountains". The study revealed that the alteration of the agricultural priorities led to shrinkages in the agriculture land, and to the abandonment of terrace maintenance. However the customary rules governing the use of forested lands were still in place, and included a rotational felling protection cycle. Zurayk, 2001 studied also the Arsaal land use, this study aimed at supporting the sustainable land management in a Lebanese village (Arsaal). Findings of this study revealed that the combination of geographical information system (GIS) and indigenous knowledge provided a satisfactory understanding of the physical and biological land management constraints in Arsaal, encouraged interaction between stakeholders, and created opportunities for the identification of sustainable land management (SLM) options.

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%).

Hamadeh *et al.* (2006) illustrated the situation of competing land use systems and the implementation of the SLM of a mountainous village of the Lebanese drylands. The study suggested the creation of a local user's network (an innovative participatory development policy between communities, researchers, decision makers, and other development actors). The local user's network (LUN) revealed to be a success especially when it facilitated communication between pastoralists and orchard growers. In addition, it managed to initiate two cooperatives: livestock herders' cooperative, the first of its kind in Lebanon, and a food processing and crafts cooperative run by women.

The implementation of livelihoods-based approaches is studied by Rennie and Singh 1996. For the livelihoods "to be sustainable, the natural resources must be sustained". In this study the people-centered model clarifies the linkages that exist between the different components of a livelihood and can indicate the most effective point of entry in order to achieve a positive livelihood outcome, including sustainable land resources. This approach was used in Lebanon in order to enhance the sustainability of land resources in Arsaal, a village of the dry northern Bekaa. Analysis of livelihood showed that only 30% of the household still relied fully on agriculture, while 70% adopted diversified livelihoods based on off-farm employment. Pastoralism and fruit tree cultivation were clashing land uses and were resulting in land degradation. Interventions were conducted at the technical levels, with the introduction of rainwater harvesting, feed blocks for the flocks and intercropping vetch with fruit trees. Other interventions were conducted at the institutional levels, with the creation of a herder's cooperative, a women's cooperative and with the introduction of organic certification to the fruit tree cultivators. Livelihood assets were enhanced as a result of improved land management practices, which resulted in their wider adoption **(**Hamadeh *et al.,* 2006**)**.

A couple of projects in Lebanon are using the value chain-based approaches in order to promote SLM. One of them, the SLM program for livelihood development, implemented by the UNDP is in its early stages, and proposes to introduce industrial hemp to the Bekaa region. Another project implemented by the MoA with support from the Drylands Development Center of the UN is in the process of supporting small producers in the production of traditional products for export through the fair trade channels. It is

still difficult, however, to evaluate the impact the project has achieved on the adoption and implementation of SLM.

The Organic Lebanese Experience was studied by (Zurayk and Touma, 2006). Organic agriculture, while very promising, suffers from a problem of scale of adoption. Several internationally funded projects have been adopted in the ESCWA region, but many organic farmers revert to conventional production after the projects end. The main reason is the absence of incentives to accept the lower yields usually associated with organic production. Another problem is the breakdown of the value chain and the inability of small farmers to capture the value added of organic production. While large investors appear to be able to flourish due to their access to foreign markets, most small producers, who represent the bulk of the ESCWA farmers, are still unable to see the benefit of organic farming.

Sattout *et al*., 2008, illustrated that the total area of Conservation Agriculture (CA) covered approximately 550 ha in Lebanon and over 1000 ha in Syria. The implementation was carried out on-farm and on-the-station in Syria and in Lebanon jointly with the Syrian extension service, American University of Beirut (AUB), Lebanese Agricultural Research Institute (LARI) and approximately 65 farmers in Lebanon. In spite of the advantages of CA, it is not widespread enough in the ESCWA region due to the lack of information, education, awareness and motivation.

Karam, 2001 studied the "Climate Change and Variability in Lebanon: Impact on Land Use and Sustainable Agriculture Development". This paper dealt with:

- The status and potential future of climate change in Lebanon, including climate monitoring and information systems;
- The current and expected future value of the above climate information in contributing to the effectiveness of agricultural management and water resources endowment in the country, with emphasis to land use associated with climate variability;
- The evaluation of specific methodologies of how climate monitoring may reduce the impacts of climatic risks at the national scale, in order to support and plan mitigation activities.

I.2.2. Legal studies

In 2002, Mallat studied the "agricultural legislation in Lebanon". This study aimed to identify the institutional and legal Lebanese agriculture in a spirit of critical evaluation to mark future areas for reflection and action. The MoA in June 2003 prepared a National Action Plan to Combat Desertification (NAP). In this report Lebanon has put in place an institutional framework and is committed to strengthen it further to ensure the implementation of the NAP and the mainstreaming of the United Nations Convention to Combat Desertification (UNCCD) with the development policies of the various line Ministries. An analysis in this report 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. A Regional report of Near East Asia and North Africa relative to the study of the "Land tenure and property rights" was prepared by ARD, Inc, July 2007. This report showed briefly the land tenure and property rights constraints in Lebanon.

In 2004, the Ministry of Environment (MoE) published a book relative to the "State of the environmental legislation development and application system in Lebanon" (SELDAS, 2004). This book compiled all the environmental legislation relative to all sectors (Agriculture, Land use, urbanism, industry, soil, transport, noise…). The SELDAS Book summarizes and presents the texts of Lebanese laws and various regulations currently in force and related to environment and outlines the various areas and sub-areas that should be tackled by environmental legislation. It also studied whether existing Lebanese Legislation and regulations do address and cover these areas, and if so, assesses the quality of coverage and analyzes applicability and enforcement related issues.

In 2010, The Ministry of Justice (MoJ) published a book titled "the Status of Environment in The Lebanese Court". This book refers to all jurisprudences in all sectors of environment especially the land use and agricultural field. This study highlighted the gaps in the law and for protecting the soil, land management, tenure and use. The study showed that the environmental laws are not applied properly. Moreover many laws need amendment for better protection of the soil and agricultural land.

Moreover, initiatives have been taken at the level of the through the Strategic Environmental Assessment project (SEA), funded by the European Union, which deals, it its practical side, with land

use and urban planning. The MoE with several local partners (MoA, the National Council for Scientific Research) prepared a map of the forest cover and land-use which is available online and distributed to those interested as a way to get acquainted with information related to land-use in Lebanon.

I.2.3. Conclusion

Over the years the Lebanese government became more aware about environmental protection, utilization and management of agricultural land. The collected scientific data is thorough but the enacted laws are insufficient to meet the need to protect the land. Indeed, after the promulgation of the law on environmental protection (Law 444/2002), the Lebanese government still has to enact new laws that are more in line with environmental needs. The legislature will have to promulgate new laws and decrees in order to manage land degradation and land use.

However, in a review of the Lebanese legislation (law 444/2002) and of any legal text, there is no clear indication to the need to take plans and environmental policies into account regarding the zoning, land use, exploration of facilities and others on the national and local levels and this is a loophole that must be corrected. In Lebanon, there is an urgent need to get parliamentary approval of the decrees to make SEA a legal requirement. The decree of Environmental Impact Assessment (EIA) was adopted in 2010 which constitutes an important step in land planning, management and protection.

I.3. Land tenure question in Lebanon

Land ownership is considered to be the most influential factor in the planning and land management for agricultural use. The lack of clear and official definition of the elements of property may create conflicts that impede development and planning works and limit the ability to exploit the land in a way that is consistent with the needs of the community, in addition to the negative effects of conflict on the environment, the natural resources and communities. The lack of clarity of land ownership is considered the major cause of land ill-use (exploitation) due to the absence of the party interested in its protection and in taking care of it. An example of this problem is the occupancy of public maritime domain in Lebanon that used to represent a scenic and agricultural land and the repercussions on the environment. Therefore the clear and official definition of the elements of property and land is considered one of the essential elements for the success of the integral methodology of planning and land management.

Private property is very common and encouraged in Lebanon, although the government still owns most public services. Land laws are similar to those in France and the United States however there is no restriction on land use and the government strongly encourages real estate development instead of agricultural exploitation. Both religious and secular courts govern land inheritance.

I.3.1. Tenure types

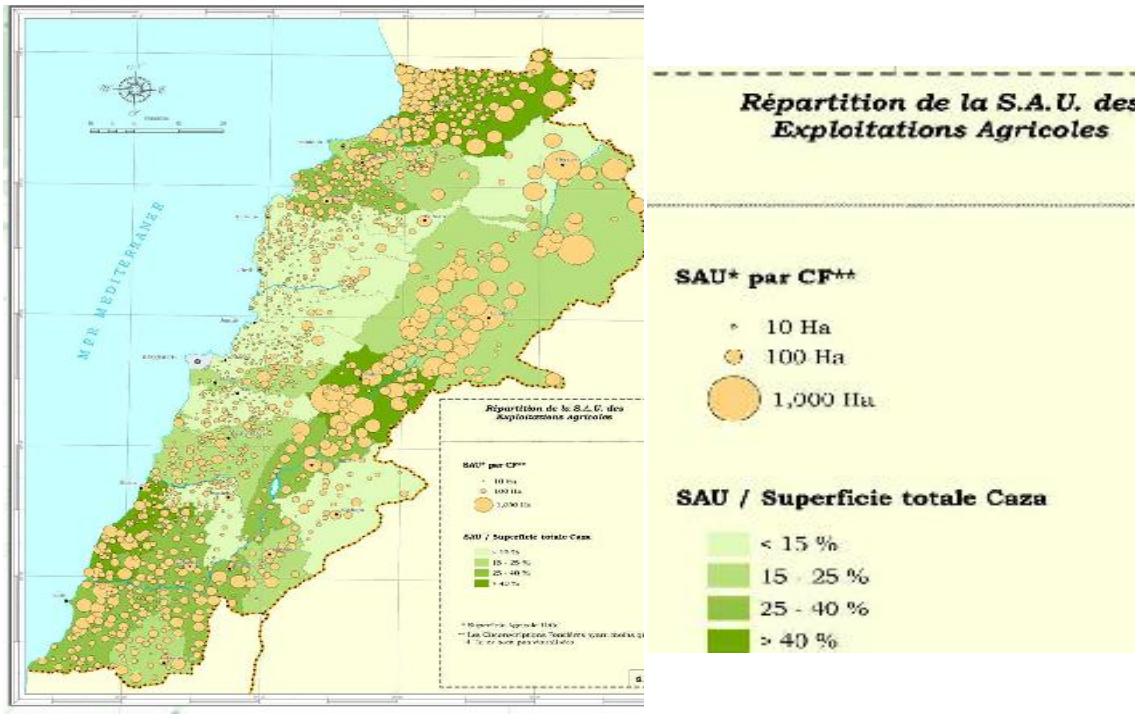
Agricultural and residential lands are privately owned. Rangeland is owned by the government, with use rights granted to local communities. Direct tenure is practiced at the level of 62% of the total useful agricultural surface. This proportion exceeds 80% for small farms with less than 0.5 ha. It gradually decreases with the size class for around 50% for farms with more than 10 ha. The mode to indirect (rental of land lease or nature) is 53 705ha, or 22% of the total useful agricultural surface. It is the leasing of land which is the most common practice with 18% of the useful agricultural surface, while the lease in nature consists of 4% of the total useful agricultural surface. The transitional tenure (issue or problem of succession) is 13% of the total useful agricultural area, while the useful agricultural surface operated as an illegal stranglehold represents 3% of the total useful agricultural surface.

I.3.1.1. Land tenure size

The dimension of the agricultural farms and plots in Lebanon is rather low. The useful agricultural surface that rises to about 248 000 ha is 24% of the total area of Lebanese territory divided into 492 000 agricultural plots (MoA, 2011). At the level of the Mohafazas, the Bekaa takes 42% of the useful agricultural surface followed by Northern Lebanon with 26% (Figure 1). While Southern records only 12%, the Mont-Lebanon and Nabatiyah represent 10% and 11% of the total useful agricultural area of the Lebanon respectively. At the level of the cazas, this rate reached its highest levels in Baalbeck (23%) and Aakkar (15%). The lower levels are registered to the Kasrawan and Bsharri with 1% for each of them. The majority of farmers hold a small useful agricultural area. Indeed, 72% of the total number of farm operators operate a useful agricultural surface less than 1 ha, 22% and 6% operate a

useful agricultural surface of average size between 1 and 4 ha and more than 4 ha respectively. The largest rates were observed in Bekaa, Consequently, the Bekaa and North Lebanon have the largest useful agricultural surface and holding size and can be considered as primary agricultural areas of interest for the country. The government needs to pay special attention to agricultural development of Bekaa and North Lebanon.

Figure 1: Distribution of useful agricultural surface and holding by Caza[1]

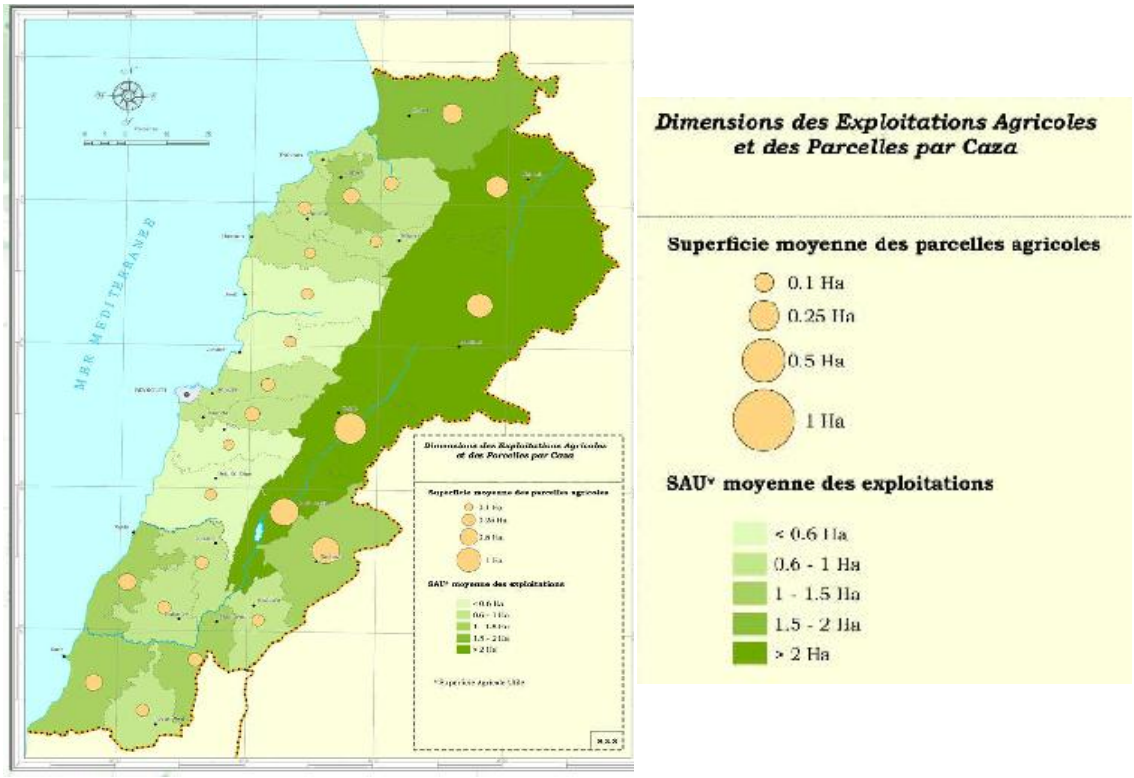


I.3.1.2. Exploitation size

The average useful agricultural surface per farm amounted to 1.3 ha in 1998, marking a decline of 28% from 1961 data. It reached 2.9 ha in the Bekaa while it recorded the lowest level in Mont-Lebanon with approximately 0.6 ha. The mean useful agricultural area per plot is 0.5 ha. It reached its highest level in Zahle with 1.7 ha (Figure 2) followed by the West Bekaa with 1.3 ha and lowest level in Batroun with 0.2 ha. In total, the trend of exploitation size development showed a decrease by 28% of the average useful agricultural surface per farm between 1961 and 1998. The country is faced with the challenge of land fragmentation.

[1] http://www.agriculture.gov.lb

Figure 2: Parcel size and dimension of agricultural exploitation[1]



I.3.1.3. Status of farm operators

According to the 1998 census, the number of farm operators reached 194,829, of which 93% are natural persons. The number of farm operators in 1998 marked a sharp increase (>36%) from the staff of the Census of 1961 and 1970. The vast majority of farmers have small areas of land. Indeed, 75% of operators have less than 1 ha of useful agricultural surface (UAS) and operate approximately 20% of the total useful agricultural area of the country. 95% of operators have less than 4 ha and exploit only 51% of the total UAS. However, although they represent only 2% of the workforce, operators with more than 10 ha possess 30% of the useful agricultural surface.

The distribution of the number of operators by Mohafaza shows a predominance of North-Lebanon (29%), Mont-Lebanon (22%) and the Bekaa (18%). At the level of the cazas more operators can be found in Aakkar and Baalbeck (12% and 10% of the total respectively). The lowest thresholds have been recorded to Hermel and Bsharri with 2% for each of them and 1% for Rachaya.

The distribution of operators by age shows that those over 65 represent 23% of the total number of operators and operate 24% of the useful agricultural surface. However, young operators with less than 35 years represent only a small proportion of 13% and operate approximately 12% of the useful agricultural surface. These proportions become excessively low for operators with less than 25 years with respectively 2% of the total number of operators and 1% of the total useful agricultural surface. It is at the level of the caza of Hermel the highest rate of operators (28%) with less than 35 years can be found, followed by Hasbaya and Aakkar with 19% and Trablous-Minié with 18%. This rate varies for other cazas between 16% to Baalbeck and 5% to Zgharta.

There is a low rate of literacy among farmers/operators. A total of 16% of farmers operating 16% of the useful agricultural surface are illiterate. Operators having 60% of the total useful agricultural surface with a level of education not exceeding the primary constitute 61% of the total number of operators. It is at the level of the caza of Koura where the highest rate of operators (70%) with a higher level of education beyond the primary can be found followed by the caza of Batroun and the Shuf with 57% and 53% respectively. This literacy level is the lowest in Aakkar with 18%.

Beside the age and level of education, the agricultural sector relies mainly on temporary workers and women labor notably in Bekaa and North Lebanon with extended cropping systems. The coastal area with intensive cropping systems relies mainly on skilled and permanent labor. The main destination of the production was the own consumption in 37% of operators, who operated 9% of the total UAS and exploited 1,827 ha of irrigated lands. Olive and fruit trees were the main agricultural speculations of these operators. This rate reached higher levels in the Shuf and Hasbaya (59% and 58 % respectively). The lowest rates were identified to Baalbeck and Hermel with respectively 9% and 8% of products produced for own consumption.

It is clear that the majority of agricultural producers are small farmers. A total of 75% of operators have less than 1 ha of useful agricultural surface. Constraints like old age, low literacy level and temporary labor can interfere with the sustainability of farming profession and implementation of innovative techniques in agriculture. Therefore, the MoA needs to create farmer's schools, consolidate lands, and promote literacy level. Such measures can increase the net return from agriculture and the involvement of new generations in agricultural business both as operators and permanent labor.

I.3.2. Legal framework

The Ottoman Land Code of 1858 regulates land administration and tenure. Under 1971 legislation, the government claimed ownership over rangelands and granted use rights to local communities.

I.3.2.1. Judicial Status of Land

The Land Property Code enacted by the Decree 3339 of 12 November 1939 is a major element of land reform that was established in Lebanon after the Medjelle and the Ottoman code. 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

The Land Property Code has identified different categories of real estate like the types of real estate, property rights and how acquisition of property in Lebanon is possible. It served the establishment of land ownership, conducted all needed legal operations and laid the ground for the implementation of a national rangeland strategy.

I.3.2.2. Categories of real estate

The Decree No. 3339 (amended by law No. 47/71 – 24/6/71 and Law No 173 – 14/2/2000 – Budget 2000) concerning the Real Property Law defined the real estate in four articles (Annex I.A.1)

I.3.2.3. Types of real estate

The Decree No. 3339 (Amended by law No. 47/71 – 24/6/71 and Law No 173 – 14/2/2000 – Budget 2000) concerning the Real Property Law classified the different types of properties in five articles (Annex I.A.2)

I.3.2.4. Rights

Article 10: The following rights in-kind can be applied to property:

a. Possession.
b. Disposition.
c. On the land's surface.
d. Usufruct.
e. Right for priority on Public Barren Property.
f. Real estate servitudes.
g. Mortgage rights: Mortgage and "Sale by faithfulness"
h. Privileges and guarantees.
i. Endowment.
j. Two rentals (one in advance and one adjourned).
k. Long lease.
l. Option resulting from the promise to sell.

I.3.2.5. State and Municipalities Rights

Article 18 of the property code illustrates the right of state and municipalities as follows:

Article 18: If the process of annexation and planning involves the implementation of a design or a layout approved by the authority, the state and the municipalities have to include, for free, to their public property, for the establishment, the expansion and the beautification of roads, streets, free spaces, parks, buildings and public interests, the equivalent of 25% of the whole area of the private property. Existent Public Property or property subject to a decision of seizure that was issued before the promulgation of the decree is not included.

This free deduction of 25% is taken into account only one time in the processes of annexation and partition, that is, the plots resulting from a previous process of annexation and partition in the sense of the concept of this legislative decree, are not included in the calculation of the area subject to the free-quarter of any subsequent process of annexation and partition. If the implementation of the design stated within the scope of the annexation and the partition necessitates that it includes to the public property more than the quarter of the private property area, and if it necessitates the demolition of constructions and the uprooting of plantations, the committee shall apply in the assessment of the expropriated rights values the principles stipulated in the Law of Appropriation in force.

Whereupon, and each time the concerned state or municipality has the duty to pay such sums, the Ministry of Finance shall put the amounts owed by the state at the disposal of the judge so he pays it to the beneficiaries. It also advances the amounts of the same kind, which could be owed by the municipality, to the judge, if this municipality fails to pay them. The Ministry of Finance, in this latter case, has to return the advanced amounts to it or to any other department from the funds belonging to the municipality.

I.3.2.6. Acquisition of right of property registration

Title 9 of the Property listed as follows the different ways acquisition of the right to land registration:

a. By inheritance;
b. For gifts inter vivo and testamentary;
c. By occupation authorized by the State;
d. For the prescription that is acquired in the property funds and fees not included in the Land Registry in quiet possession, service continues as owner for five years by himself or by one third for himself, provided that the possessor has a good reason, and for 15 years if he has no good reason - knowing that the farmer, the usufructuary, a trustee, the borrower or their heirs cannot prescribe (Article 257 of the Property Code);
e. For pre-emption is an exceptional right that allows the holder to evict the buyer of a property mulk or Amiri if he would have an easement on that land (Article 238 of the Property Code).

I.3.2.7. Analysis of real rights

The complete definition of real rights (property, disposition, usufruct, easement and others arte listed in Annex I. A. 3.

I.3.3. Property Improvements of Agricultural Land

I.3.3.1. Works related to real estate improvement

By the 1920s, the legislature referred to enact and implement legislation which would help landowners to promote their land under agricultural and economical use. Thus, addition to the enactment of laws governing land ownership and Land Registry, the order of 37/LR February 5, 1934 entitled "Improvements on agricultural land" has come to regulate the restructuring of rural land. This order that has the force of law consists of three chapters: the first chapter related to land improvement, the second to the procedure of execution for land improvement and the third to the penal provisions. It is necessary within this framework to identify the elements of this legislation; the effects on the field deserve a thorough evaluation to determine to what extent it could support and assist the movement of agricultural development in Lebanon. The detailed articles of Resolution No. 37 LR Issued on February 5, 1934 are listed in Annex I. A. 4.

I.3.4. Foreign acquisition of property

1. The acquisition of real estate rights in Lebanon by foreigners, whether natural or moral persons, is regulated by Legislative Decree Number 11614 dated 4 January 1969 and it subsequent amendments (the "Law").
2. In accordance to the Law, any individual who does not hold the Lebanese nationality is treated as a foreigner.
3. Legal entities established outside Lebanon are considered as foreign entities.

Entities established in Lebanon are considered as foreign entities:

- For *intuitu personae* companies (e.g., general partnerships) and limited liability companies, when the whole of the parts or the shares are not held by Lebanese individuals or when its articles of association do not prohibit the transfer of said shares or parts of these shares to non-Lebanese individuals or companies.
- Joint stock companies or partnerships limited by shares, when the whole nominative shares are not held by Lebanese individuals or fully (100%) Lebanese-owned companies or and when its articles of association do not prohibit the transfer of said shares to non-Lebanese individuals or companies not fully Lebanese-owned.

I.3.5. Restrictions on foreign ownership formalities

a. The Law expressly allows foreign ownership by any one individual or entity of up to 3,000 square meters of land in the aggregate (including built property) across the whole Lebanese territory. For the purposes of the Law, spouses and their minor descendants are considered as one individual.
b. Foreign acquisition of real property over and above 3,000 square meters requires the grant of a license issued by a decree of the Council of Ministers upon the proposal of the Ministry of Finance (the "License").
c. An application for a License shall include a brief description of the purpose other acquisition (e.g., personal use, project).
d. The Council of Ministers enjoys full discretionary power to accept or refuse an application for a License and its decisions are not subject to any form of appeal. However, historically the Council of Ministers rarely has refused to grant a license whenever the applicant complied with the conditions of the applicable laws.
e. Following the issuance of the License, the applicant should complete the purchase of the real property no later than one (1) year; otherwise the License shall become automatically cancelled. Moreover, a foreign individual who has been granted a License shall be required to erect a building on the acquired land no later than five (5) years, and a foreign entity which has been granted a License shall also be required to implement the project (in contemplation of which the License was granted) no later than five (5) years.
f. Pursuant to article 7 of the Law, no further License may be granted for foreign acquisition of real property from a Lebanese individual or company when: 3% of the total surface of the Lebanese territory has become owned by non-Lebanese individuals or entities (as defined by the Law); Within the limits of a particular Caza (a territorial district), 3% of the total surface of the said Caza has become owned by non-Lebanese individuals or entities.
g. Within the limits of Beirut (the capital), 10% of its total surface has become owned by non-Lebanese individuals or entities.
h. The Law provides for specific formulas to calculate the above percentages, which formulas take into consideration the level of foreign shareholding in foreign companies owning real estate in Lebanon.
i. It is to be noted that each time a foreigner is willing to own real estate property in Lebanon; a real estate ownership declaration fee is to be paid amounting to USD 350. The purpose of such fee is to obtain a certificate showing that the foreigner investor does not own real estate property beyond the authorized land area (3,000 square meters) for each foreigner.

I.3.6. Conclusion

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.

By reviewing the Lebanese legislations, we have not noted the existence of any texts linking the planning and study of the public properties process and the private state properties to the subject of protection and safety of the environment, which is a key weakness that should be addressed. It should also be noted that the Lebanese constitution consecrates the right of private property which is a sacred right that faces the attempts to and stop the planning and management and the adoption of regulatory measures which contribute to the protection of the environment and non renewable natural resources.

Other problems are the following:

a. No regulations that restrict land use especially for protecting agricultural land.
b. Foreign entities are buying land for real estate development and not development for agricultural or industrial activities.
a. Sanctions are not followed up properly by the government in case of destructions of forests and agricultural land.

I.4. Laws and regulations

Some laws and regulations related to land tenure are old and referred to the Medjelle and Ottomans laws. Other laws exist in the civil code, and some are very recent as the law for the protection of the environment (law 444/2002). What is complex is the definition of land which may include buildings as it can include natural resources like water. The concept of sustainable land management includes, for example, water, soil, biodiversity, natural resources and so on which is not found in the Lebanese regulations.

Different laws related to land management and land use are quoted below.

I.4.1. Relevant laws and decrees

Some relevant present laws and decrees related to land tenure are listed in Annex I.A.5.

I.4.2. Law for the protection of the Environment (Law 444/ 2002)

I.4.2.1. Financial matters

In relation to financial aspects, the law on the protection of the environment stated the establishment of the national fund for the environment under the control of the Rear Audit Bureau and the guardianship of the Minister of Environment. Several tasks shall be entrusted to it, including contributing to the financing procedures of monitoring and supervision of the implementation of the Environmental Protection Act and its applied provisions, supporting the development research and technological progress in matters of environmental protection. It also entrusted supporting and encouraging activities and sustainable development projects aiming at the protection of the environment, fighting against desertification, deforestation, soil erosion and biodiversity, contributing to the preventive activities that have an impact on the environment in general. The Law granted loans, defined by a decree of the Council of Ministers and based on the proposal of the Minister of Environment and the Minister of Finance, for everyone who would undertake an activity that would improve the quality of the environment. This fund, in the event of its establishment, constitutes a good way to combat pollution of all kinds.

In addition, the Environmental Protection Act comprised several measures that would give financial incentives to companies and people to maintain the environment integrity, including giving reductions

on customs duties by 50% maximum on the equipment and technological devices that allow the avoidance or to reduction or the elimination of all forms of pollution. This is done in accordance with the conditions and the principles that are defined by a decree of the Council of Ministers upon the proposal of the Minister of environment and the Minister of Finance.

Although there is no clear indication of that, the financial points above can be used to control pollution resulting from poor zoning and land misuse in addition to poor investment in other industrial facilities.

I.4.2.2. Administrative Procedures

Including the administrative procedures related to violations, the Environmental Protection Act stated the application of penal sanctions, but did not prevent the power of the Administrations and the competent authorities to take actions against the violator. After warning the violator in writing and him being notified of this warning, the following administrative measures can be taken:

The imposition of special conditions to allow the continuation of the execution of a particular activity, as well as preventive measures, self-monitoring, environmental audit and the suspension of the license pertaining to this activity, until the adherence to the special conditions and to the measures mentioned.

- Prevention of a particular activity because of the serious risks it poses to the environment and annulations of the license concerning it and the closure of the institution.
- Repair works such as removing pollution, reforestation and maintenance of premises, are at the expense of the violator.
- Imposition of the obligations and the fines.
- All other measures designed to prevent or to reduce all damage to the environment.

It should be noted that the legislation provides that principles for addressing matters related to the environment should be identified and should be processed under the provisions in force by more than one ministry or authority, through a joint resolution issued by the Minister of Environment and the Minister concerned so as to ensure coordination and integration in the implementation. However the legislation does not make coordination with the DGUP mandatory with respect to the use and management of land, or the Ministry of Industry in relation to bad exploitation of industrial facilities for example. Coordination depends solely on the Minister of Environment decision.

I.4.2.3. Penalties

The Law 444/2002 stated a number of penalties for violating regulations and procedures mentioned in the law, which cause harm to the environment, including public violations sentenced by a detention ranging from one month to a year and a fine of fifteen million to two hundred million Lebanese pounds (1 $=1500 L.P):

a. Violations associated with conducting environmental impact assessment studies and initial environmental examination.
b. Implementation of projects that are not in conformity with national standards.
c. Opposing or hindering the inspection, control and test procedures set forth in this Act and/or its applied provisions.

The Environmental Protection Act obligated the responsible for any damage that affects the environment due to works done without a permit or in violation of legal and statutory provisions in force, particularly those related to the initial environmental testing studies or environmental impact assessment, to take all measures which lead to the removal of the damage, at his own expense. The expenses resulting from measures taken by the competent authorities to prevent all damage that affects the environment are the responsibility of the person causing this damage. Despite the generality of the provisions set forth above, it certainly applies to the zoning and land use project and the exploitation of facilities and others.

I.4.3. Conclusion

As noted there are a large number of laws covering this area but most of these laws are old and are no longer consistent with the sustainable land management and new approaches to environmental protection. Today mismanagement and land use shows that these laws do not protect the land and there

is an urgent need to update legislation and strengthen their application to protect the non renewable land resources in the country.

I.5. Land use systems

I.5.1. Zoning

The responsibility of the Zoning and land management is primarily that of the Directorate General of Urban Planning (DGUP), subsidiary of the Ministry of Public Works and Transport. The DGUP was established in 1962 (law 24/9/1962) and its cadre was determined in 1964 (decree 16314/1964) then reorganized in 1997 (decree 10490/1997). However, the review of the Lebanese legislative texts has proven the existence of an overlap in the powers in the area of zoning and land management between the DGUP and a number of various public administrations, including the Council for Development and Reconstruction (CDR), the MoE, the Ministry of Industry and the MoEW and the Ministry of Interior and Municipalities (Internal Security Forces).

I.5.1.1. Planning and Studies

One of the main objectives of the regulation of land-use is the suitability of the quality of the land and the possibilities of exploiting it with the aspirations and needs of communities. This enhances the ability of communities and contributes to poverty reduction. Therefore, the successful planning and studies concerning the zoning depends on the integral approach pursued in the studies and on taking all the environmental standards into consideration.

Several functions related to zoning and land management are undertaken through various DGUP departments, namely:

- The Department of Urban Planning Design is developing studies, designs and instructional and detailed systems of urban planning for cities and villages and defining lands necessary for public administrative, cultural, school and hospital buildings, public parks, playgrounds, green spaces, traffic study and the expansion of public spaces (decree 10490/1997 and its amendments).
- The Department of Planning is studying and developing detailed plans for the Urban Planning approved charts and designs and is studying and developing sub-charts, modifying, correcting and extending them as well as indicating squares and parking spaces (decree 10490/1997 and its amendments).
- The Roads and Buildings Department, at the Office of Municipal Projects in the DGUP undertakes the responsibility of developing studies related to public parks, playgrounds, cemeteries and others (decree 10490/1997 and its amendments).
- It should be noted here that the decree of the reorganization and the determination of the DGUP cadre, issued in 1997, imposed the need for coordination with the various departments concerned with environmental affairs, health, safety, agriculture, housing and archeology upon the preparation of the studies and the primary bases for public designs and plans of various areas (decree 10490/1997 and its amendments). This decree charged the Department of Programs and Coordination in the Department of Urban Planning Studies with these tasks. However, the decree has not clarified the quintessence of the coordination and procedures to be performed, which is a weakness in this decree and a legal loophole that could allow the absence of coordination with the MoE, as it notes the absence of any determination of clear environmental criteria and conditions that should be taken into consideration when preparing guidelines charts.

On the other hand, the Environmental Protection Act (law 444/2002) imposed the need to subjugate projects to the initial environmental screening studies and the environmental impact assessment and defined the meaning of the word “Project”, including any program proposal or study or exploitation or organization that affects an entire Lebanese region or an entire activity sector, which applies to the zoning and land-use. However, the extent of this law’s enforcement stays actually limited due to the absence of applied decrees.

The Lebanese legislation has entrusted the CDR with many tasks related to zoning as the preparation of programs and plans, proposing draft laws of reconstruction and development nature, developing the

general guidelines framework project of Urban Planning which achieves the goals of development and reconstruction and presenting it to the Cabinet (decree law 5/1977 and its amendments).

I.5.1.2. Criteria and Conditions

The review of the Lebanese legislation clarified that cities, villages and rural areas planning and the determination of the ways to use the land in these places is achieved by developing designs guidelines and detailed plans prepared by the DGUP through its competent authorities. After the preparation of these designs, the Supreme Council of Urban Planning approves them and submits them to the Minister of Public Works and Transport and in turn the Minister proposes these designs to the Cabinet which should approve them before deposing them at the Presidency of the Republic. This latter issues these designs by decrees and requests their publication.

These designs guidelines and detailed systems have general and special conditions. The general conditions address the following topics:

- Construction (minimum measurements of the plots, cutting back on private roads, superficial exploitation factor, factor of public exploitation, exceptions, etc. ..).
- Partition and annexation and partition (division and forms of the plots, finding open spaces, interface and depth of the property, annexation and partition terms, spaces dedicated for parks and playground, spaces allocated for roads and cars, etc…).

As for the special conditions, they classify the lands and determine their points of use through detailed maps that clarify accurately and explicitly the limits and features of:

- Residential areas and their use.
- Agricultural areas and their use.
- Natural areas and their use.
- Archeological areas and their use.
- Industrial areas and their use.
- Commercial areas and their use.
- Roads and open spaces and their use.

The review of the designs guidelines of a number of Lebanese regions showed the existence of many texts that mention the close relationship between the use and classification of land on the one hand and the safety and protection of the environment on the other hand, whether in the general or in the special conditions of these designs. Main clauses clarifying some of these texts are listed in Annex I. A.6.

I.5.1.3. Methods available to protect the prejudiced

The review of the Lebanese legislation has not shown the existence of any legal provisions that determine the administrative and judicial procedures (control of infringements and sanctions) associated with environmental violations related to zoning.

I.5.2. Construction and infrastructure

I.5.2.1. Planning and Studies

The review of the Lebanese legislation did not reveal the existence of any legal provisions that link the construction sector with the subject of protection and environment safety which is considered to be a fundamental weakness that should be addressed.

As for the infrastructure related to water and electricity, the legislative texts have charged the Lebanese Department of Sanitary, Mechanical and Electrical Engineering, at the DGUP, with the elaboration of studies and documents necessary to implement public health works and mechanical and electrical networks, and with the study of the collection and disposal of wastewater, sewerage and rainwater. Here, we note the absence of any reference to the need for coordination with the MoE when carrying out the studies required. This is in addition to the absence of standards and clear environmental conditions that must be taken into account when preparing guidelines charts.

The decree organizing the MoEW and determining its cadre charged the water department in the ministry with the following tasks (decree 5469/1966 and its amendments):

- Studying the natural resources of water and reckoning them.
- Studying the needs for water of each region and designing the main lines of the construction projects.
- Studying the proposed irrigation projects from an economic view in terms of project costs and income expected after the implementation and the amount of water available to enable the management to decide whether the project should be implemented or postponed.
- Studying irrigation systems.
- Appointment of areas suitable for irrigation by studying the classification and the determination of soil.
- All transactions relating to Public River Property.
- Studying of water drainage to remove excess moisture in the land.
- Mapping of private establishments related to projects of irrigation and drinking water, including dams, bridges and others.
- Developing a census of all metals and quarries that can be used for civil or industrial engineering.

We note the absence of any reference, direct or indirect, to the need for coordination with the DGUP and/or the MoE when carrying out the above tasks. This is in addition to the absence of reference to the need to adopt standards and environmental conditions when doing network design and infrastructure.

As of the Directorate of Electricity in the MoEW, it undertakes the following tasks (decree 5469/1966 and its amendments):

- Design of the main lines of electricity projects.
- Study of the junction network.
- Study of the high and low tension lines.

It is noted here as well that there is no reference to the need for coordination with the Urban Planning and/or the MoE while studying these electricity networks and identifying the tracks and the land through which they must pass. This is in addition to the absence of any mention to the need to take into account the conditions and environmental standards when undertaking such studies.

It is noted from the above, that there is an overlap in the powers and responsibilities between the DGUP and the MoEW, concerning the design of water and electricity.

I.5.2.2. Criteria and Conditions

From the review of the design guideline and the detailed regulation for a number of regions in Lebanon, it appears that it stated some of the texts that set out the conditions for the environmental-related construction, including:

- When making an additional loft building on the existing building, the additional building must be built with the same materials used in the existing building as of the interfaces coating and the same holes that are in it.
- In provincial and rural areas, (in general) the natural stone should be coated and bricks should be used on the rooftop (the ratio depends on the nature of the region).
- In general, the review of the guidelines charts showed that, when you do construction works, you must plant at least one tree for every tree cut, two trees in some cases, especially when the cut tree is an olive tree.
- Trees must be planted in areas that are not built (and in general, and based on the review of guidelines charts, it was found that the ratio is usually one tree per 100 m^2 or 200 m^2 according to the region).
- Trees are to be planted along the front property facades that are adjacent to public and private roads, within the legal limits of decline (and usually the distance between the trees is a maximum of 3 meters and the width of a row of shrubs is one meter).
- A specific area should be left for forestation in the provincial and rural properties (usually 15% of the property).
- It is allowed to reduce the roads width when the property is in a mountainous or a forest area (when needed) to reduce the number of trees to be cut.
- The establishment of any building of any form is prohibited in the natural areas as it is prohibited to modify or change the natural face of the land.

- A decline by a certain distance of public and Maritime Property is required (usually 10 meters).

It should be noted that the points above mentioned cannot be generalized on charts guidelines, as these conditions vary depending on the characteristics of the region under study. These points were mentioned in general, based on the review of a number of charts guidelines, only to illustrate the relationship in the special conditions between the building and the environment.

I.5.2.3. Licensing and Sector Monitoring

It appears from the review of the General Design guideline text of a number of Lebanese regions, the existence of several legal provisions specifying certain environment-related conditions for licensing and allowing construction, some of which are:

- An altitude map of the natural property land showing the location of existing trees, their kind and their location made by an engineer or a surveyor must be attached to the building permit file. It must also indicate the number and locations of trees to be cut as well as the location, the number and the quality of the trees that will be planted instead of those cut ones. This would be a prerequisite for a building permit.
- The DGUP can refuse a building permit in case the person concerned changes the parameters of the natural land or demolishes buildings with architectural value or uproots trees or burns them or starts leveling the land before getting technical clearance from the relevant authorities for licensing.

The Lebanese legislation also regulated the method of licensing and investment of other non-industrial facilities, and how to manage the lands of these facilities and the means of protecting the environment from them. Specifically, the Lebanese legislation has identified the way of licensing for the following facilities:

a. Slaughter houses
b. Solid waste treatment centers
c. Low-income housing
d. Mines
e. Gas stations
f. Centers of tourism and summering
g. Ports

I.5.2.4. Methods available to protect the prejudiced

Concerning construction, the Penal Code of 1943 stated several penalties for vandalism and damage to buildings; as for example and not for limitation, penalties for burning buildings. However, the environmental aspect is weak or absent in the stipulated penalties.

I.5.3. Natural Sites

I.5.3.1. Planning and Studies

The Lebanese legislation charged the Department of Programs and Coordination at the DGUP with the responsibility of stating touristic and natural regions, studying ways for their development and their conservation, proposing green areas or landscapes that have to be protected and preserved and carrying out the research required for that (decree 10490/1977 and its amendments). The legislation also required the need for coordination with various departments and all competent authorities (including the MoE and MoA) while preparing studies and initial foundations for the designs and plans for the various regions.

The legislation charged the Lebanese departments, which comprise the Nature Conservation Service at the MoE, with developing studies for natural sites, their preservation and their protection. Indeed:

- The Department of Planning and Programs is in charge of the development of necessary studies and recommendations concerning the use of communal lands and their classification, especially those that must be given care and protection (decree 5591/1994 and its amendments).

- The Department of Natural Resources Protection is in charge of the preservation of the landscape and its classification and proposing draft resolutions and decrees for its protection (decree 5591/1994 and its amendments).
- The Department of Parks and Reserves is in charge of the determination of natural sites appropriate for the establishment of natural reserves and the conditions to be provided in these reserves and to encourage local authorities to create gardens, yards, parks and public swimming pools and propose the appropriate places for that (decree 5591/1994 and its amendments).

We note the absence of a clear reference to the necessity of coordination with the DGUP in relation to the functions of these departments.

The law on the protection of landscapes and natural sites in Lebanon, issued in 1939 and amended by the law 216/93 also dealt in detail with the classification and the protection of natural sites and stated the following:

- All lands or properties that it is necessary to classify in order to isolate a natural site or a landscape or to clear their sides, can be classified as natural sites or landscapes (law 7/8/1939 and its amendments).
- It is possible to impose legal servitude rights in the public interest on each property or land that is close to or in front of a natural site or a landscape with a view to preserve its technical or attractive feature to tourists (law 7/8/1939 and its amendments).
- All projects of major works of any kind, if they are related to the site or to the landscape (whole or in part) that is classified must be submitted to the Minister of Environment for approval (law 216/93).
- In the proposal of classification and in the decree issued by the Head of State, each special case has to determine the limits of the landscape or the natural site limits of the landscape which is to be classified and the decree shows, when necessary, the special Servitude rights required and these rights do not require the payment of compensation (law 7/8/1939 and its amendments).

Later, the legislative Decree No. 22-1943 transferred all the powers and functions vested to the Minister of National Economy to the Minister of Interior, while article 8 of the law of the establishment of the MoE cancelled all legislative provisions that are contrary to the provisions of this law or which do not coalesce with its content. Article 2 of the same law transferred to the MoE the power of classifying landscapes and natural sites, determining the location of the establishment of natural reserves of all types and proposing draft laws and regulations for their protection and their management, as it mentioned the necessity of coordination with the departments concerned. Although this article did not specify, in a clear and direct way the necessity to coordinate with the DGUP and the way to conduct this coordination, the legislation still suffers from weakness in this area and this imbalance must be corrected through noting clearly and explicitly the need for coordination with the DGUP and clarifying the procedures to be followed when carrying out such coordination concerning studies on natural sites.

Knowing that the Decree No. 5591-1994 stated that concerning the issues relating to the environment affairs, and which are dealt with by more than one ministry or authority, the origin and the handling of these issues must be determined by a common resolution issued by the Minister of Environment and the Minister concerned so as to ensure coordination and integration in the implementation.

In application of the Law of protection of natural sites, the Decree No. 434-1942 was enacted and specified several regions and natural sites that must be protected, including " Bikaat al Arz", the site of " Deir el Kalaa", the site of " Bois de Boulogne", the site of " Sindyan el Mrouj", the site of "Horsh Beirut", the site of the historic buildings of Baalbek, the site of "Lake Yamoune" and the site of the natural bridge on " Nabh el Assal". The scope and limits of these sites were also specified by virtue of detailed maps.

The Decree No. 836-1950 was enacted to regulate the Cedars region preservation and protection as an important natural site. It divided this region into seven sections dedicated to the following uses, with several conditions to ensure the conservation of this region:

a. Vicinity of the Cedars

b. Dedicated to aforestation
c. Dedicated to winter sports
d. Dedicated to buildings and private homes
e. Dedicated to gardens and parks
f. Dedicated to summer sports
g. Dedicated to the construction of hotels, amusement parks, temples and other public buildings.

Moreover, the law of the establishment of the MoE, in coordination with concerned public administrations, undertook the classification of landscapes and the determination of the establishment of natural reserves of various types, in addition to proposing draft laws and regulations for their protection and their management.

I.5.3.2. Criteria and Conditions

The decree organizing the MoE, the determination of its cadre and the conditions of appointment of some of its functions, charged the department of preservation of natural wealth in the MoE with the setting of the bases and conditions of communal land use and forests, in coordination with the concerned authorities. This was done in a way that prevents its exposure to degradation and pollution, according to what is set by the Programs and Planning Department (decree 5591/1994). The text did not note explicitly the need for coordination with the DGUP, but noted only the need for coordination with the concerned administrations.

I.5.3.3. Licensing and Sector Monitoring

Concerning the inventory of the landscapes and natural sites:

- At the MoE, shall be set a complete inventory list of the landscapes and natural sites, of which the maintenance and the protection is of public interest, whether in view of art or urban planning or tourism. They are considered as landscapes and natural sites, trees and kinds of individual trees, which should be preserved in view of their age or beauty or historical value (law 8/7/1939 and its amendments).
- The MoE includes landscapes and natural sites in the inventory and notifies their inscriptions on the list, the administrative way, to the high cadre, and then he notes their registration on the property cadastre with the Land Register for free, in the section dedicated for the mention of inscriptions and conditions related to the right of disposition (law 8/7/1939 and its amendments).
- The inscription in the inventory imposes to the owner not to start, in his land, or let anyone start, to make any change in the registered property or in a part of this latter and in particular not to construct any building. Overall, he is required to refrain from any action that would change the general appearance of the landscape or natural sites or spoil or lessen the importance given to tourism, as he is required to refrain from cutting or trimming any tree before he notifies the MoE of his intention and explains to him the changes or works that he intends to make and obtains from him the necessary license. Anyone who violates the provisions of this Article shall be sentenced with a cash fine and a Compensation Lawsuit can be filed against him (law 8/7/1939 and its amendments).

Concerning the landscape and natural sites taken out of the classification:

The removal of landscapes or natural sites from the classification, whether in whole or in part, is determined pursuant to a decree issued by the President of the Republic upon the proposal of the Minister of Environment. This decree is communicated to important people and a replica of it is sent to the Secretary of the Land Registry who proceeds to crossing out or mentioning what is required on the property cadastre.

Several resolutions and decrees have been issued, over the years, by the MoE for the conservation and protection of several natural sites such as “Nahr el Jawz” river, “Nahr el Kalb” river, the stream of the valley of Damour, the riverbed of Beirut River, the riverbed of “ Nahr el Awwali”, “Makmel” mountain, etc.. . These decisions noted the need of coordination with the DGUP in order to give any license, for building or installation in some natural regions, which takes into account the protection measures deemed necessary by the MoE, while further decisions prevented any building or installation

or investment in other natural regions. Certainly, this decision depends on the sensitivity and importance of the natural region under study.

I.5.3.4. Methods available to protect the prejudiced

The law on the protection of landscape and natural sites in Lebanon, issued in 1939, stated the following penalties for damage to natural sites:

- Within the scope of land classified as a landscape or as a natural site, it is prohibited to perform any act of limitation or restoration or construction or irrigation or fixing of columns designed to put wires that bear a force nor the establishment of a cemetery or a depository of debris or wastes, nor putting plants or making pits or cutting or pulling any tree. In general, it is not allowed to make any changes in the landscape or the natural site except after obtaining a license from the MoE. Any violation of the provisions of this article shall be sentences by paying a cash fine while reserving the right for compensation by a lawsuit that could be filed (law 8/7/1939 and its amendments).
- Whoever destroys or distorts or damages intentionally a registered or stated landscape or a natural site shall be sentenced by paying a cash fine while reserving the right for compensation by a lawsuit that could be filed (law 8/7/1939 and its amendments).

I.5.4. Archaeological sites

I.5.4.1. Planning and Studies

The Lebanese legislation charged the Programs and Coordination Department in the DGUP with the statement of touristic and archaeological regions and the study of ways to develop and preserve them, and proposing old neighborhoods or historic buildings that have to be protected and preserved and carrying out the necessary studies for that. The Legislation also required the need for coordination with various departments and all competent authorities (including the Directorate General of Antiquities and the MoE) while effectuating these tasks.

The provisions of Article 19 of the ancient monuments regulation stated that maps related to the expansion and beautification of cities cannot be decided except after the approval of the Director of the ancient monuments department. An engineer of the Antiquities Department contributes to the development of these maps. When it comes to a locality where archaeological interest is the most important of all interests, an engineer from the Department of Archaeology develops these maps (decision No. 166 / L.R. in 1933).

Over the years, a number of decrees and resolutions have been issued under which some of the buildings and sites were considered historical sites including the Mosque of "Amir Monzer" in Beirut, the area surrounding the "Maaniyon" and the "Al Shihabaon" princes palaces in Deir el Kamar, "Kanater Zubaida", ruins of Anjar, constructional monuments in Nahr Ibrahim, Adonis sculpture in Gheeneh.

I.5.4.2. Criteria and Conditions

Some of the conditions specified that should be reviewed in order to preserve the antiquities have been noted, including:

- Not to take any action that would alter the shape of the land and of the region except after obtaining the approval of the Directorate General of Antiquities.
- Building or renovation of any building in the archaeological region is not allowed before obtaining a previous license from the General Directorate of Antiquities.
- In some cases, around the archaeological region or the historic building, there is a prohibited area for a specific distance (50 to 200 meters in total) from all sides and the right for servitude states the inadmissibility of construction on the above mentioned surrounding scope.

I.5.4.3. Licensing and monitoring sectors

The decision No. 166 / L.R. in 1933 defined the regulation of ancient monuments and how to preserve the monuments and protect them. This decision dealt, through its various articles, with the way of licensing, the use of property and ancient monuments while assuring their protection and their

conservation. As for example and not for limitation, the following Articles are pointed out to (with the observation that the focus here is on the immovable ancient monuments due to their direct relationship with the subject of land and property management).

- The historical buildings general record is open at the Directorate of the Department of Antiquities.
- Shall be entered in this inventory: (1) State-owned Immovable ancient monuments (2) Immovable antiquities that are the property of individuals or endowments or moral persons or communities or groups and of which the preservation is of artistic or historic public interest.
- The inscription in the inventory prevents landlords from making any alteration to their land in the property or in a section of the property restricted and in general that they do not effectuate any work that would change the monument's view or change its feature without informing, two months in advance, the Department of Antiquities of their intention, and that they define the modifications or works they intend to make. Any violation of the provisions of this article shall be sanctioned by a cash fine sanction and this does not preclude the possibility of a compensation claim.
- The Department of Antiquities studies these projects, if they harm old buildings, it will make every effort, by an amicable discussion with the landlord, to modify the project. If no agreement can be possible, the Department of Antiquities can object to the execution of the works through registering the land and the properties as historic monuments in the general inventory record. If it approves the execution of the works, it supervises them to make sure they are in accordance with the license given to them.
- It is possible to put legal servitude rights of public interest on each property or land located close to a historic building or a sight of it in order to preserve its artistic or archaeological feature or the feature of its magnificent appearance.

Based on the above mentioned, the existence of several provisions in the Lebanese Antiquities regulation protects and preserves the ancient monuments, and that is by determining the licensing process for the use of property and monuments. However, the absence of provisions that impose the need for coordination between the Directorate General of Antiquities and the DGUP in a clear and explicit way, as well as defining how to do this coordination and the procedures to be followed, remain significant gaps that must be addressed.

I.5.4.4. Methods available to protect the prejudiced

Administrative procedures

The law relating to ancient monuments, issued in 1933, stated that the Department of Antiquities, after a notification sent to the landlord and remained useless, could conduct repairs or maintenance deemed necessary to save the buildings recorded or contained in the inventory and which do not belong to the state. In the event of a necessity to hurry or in the presence of risk demonstrated by the technical municipal services or by the Department of Antiquities, the Director of the Antiquities Department or the mayor, in agreement with the Director of the Antiquities Department, after a day of notification of the landlord by the President of the Court of First Instance, requires the issuance of a decision, in which he appoints within twenty four hours, a men related to art people to check the status of the buildings and the work design developed by the Antiquities Department engineer. This expert has to present a report to the court's Registrar within twenty-four hours after the date of his appointment. The court must decide, within forty-eight hours after the date of the filing of this report, whether the duty of the landlord is to conduct the works required under the control of an engineer from the Department of Antiquities and within a period to be determined, or to pay to the Department of Antiquities an amount sufficient to cover the expenses that result from these works.

Judicial Proceedings

Articles 730 and 731 of the Lebanese Penal Code relating to damage to state property and individuals' property state the following:

- Anyone who demolishes or ruins intentionally buildings, monuments, statues or other structures designed for the benefit of the public or for public decoration shall be sentenced by imprisonment from six months to three years and by a cash fine.
- Anyone who demolishes or ruins a memorial or anything movable or immovable of historical value or a statue or a registered landscape, whether it is his property or others' deserves the same sentence.

The law relative to ancient monuments, issued in 1933, stated as well the following penalties related to damaging antiquities:

- It is prohibited, in general, to destroy movable or immovable ancient monuments, to damage them, to distort them and to write anything on them or sculpt them. It is also prohibited to own any materials from old buildings or that were in old building. It is forbidden to sell them or buy them without a license. Any violation of the provisions of this Article shall be sentenced by a cash fine and it does not preclude filing a Compensation Lawsuit.
- It is not possible to demolish a building registered in the general inventory or to move it from its place or to move a part of it, or to restore it or repair it or alter it without the consent of the Department of Antiquities. Any violation of the provisions of this Article shall be sentenced by a cash fine and it does not preclude filing a Compensation Lawsuit.
- It is not possible, on a land registered as a historical site, to build a depository of debris or wastes or to plant or dig or cut or pull trees from this land, or to construct a building on it or to carry out watering or to build a cemetery. In general, its actual situation may not be changed without a license from the Department of Antiquities. Any violation of the provisions of this Article shall be sentenced by a cash fine and it does not preclude filing a Compensation Lawsuit.

I.5.6. Natural Resources and National Wealth

Natural resources and national wealth include the following:

a. Public water
b. Sand and gravel extracted from the Maritime Public Property
c. Sand and gravel extracted from quarries and rock breakers
d. Extraction of gravel and dust sediments from the sea, oil exploration
e. The use of groundwater
f. The use of forests and forestry
g. The use of pastures and others

I.5.6.1. Planning and Studies

The review of the Lebanese legislation did not note the presence of any texts linking planning and investment operations of public water or the extraction of sand and gravel from Public Maritime Property or quarries and rock breakers, which is considered as a key weakness that should be addressed.

I.5.6.2. Criteria and Conditions

Concerning the investment in public property water, the resolution no. 320 issued in 1926 regulated the use of public property water and how to preserve it. This resolution has been amended under the Decree No. 680-1990. These texts define several conditions for the use of public property water and prevent any of the following in any way:

a. The destruction or demolition or breakdown of any kind, of all or part of a construction built for the use of public property water such as bridges, dams, archways, navigation, irrigation or drying or drainage canals, pipes outstretched on the surface of the ground or embedded in it, distribution devices, etc...
b. That water or materials harmful to the health or the public comfort be thrown in public property water.
c. The dumping of animal and fertilizer in the territories falling within the protection zone of a spring of water used for the public needs and the creation of repositories for wastes and generally performing any action that pollutes that spring.

The review of the Lebanese legislation did not observe the existence of any legal provisions that determine explicit conditions and environmental standards for sand and gravel extraction processes from the Maritime Public Property or quarries and rock breakers. It only observed environmental requirements for the exploitation of quarries and rock breakers, as part of the decree regulating quarries and rock breakers.

I.5.6.3. Licensing and monitoring sectors

Resolution 320 issued in 1926, determines the way to license for the exploitation and use of public property water. In particular, this law stated the following:

- It is prohibited, without a license granted by the administration, to do the following actions: (1) Prevent the public property water of running freely (2) Commit an infringement of any kind on the borders of the lands belonging to the temporary or permanent water banks of streams, swamps, brooks, lakes, ponds and springs, as well as on the border of water arches' passageways and their canals, and navigation, irrigation, drying and drainage canals declared as set up for the public benefit (3) Effectuate any deposit or ingrain or planting on the land connected to temporary or permanent channels and in their flume, as well as in lakes, swamps, ponds and springs and between the borders of the canals passageways and arches of water pipes and navigation, irrigation, drying and drainage canals declared that they were set up for the public benefit (4) Remove grass, trees, shrubs, soil or stones from the land of the temporary or permanent water banks, lakes, swamps, ponds and springs (5) Clean the temporary or permanent water channels or deepen them or arrange them (6) Do works related to exploration of underground or gushing out water. It is possible, in private properties and without a license, to drill unsporting wells of which the depth does not exceed a hundred and fifty meters (7) It is prohibited, in general, to do any temporary or permanent work that may have an impact on the amount of public property water or on its flow.
- Special conditions to grant License are defined in the License as: (1) If the license is related to water exploration, the region where the works will take place, the methods used to drill or drain water, the instructions or the forms that the license holder shall submit to the Administration and the conditions under which the monitoring of works will be carried out, shall be defined in the license. (2) If the license is related to establishing a construction on the water channels or a construction to put these channels together or any project related to water flow, the licensed works location, their type, their order and their fundamental size shall be mentioned and the conditions of control of the establishment of a construction, its preservation and its investment shall be mentioned too. (3) Measures to be taken to protect against the inundation of water and the preservation of public health and to meet the domestic needs of the people nearby, as drinking and others.

It is clear from the foregoing, that the licenses given to the use of public property water take the protection and safety of the environment into consideration, but in an unclear and indirect way. These provisions omitted to specify the environmental explicit and clear criteria and conditions that must be adhered to in order to obtain a license to explore public property water (for example the maximum limits to water and noise pollution from the usage, etc.). This is a loophole in the legislation that must be addressed. These texts omitted as well the need for cooperation between the MoEW on the one hand and the DGUP and the MoE on the other hand, in this area.

As for the investment in quarries and rock breakers, the Lebanese legislation has charged the Department of Protection of Natural Resources at the MoE with determining the environmental conditions that must be met in the license applications conducive to the exploitation of mines and quarries, the extraction of sand and the establishment and investment of quarries, mixers and asphalt factories, in a manner to prevent the distortion of the environment and its pollution, and reporting it to the competent authorities.

The MoE has developed over the years a number of decisions setting out the terms and method of Licensing for quarries and rock breakers. These decisions have stated the need for the license application to include an environmental study that comprises several maps and reports which are to explain the proposed use of quarries and the way to maintain the environmental integrity during the exploitation period. Among these reports, a report must be submitted, containing an environmental study of the direct and indirect impacts resulting from the use of quarries such as air and water pollution, health damage resulting from it, destruction of plants, noise and damage caused by transportation, and damage to infrastructure, etc., and propose solutions to limit the damage.

This review also indicated that the licensing decision to invest quarries are given for a period ranging usually between five and ten years, subject to annual renewal of licenses after the MoE are sure of the correctness of the implementation to this date. This includes field control to make sure all the implementation and all the environmental conditions imposed on the use of quarry mentioned in the

exploitation license are implemented. But the extent of effectuating these environmental controls at the field level remains doubtful.

I.5.6.4. Methods available to protect the prejudiced

Administrative procedures

The review of the Lebanese legislation has not shown the existence of any Lebanese administrative procedures concerning the violations related to the exploitation of public property water or the extraction of sand and gravel from Maritime Public Property.

As for the extraction of sand and gravel from quarries and rock breakers, the Lebanese legislation charged the Control Department in the MoE with ensuring the application of the conditions imposed on poultry farms, animal farms, rock breakers, quarries, mines and graveyards in coordination with the departments concerned (without a clear signal to the DGUP).

The MoE has established as well several decisions securing the ministry rights to impose new environmental requirements if necessary and to exercise its right to carry out regular monitoring and to take appropriate action against offenders, including the suspension of works being done under the licenses given to them to exploit quarries and rock breakers. These decisions remain in force, but it is possible to refute their legality during the course of opposing the measures taken for their enforcement.

Judicial Proceedings

The review of the Lebanese legislation has not shown the existence of any legal provisions concerning the control of violations (from an environmental perspective) related to the exploitation of public property water. However, the decree regulating quarries and rock breakers states legal mechanisms to deter offenders and control violations. The Decree No. 8803-2002 and its amendments has assigned to the National Council for Quarries the power to propose that rock breakers operate outside the quarries and to stop them in case of violation as well as proposing appropriate measures concerning them. The executive power to set the violations is also assigned to the governor.

Penalties

The Penal Code stated the following penalties for crimes related to the water system.

- Is punishable by imprisonment of up to a year and a cash fine, or either one of these two penalties, anyone who, without permission (1) carries out an exploration of underground or gushing out water or centralize it (2) conducts excavations carried out at a distance less than the depth of excavations, and in any case less than three meters far from water banks, their passageways, irrigation, drying and drainage canals (3) removes stones or dust sediments or sand or trees or shrubs or herbs from those banks or from the streams of temporary or permanent water basins or from lakes, swamps , pools and ponds (4) ingrains or plants or puts something on the banks of lakes, swamps, pools and ponds (5) commits an infringement in any way on the temporary or permanent banks of springs and streams of swamps, lakes and ponds (6) prevents the public water from running freely and cuts off drinking water from its beneficiaries.
- Is punishable by imprisonment of up to two years and a cash fine whoever demolishes or turns or ruins all or some installations constructed for the use of public property water.
- Are judged with the same sentence those who: (1) melt in public property water which is granted a permit or not, or pour or throw liquids or materials harmful to public health or to public comfort, or prevent the good utilization of the water (2) put an animal, fertilizer or wastes in the lands falling within the zone set by the Authority to protect a spring of which the public benefits (3) throw or place rubbish or garbage or anything else on the public road (4) place ads on historical monuments, public buildings, cemeteries and buildings intended for worship.

Concerning the extraction of sand and gravel, the sanctions were diversified and differentiated depending on the violations committed. Any person was prohibited from obtaining a new license to exploit quarries if it is proven that he had been subject to prosecution for failing to comply to obligations stipulated in the Decree No. 8803-2002 regulating quarries and rock breakers, or to the terms of licensing and was convicted. In the case of conviction, he shall not be given a new license except after the expiry of five years from the date of the sentence or the expiry of the period specified in the ruling if more than two years.

I.6. Land markets: challenges and opportunities

I.6.1. Introduction

Lebanon's dynamic emerging market, its strategic location and free economy along with its legal framework have been a potential asset in attracting foreign investment. The Lebanese economy is service-oriented and its main growth sectors include banking, tourism and foreign investment. To help strengthen the economy, the authorities have initiated a low income tax scheme to provide investment incentive, increase disposable income and expand the tax base.

The real estate market in Lebanon plays a key role in the Lebanese economy and is heavily affected by economic activity. Also it is worth noting that the real estate activity has moved in correlation with Lebanon's post-war economic cycle. In addition, the general drivers for the real estate sector in Lebanon include reduced interest rates, favorable demographics, high liquidity in the banking sector, availability of long-term mortgages, external demand, favorable laws for real estate foreign ownership, low taxes, inflow of Arab and foreign capital and alternative sources of financing.

On the other hand, the rising oil price has created an abundance of liquidity. This resulted in Arab capital looking for investment outlets and alternatives in the region, leading to a rise in such capital flows to Lebanon and a focus on investing in real estate. Property demand has increased significantly as Arab nationals have invested in various regions and in different products ranging from large tourism projects, to land and residences. Since 1969, the legal framework governing real estate and foreign investments in Lebanon was amended on several occasions to encourage the acquisition of real estate by foreigners and the initiation of projects in Lebanon. Coupled with the remoteness of the implementation of rural and sustainable development, this causes a major problem in the protection of natural resources and contributes to agricultural land abandonment as a result of land price rising leading to low profit from agriculture and further deterioration of the agricultural sector leading to land degradation.

I.6.2. Challenges and opportunities

I.6.2.1. Environmental Implications

Lebanon is increasingly plagued by environmental problems. Some major aspects are as follows:

a. As a direct result of urbanization, great threat to health and safety in Beirut comes from water and air pollution, especially at the households and community levels. Waterborne diseases are found most commonly in low-income neighborhoods as a result of inadequate sanitation, drainage and solid waste collection services. Health risks, especially to the poor, are also posed by pesticides and industrial effluents.
b. The productivity of many cities is adversely affected by traffic congestion and water pollution. The loss in productivity includes the total productive time wasted in traffic and the associated increase in the costs of operating and maintaining vehicles. The rising costs of treating polluted water for industrial and domestic purposes are damaging the productivity of urban economies. Fisheries are also being severely harmed by water pollution.
c. Uncollected and improperly handled solid waste can have serious health consequences. They block drainage systems and contaminate groundwater at landfill sites. In Lebanon, it is difficult to secure land for waste disposal facilities, especially onshore landfill sites. Especially Beirut is unable to manage the increasing amounts of hazardous wastes generated by rapid urbanization and industrialization.
d. Conversion of agricultural land and forest, as well as reclaiming of wetlands, for urban uses and infrastructure, is associated with widespread removal of vegetation to support urban ecosystem and put additional pressure on nearby areas that may be even more ecologically sensitive. Groundwater overdraft has led to land subsidence and a higher frequency of flooding, particularly in the lowest-lying and poorest areas.
e. Urbanization in coastal areas of Beirut often leads to the destruction of sensitive ecosystems and can also alter the hydrology of coasts and their natural features such as beaches that serve as barriers to erosion and form important habitats or species. Intensive and extensive exploitation of natural resources to support urban economy includes excessive extraction of energy resources (including fuel wood), quarrying and excavation of sand, gravel and building materials at large scales, and over extraction of water. These all contribute to degradation of

the natural support systems and irreversible loss of critical ecosystem functions, such as the hydrological cycle, carbon cycle and biological diversity, in addition to conflicts with rural uses of such limited resources.

I.6.2.2. Poverty

Pollution especially affects the poor live at the urban periphery, where manufacturing and processing plants are built and where environmental protection is frequently weak. Environmental sensitive sites such as steep hillsides, flood plains, dry land or the most polluted sites near solid waste dumps and next to open drains and sewers are often the only places where low-income groups can live without the fear of eviction.

I.6.2.3. Inappropriate regulations leading to land degradation

Lebanese laws lack regulations when it comes to irrigation, drip irrigation and groundwater usage and pumping. There are no incentives for certain crops in order to improve land production and reduce groundwater usage. Moreover there are no proper regulations for 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. Lebanese products lack ISO certification and do not follow other standards which limit export to Western countries.

I.6.2.4. Waste Recycling - New Challenges of Sustainability

Waste generation in urban areas continues to increase with concentration of populations and increase in living standards, and has reached to unmanageable levels in many localities. High proportion of the waste could be recycled, not simply to reduce the amount of waste to be disposed of. The practice also provides an opportunity to generate income for the urban poor, to prevent environmental damages of waste dumping, and further to demonstrate less material- and energy-intensive consumption patterns. Promotion of sustainable consumption should have the far-reaching benefit of fostering domestic enterprises and pushing the production sector towards sustainable pathways. There is a need to develop an integrated approach where the public, private and community sectors work together to develop local solutions promoting sustainable waste management of material recycling.

Despite the lack of a comprehensive solid waste management plan in Lebanon, recycling is on the increase. Thirty-four recycling centers are known to be operating in the country and recycle waste ranging from paper, glass and plastic to metal, textiles and even motor oil. Yet due to a lack of proper regulation, recycling plants only recycle 10 percent of the total amount of waste produced in the country. The recycling industry in Lebanon still has a long way to go before it can significantly reduce the 4,000 tons of solid waste collected by municipalities every day.

Greenpeace has recommended that the country aim for a zero-waste policy. This policy would focus primarily on minimizing waste and involve a comprehensive national recycling plan in which each household separates its own waste to make it easier to recycle. The plan would also involve industry redesigning its products to make them easier to recycle. A zero-waste policy would avoid incinerators and uncontrolled dumpsites that are an environmental hazard in themselves. Greenpeace stated that the adoption of a zero-waste policy would reduce pollution levels, improve public health, increase the value of land and improve the overall quality of life.

I.6.3. Construction activity on the rise

According to the Order of Engineers and Architects of Beirut and Tripoli, the total construction permits, an indicator of economic activity, rose to 6.27 million sq. m. in the first half of 2009 (by 23%), compared to 5.1 million sq. m. for the same period of last year. The surge in construction permits was a response to increasing housing demand. In 2008, construction permits (measured in terms of area) rose by an astonishing 79% to 16.1 million sq. m., from an average of 4.1% for the precedent two years. Cement deliveries, also a gauge of the state of the construction sector, increased by 7.7% to 4.2 million tons in 2008.

About 70% of the country's total population owns their homes, according to Lebanon Opportunities. The annual report of the movement of the recording of transactions in 2010 published by the Order of Engineers and Architects Shows the results in the tables 1, 2 and 3 below:

Following is the movement of recording transactions and upward pace in 2010, which closed at the end of the year to record a total of 15,175,926 m², an annual increase of almost 32% for areas recorded in 2009, which amounted to 11,509,142 m². This increase has been distributed over the months of the year. A significant increase was registered in May that continued until August.

Table 1: Transactions' recording for 2009 and 2010

Jan	Feb	Mar	Ap	May	June	Total
111,003	909,435	679,302	849,251	866,021	1,793,639	11,509,142
598,556	1,033,784	1,653,988	1,105,113	1,479,108	1,434,012	15,175,926
July	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	
358,313	706,832	1,235,653	833,624	1,004,482	2,161,587	
1,419,608	1,395,003	1,184,671	1,173,057	1,028,299	1,670,727	

Source: OEA, 2009, 2010.

Table 2 shows the percentage of annual increase according to the district.

Table 2: Percentage of annual increase, according to the district

Increase (%)	2009 (m^2)	2010 (m^2)	District (mohafazat)
11	1,403,658	1,564,581	Beirut
42	6,759,687	9,605,388	Mount-Lebanon
27	908,247	1,155,596	Bekaa
20	1,425,169	1,706,440	South
34	730,987	976,010	Nabatieh
-40	281,394	167,911	North*
32	11,509,142	15,175,926	Total

* Spaces belonging to the province of the north and recorded only in the order of Beirut
Source: OEA, 2009, 2010.

Table 3 indicates below the distribution of space and permits of new buildings according to the intended use.

Table 3: Distribution of space and permits of new buildings according to the intended use in 2009 and 2010

Percentage (%)	Surface Area (m^2)	Use
83.21	8,203,193	Residential building
6.06	597,703	Commercial buildings
1.58	155,819	Buildings, hotels and tourism services
1.11	109,194	Buildings, public services (schools, hospitals ...)
5.28	520,080	Buildings, the economic sector (agriculture, industry)
2.76	271,954	Public buildings (administrative, social, cultural)
100.0%	**9,857,943**	**Total**

Source: OEA, 2010.

I.6.4. Conclusion

According to the statistical results above we can conclude that the lack of protection of land and degradation of natural resources is mainly due to chaotic urban development in Lebanon. For several years the Lebanese government was following the strategy of economic development based on real estate construction and was not interested in the development of agricultural sector and protection of

the environment. This logic is completely in contradiction with the sustainable development. The concept of the sustainable development means that without the protection of the environment (natural resources, quality of life, forest, noise, agriculture, industry, protection of land, biodiversity, urban planning, water...) the society cannot have a sustainable economical development.
The lack of laws for land management, non-compliance with existing laws and the non restrictions of illegal buildings and constructions confirm the conclusion.

I.7. Issues and Conclusion

It was observed from the review of international experience the emphasis on the close relationship between zoning and land management on the one hand, and between safety and protection of the environment on the other. Specifically, the international legislation imposed the need for an environmental assessment and an environmental impact study while zoning, and determining land use and classification (decision EC/42/2001).

In general, in a review of the Lebanese legislation, there is no indication of a clear and explicit need to adopt standards and environmental conditions while preparing design guidelines and detailed regulations, neither the quintessence of these standards and conditions, as plans have to observe plans policies to preserve agricultural land, natural sites and improve the environment. Environmental standards that should be noted in the schemes of land use include: (as indicated in the Planning Policy Manual 12: Development Plans, Britain).

- Green belts.
- Nature conservation and biodiversity.
- Ways and methods for the applied and planned management of solid and liquid wastes.
- Energy consumption and the possibility of using renewable energy sources.
- Mitigation of air pollution (the planning of roads and industrial regions).
- Mitigation of noise pollution.
- Maintaining the features of the Coastal Strip.
- Implications on the landscape.
- Improvement of the environment by observing green spaces and the possibility of reforestation.
- Consistency between urbanization and environmental and natural milieu.
- Factors of water and rain flow and protection from floods.
- Availability of water resources for land use (sectors need for quantities of water and the extent provided in the scope of planning).
- Protection of water resources from contamination by land-use.
- Preservation of the quality of the soil and prevention of its erosion and degradation.

The Zoning and Land Management have a key role of paramount importance in the protection of the country's and the citizens' interest, as good organization for cities and villages and good management of the land would preserve the national wealth and the natural resources, ensuring progress and economic prosperity. This is, of course, in addition to ensuring the protection of land in particular and the environment in general and the preservation of public safety.

The review of the Lebanese legislation confirmed the existence of many legal provisions that address to a large extent zoning and land management. In particular, the Lebanese legislation addressed the following topics related to this area:

a. Zoning, regulation of lands, cities, villages and countryside.
b. Utility Regulation.
c. Building Planning and Infrastructure.
d. Regulation of natural sites.
e. Regulation of archaeological sites.
f. The management of Public Property and Public State Property.
g. Regulation of the use of natural resources and national wealth.

In analyzing the Lebanese legislations and comparing them with international legislation, it became clear that there are gaps in the legal texts concerning zoning and land management, specifically in the field of protection and safety of agricultural land and of the environment. Overall, the following weaknesses in the Lebanese legislation in this area were noted.

a. The Lebanese legislation does not notice in a clear and explicit way, how to take care of agricultural land and environmental protection when effectuating zoning and land management, in contrast to the countries of the civilized world, which give to this matter a paramount importance. In the few cases in which this topic is addressed, it was in a general and outright way. It is necessary then to determine clear, direct and explicit environmental conditions and standards that should be taken into account when preparing guidelines charts for the regions and the studies of land use, as noting the natural factors, the green cover and the protection of water resources, crops, as well as the needs of population on the level of the management of solid and liquid wastes and the movement of transport, energy and water consumption.
b. The absence of some basic definitions and fundamental concepts to link zoning and land management in a clear and direct way to the protection and safety of the environment, as for example but not for limitation, there is an absence in the Lebanese legislations to the need for public participation in the process of zoning, land classification and land use, which is absolutely necessary in the countries of the civilized world. This is not only to make the plans guidelines more acceptable of the public, but it aims at quoting the ideas of the public on how to protect and preserve the land and the environment in the preparation of these plans.
c. In the Lebanese legislation, we note an overlap of powers and a lack of responsibilities in certain areas in the zoning and land management among a number of Public Administrations. This may lead to problems in planning and implementation and impact negatively the effectiveness of zoning plans and land management plans, limiting their ability to ensure the safety and preservation of the environment.
d. Overall, with the exception of the Supreme Council of Urban Planning which includes several departments concerned with the land-use regulation, including the MoE, the provisions of the laws, decrees and decisions do not indicate clearly and explicitly the need and the necessity for coordination between the various departments involved in zoning and land management and the MoE. These texts also do not specify how to do this coordination nor these procedures and mechanisms that must be applied to ensure proper coordination with the MoE. It is possible to link this problem with the fact that many of the legislations preceded the date of creation of the MoE in 1993.
e. The Environmental Protection Act referred to the topic of environmental assessment when it imposed the need to subject projects to the studies of the environmental testing and the assessment of environmental impact. Despite the fact that this law is supposed to incorporate the concept of protection and safety of the environment when preparing guidelines charts for regions and studies for land use, but the degree of application of this law remains questionable due to the absence of promulgation of applied decrees necessary to put it into effect.
f. No implementation of sustainable land management due to the absence of appropriate policies legislations and incentives and failure to mainstream sustainable land management in land use planning and in rural development.
g. Lack of a comprehensive legislative framework for the management of natural resources.
h. Conflicts between existing laws and decrees. For example, some ministerial decrees disconcert the execution of several laws related to forest management and protection.
i. Weak enforcement of existing legislation especially with regard to forest management.
j. 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.
k. Institutional problems, for example, the absence of a Ministry of Planning
l. Lack of clear and consistent policy for sustainable land use.
m. The small size of the agricultural holdings which is the main reason for the high cost of production.
n. Lack of medium and long-term agriculture and land use policies, programs and plans, limited governmental support and reactive interventions.
o. Inadequate or ineffective regulation of land use.
p. Lack of funds and Lack of specialized agricultural credit (medium and long-term, low interest).
q. Lack of access to information, tools or training to make informed decisions
r. Lack of well targeted incentives, or inappropriate incentives
s. The legal confusion in land tenure issues and traditional land use rights
t. Unconstrained use of land because in Lebanon the property code needs to be amended especially with the development of new policies for the environment and we have no

restrictions to the private ownership. We should note also that the rural code does not exist till now.

u. Roles and responsibilities for managing the common lands are not clear leading to their over-exploitation for grazing, quarrying and agriculture.
v. Land fragmentation due to inheritance laws paralyses efficient land use.
w. 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.

I.8. Recommendations

A variety of options in terms of policy responses and tools to protect and manage the land use are proposed below:

I.8.1. Legislative recommendations

a. Elaborate a comprehensive legislative framework for the management and land use
b. Develop a comprehensive legislative and policy frameworks with the active participation of all rangeland users
c. Support the establishment of proper land tenure systems so that users have long-term stake in sustainable use
d. Land market assessments provides accurate and up-to date information on land prices, supply of serviced land, present and future land projects, housing typologies, and other aspects of the housing and land market. Thus it is used to support government planning and decision making, the evaluation of government policies and actions, private sector investment and development decisions and structuring of land based taxation systems.
e. Improving the urban governance, in particular, through increasing transparency accountability of policy formulation and decision making processes.
f. Analysis and evaluation of the past and present land use policies and planning practices, in particular, through Strategic Environmental Assessment techniques;
g. Elaborate laws relatives to the new crops and cropping technologies, integrated pest management, organic agriculture, recycling and reuse of treated waters and sludge and watershed management.

I.8.2. Environmental recommendations

a. Enhance biomass and vegetative cover of the rangelands
b. Support research activities to develop a better understanding of rangeland dynamics, rehabilitation and management techniques
c. Support an efficient extension service for rangeland management, rehabilitation and sustainable livestock production
d. Implement a national rangeland strategy
e. Support sustainable livestock production through the introduction of improved stock, animal husbandry, stock management, alternative feed resources and health programs
f. Support institutional strengthening of livestock herders
g. Support research activities to develop a better understanding of rangeland dynamics, rehabilitation and management techniques
h. Support an efficient extension service for rangeland management, rehabilitation and sustainable livestock production
i. Propose a national planning to control urbanization to manageable levels:

    - As a primary tool, a National Physical (Spatial) Development Plan could be established to address the mid- and long-term national direction on distribution of population; utilization of land; development of new land, water and energy; provision of infrastructure, housing and transportation that favor decentralized economic development.
    - Such planning approach, especially when coordinated with the overall economic policy as well as relevant sectoral development programmers covering, in particular, industrial and agricultural productivity, would be effective in establishing an orderly and consistent utilization of land on a national basis and providing the opportunity for urbanization issues to be addressed in the coherent way in the context of overall national development.

j. Integrate and implement Geographical information systems (GIS) as a tool for decision-making in planning.
k. Innovative planning tools (such as Geographic information system, land market assessment and new zoning techniques, in contrast with conventional indigenous planning tools)
l. Sustainable urban consumption model (maximization of material recycling, circular economy)
m. Participation and partnership approach to planning/management/financing of urban environmental infrastructure
n. Early identification and raising preparedness for emerging environmental threats.

PART TWO

II.1. Introduction

Lebanon is a mountainous east Mediterranean country with steep slopes and torrential rainfall. Since Phoenician times, land management was faced with soil erosion. The old legend of Adonis who was killed by the wild pig and his blood colored the Ibrahim River red, which is recurrent each spring, witness sediment input from the surrounding red Mediterranean soils. The abundance of rocky lands with soil patches points to the process of soil erosion since prehistoric times. For this reason, our ancestors implemented terracing on sloping and steep lands to alleviate the impact of soil erosion and sedimentation.

Recently, land degradation expanded and intensified to cover also soil salinity, soil and water contamination, soil sealing and vegetation recession. These negative processes are due to human pressure, poverty, mismanagement, deforestation, quarrying, overgrazing, chaotic urban expansion and weakness of policies and outdated legislation. Despite the promulgation of laws and elaboration of the landuse planning project, the limited renewable and non renewable natural resources in the country are nowadays threatened more than ever.

For this reason, enhancing institutional response, empowering stakeholder reaction and participation as well as mainstreaming in proactive policies gains increasing importance to limit land abandonment and rural exodus, uproot poverty, stop and reverse land degradation. Several implementations related to sustainable land management like the integrated pest management, organic farming and conservation agriculture are promising tools to increase farmer's income, secure more sustainable soil and water management and combat desertification.

II.2. Inventory of land resources and ecosystems in Lebanon

A. Geography

The Republic of Lebanon is located on the eastern coast of the Mediterranean Sea with a total area of 10,452 km² and a number of populations slightly exceeding 4 Million. Lebanon consists mainly of rugged mountainous regions with slopping and steep lands. The change in elevation above sea level is abrupt with a distance between sea level and 1,750 m above mean sea level (amsl) less than 20 km (Figure 3). The width of the country from east to west varies between 15 km and 85 km with an average of 50 km. However, the coastline stretches over 225 km from north to south representing relatively large plain in the north and narrow plains in the rest of the country.

B. Basic information

Lebanon is characterized by the presence of two mountain chains positioned parallel to the coast, "Mount Lebanon" with the highest peaks reaching 3,088 m amsl to the west and "Anti-Lebanon" at the Syrian border slightly exceeding 2,800 m amsl. Accordingly, Lebanon can be divided from east to west into four parallel topographic components:

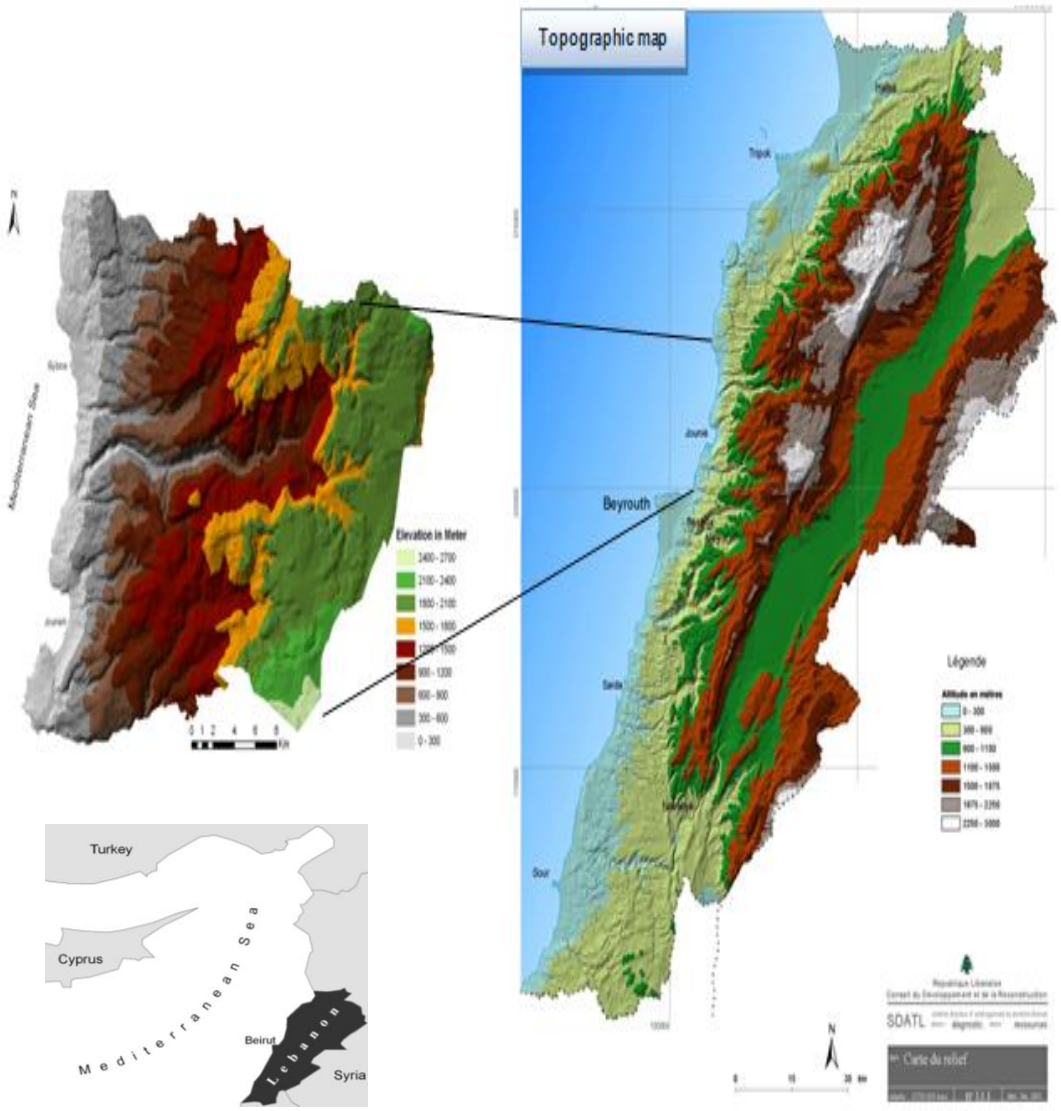
1. The "Anti-Lebanon" mountain chain in the east runs along the Syrian border which has a lower elevation than "Mount Lebanon". In the southeast, the Haramon summit rises above the south Bekaa and the Syrian Golan and reaches an altitude of 2,820 m.

2. The Bekaa Valley stretching at height around 900 m in its west and central parts and less than 600 m in the north east. Having a width varying between 5 and 20 km, the Bekaa plain represents an area with special agricultural interest (SDATL, 2003), and thus it is devoted mainly to agricultural activities.

3. The "Mount Lebanon" chain stretching from the north to the south with the highest crest in the country, Quornet Es-Saouda (3,088 m) located near the Cedar area and covered by snow between November-December and August-September.

4. The flat, narrow coastal plain parallel to the sea; reaching a maximum of 9 km at Akkar Plain in the north, a minimum of 1 km near Nakoura in the South and nil in Chakka where the mountain dips directly into the sea.

Figure 3. Digital Elevation Model (DEM) extracted from Stereoscopic Russian Image shows the complex topography of the country (Source: SDATL, 2004).

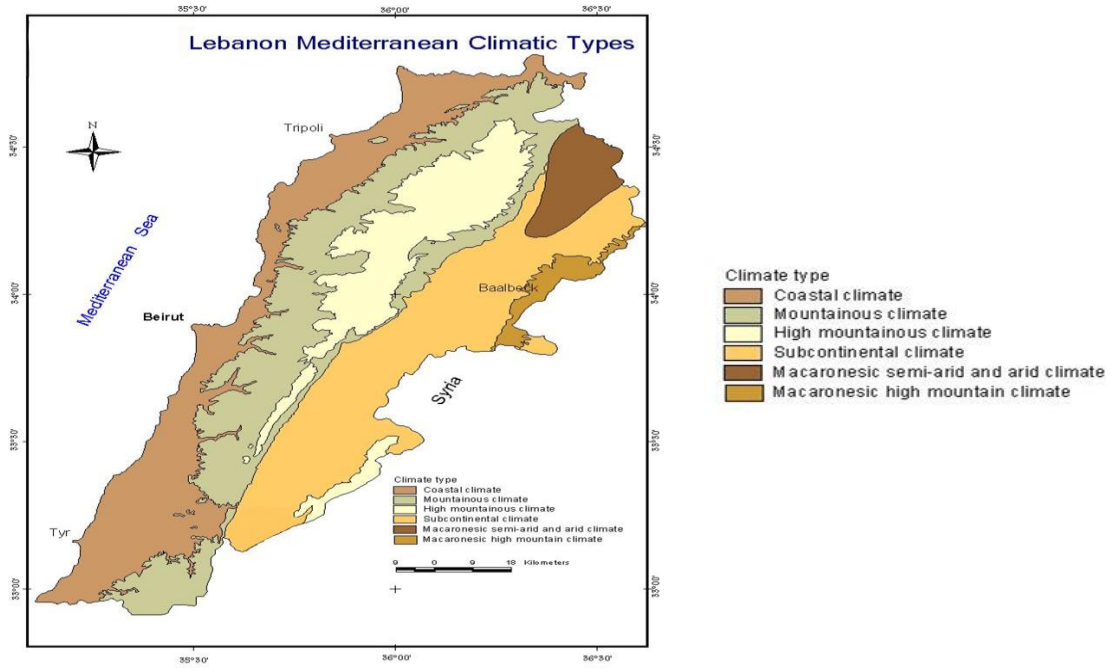


The population of Lebanon is estimated at 3.8 to 4.0 million with an estimated growth rate of 1.2 percent between 2000 and 2015. This population is unevenly distributed across the country with more than 90% living in urban areas; 60% of the population is squeezed onto 8% of the land in the narrow coastal zone (CDR, 2004). The spatial distribution of the population has major implications for the environment, in terms of demand for land and water resources, the use of land, and for the environmental services it provides (ECODIT, 2009).

b.1. Climate

Lebanon has a typical Mediterranean climate with long, dry, summer and mild winter with torrential rain and relatively short spring and autumn seasons (Figure 4). The complex orography and vicinity to the Mediterranean Sea predetermine Lebanon's climatic conditions.

Figure 4. Main climatic types of the Lebanese Republic classified according to the Soil Geographic Database of Euro-Mediterranean countries (Source: Darwish, CNRS)

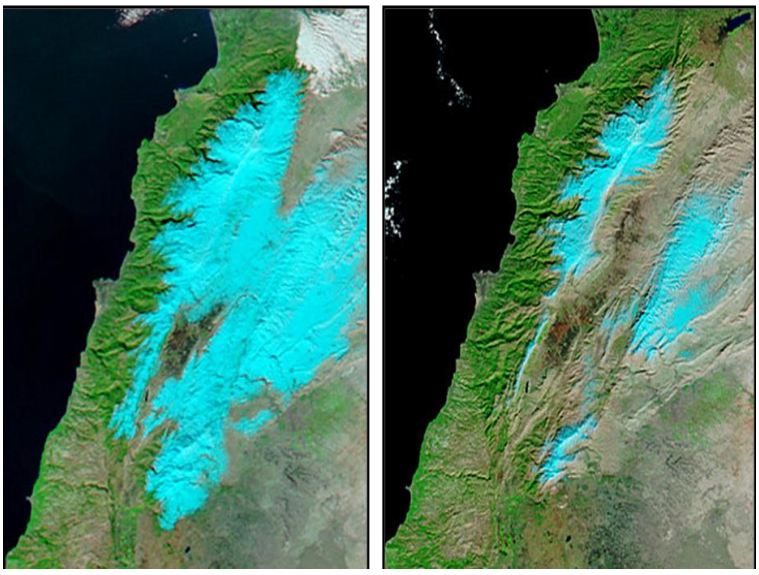


Local topographic features and the Arabic Peninsula in the east create a variety of micro-climates within the country with contrasting temperatures, rainfall amount and distribution. Conditions vary from typical Mediterranean climate along the coastal plain to subhumid in the middle mountain range and sub-alpine or mountain Mediterranean climate on the highest slopes, which are covered by snow during at least 10 months per year

However, despite the fact that snow represents the main source of water in Lebanon few data are available on the snow dynamics on the Lebanese mountains and water equivalent. Recent observations using MODIS (CNRS, 2011) showed very fast melting process and reduction of snow cover from 2200 km^2 on 15.12.2010 to 1700 km^2 on 25.12.2010 threatening the normal recharge and causing increasing risk of soil erosion (Figure 5). Recent climatic changes for the past 30 years affected the useful rainfall with trends to decreasing precipitation by 15% and increased temperatures by 1.6 °C (Shaban, 2009) affecting crop water demands and interfering with the agricultural cycles (Hamzé *et al.*, 2010).

Figure 5. Spatial and temporal change of snow cover in Lebanon (Source: NASA; CNRS, 2011)

MODIS 15. 12. 2010 MODIS 25. 12. 2010

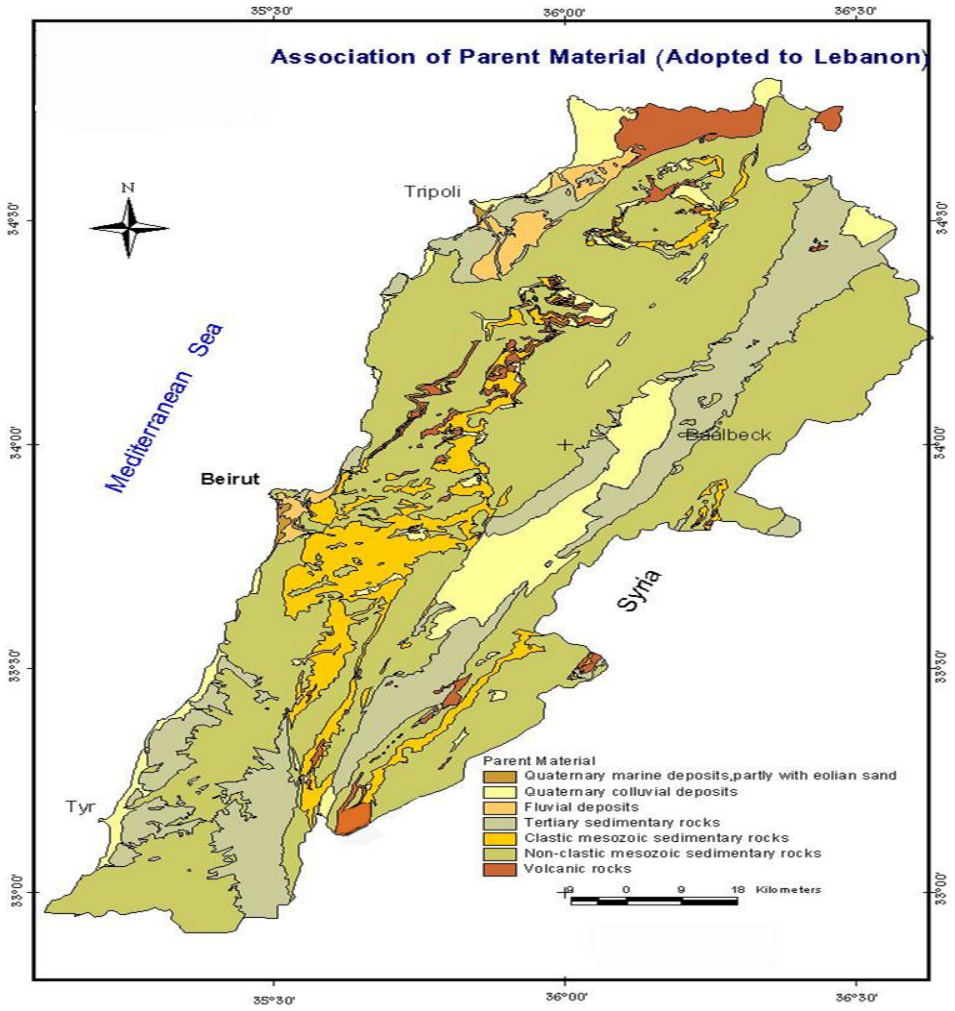


b.2. Geology

The geology of Lebanon was grouped into seven major associations (Figure 6). Based on porosity four groups (quaternary alluvial and colluvial sediments, fluvial and tertiary sediments-marl, shale and clay) have different, relatively low, permeability. The non clastic Mesozoic sedimentary carbonates (mainly limestone and dolomite) expose secondary porosity and present elongated fractures with large spacing; thus, they have high permeability. The clastic Mesozoic sedimentary rocks (sandstone), defined as low permeable, since they include chaotic inclusion of clay either laterally or vertically. The volcanic rocks (basalt) are locally permeable except when they include soft tuff material.

This classification is important for the assessment of the soil formation and evolution, regional and local drainage, land capability and land management in Lebanon and for the estimation of soil erosion risks, soil hydrologic regime, water retention capacity and fertility potential and irrigation scheduling.

Figure 6. Association of parent materials as major soil forming agents grouped according the GeoreferencedSoil Database of Euro-Mediterranean countries (Source: T. Darwish, CNRS)



b.3. Administration and Demography

The Republic of Lebanon is divided into six main administrative provinces or Mohafaza, which are divided into smaller districts or Caza (Table 4). In total there are 25 Cazas. Each Caza is divided into cadastral zones, called Manateq Ikarieh. Overall, there are 1,492 cadastral zones. The Bekaa is the largest Mohafaza (4,161 km^2), followed by the North (2,025 km^2) and Mount Lebanon (1,968 km^2). One of the main problems in land tenure and land management issues is the cadastre where a significant part of Lebanon is still outside the cadastre (North Bekaa, East Mountains). Land use and land tenure in these areas consist mainly of land exploitation by an act of presence and settlement on

the land without documented legal ownership with all resulting exploitation conflicts and heritage rights.

The population of Lebanon in 2007 was 4 million with 407,362 residing in Beirut, the administrative capital of Lebanon. Tripoli represent the second capital with about 267,922 inhabitants is located 90 km north of Beirut. Saida (Sidon) – 195,820 and Zahlé – 147,837 inhabitants are located 41 km south of Beirut and 47 km east of Beirut respectively are followed by Tyr (Sour), with about 204,635 inhabitants, located 79 km south of Beirut (SDATL, 2004).

Table 4. Distribution of population by Mohafaza (2007)

Mohafaza	Population	Percent (%)	Projected Surface Area (km^2)	Population Density
Beirut	407,362	10	21	19,183
Mont Lebanon	1,554,043	39	1970	789
North	864,578	22	1973	438
South	424,453	11	924	459
Nabatiye	496,971	12	1100	217
Bekaa	238,365	6	4258	117
Total	3,985,772	100%	10,246	389

Source: SDATL, 2004.

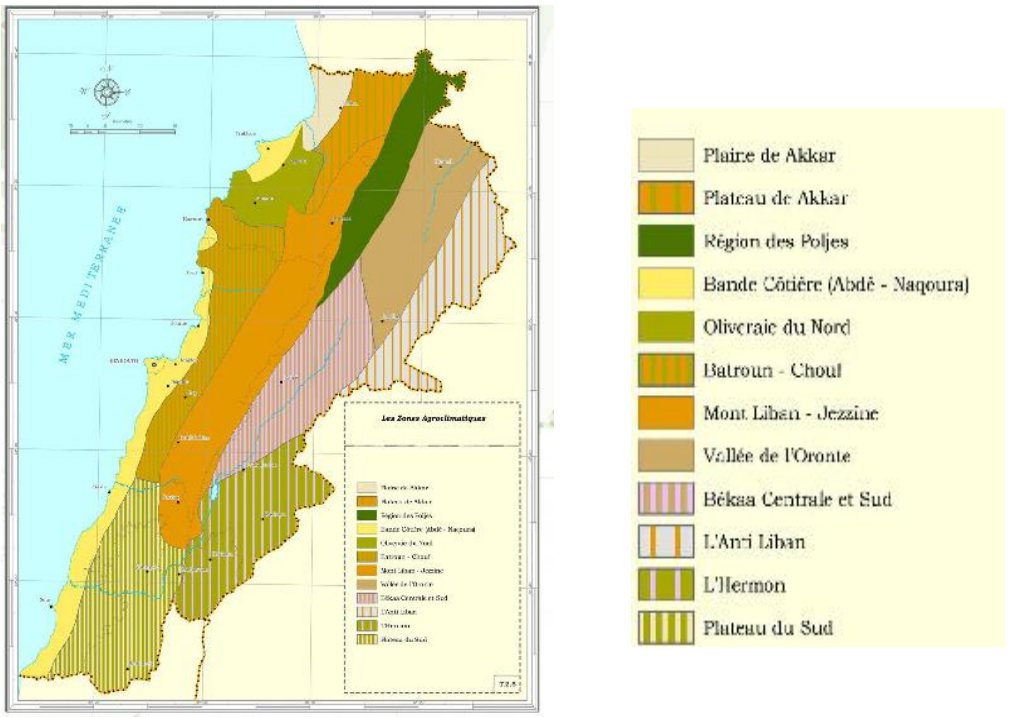
b.4. Agro climatic zones

Based on rainfall amount and land occupation, Lebanon was divided into five large regions and twelve agro climatic zones (Figure 7). The key elements of information that emerge are as follows:

A. The coastal plains: they are characterized by levels of precipitation close to 800 mm and the climate allows the development of vegetable, fruit crops and greenhouse production. This area stretches from Abdé in the North to Nakoura in the South and can be divided into several parts:
   1. Plain of the Aakkar: with about 14 000 ha, of which 78% are irrigated and with 5000 large livestock units.
   2. Coastal bands: this band includes the coastal plains of the North, Mount-Lebanon and South and a useful agricultural area in the order of 15 000 ha.

B. Mount-Lebanon area: It is a mountainous area which includes shelf of Aakkar to Shuf-Naher el Awali. It is characterized by a level of high precipitation, altitudes ranging from 250 m to more than 2000 m, a development of irrigated arboriculture and non-irrigated olive trees, vineyards and almond trees. This area is also characterized by the abandonment of marginal agricultural land and the expansion of urbanization. The dimension of surfaces to forest nature and pastures allow a livestock development, and particularly that of goats. This area can be divided into 5 subsets:
   3. Plateau of the Aakkar: The useful agricultural area of this plateau is of the order of 20 000 ha of which 25% is irrigated, and the number of large livestock unit is in the order of 15 000.
   4. The Poljes regions: The useful agricultural area of these regions amounted to 5,600 ha, 27% of which is irrigated and the number of the amounts to large livestock unit is 7 000.
   5. Olive grove in the North: The useful agricultural area is in the order of 13 000 ha of which 13% is irrigated and the number of the large livestock unit is of the order of 5000.
   6. Batroun - Chouf: This region with altitude greater than 800 m contains about 13 000 ha of useful agricultural area of which 19% is irrigated and 9 000 large livestock unit.
   7. Mont-Lebanon - Jezzine: altitude is less than 800 m, and the useful agricultural area of this region is of the order of 27 000 ha of which half is irrigated. The herd is very important (28 000 large livestock unit).

Figure 7: Agroclimatic zones (Source: MoA[1])



C. Bekaa plain: Is divided into two distinct parts:

8. The Orontes Valley: this valley is characterized by a low level of precipitation (between 200 and 400 mm), and large tracts of pastures. The useful agricultural area is in the order of 20, 000 ha of which 53% is irrigated and the livestock, mostly cattle and goats, is of the order of 21 000 large livestock unit.
9. Central Bekaa and South: this is the most fertile region of the Lebanon; it is characterized by a relatively high (between 500 and 800 mm) level of precipitation. The useful agricultural area is estimated at about 64 000 Ha of which 61% are irrigated and livestock is very developed; the herd is of the order of 44 000 large livestock unit. This region is a consistent part of Lebanese agriculture with 25% of the large livestock unit, 25% of useful agricultural area and 30% of the irrigated useful agricultural area.

D. The Anti-Lebanon: it is a mountainous area that has a low level of precipitation. Is divided into 2 zones:

10. The Anti-Lebanon: the useful agricultural area is of the order of 7 000 ha of which 13% is irrigated. The herd is of the order of 12 000 large livestock unit.
11. The Hermon: useful agricultural area is the order of 13 000 ha of which 16% is irrigated, the herd is of the order of 20,000 large livestock unit.

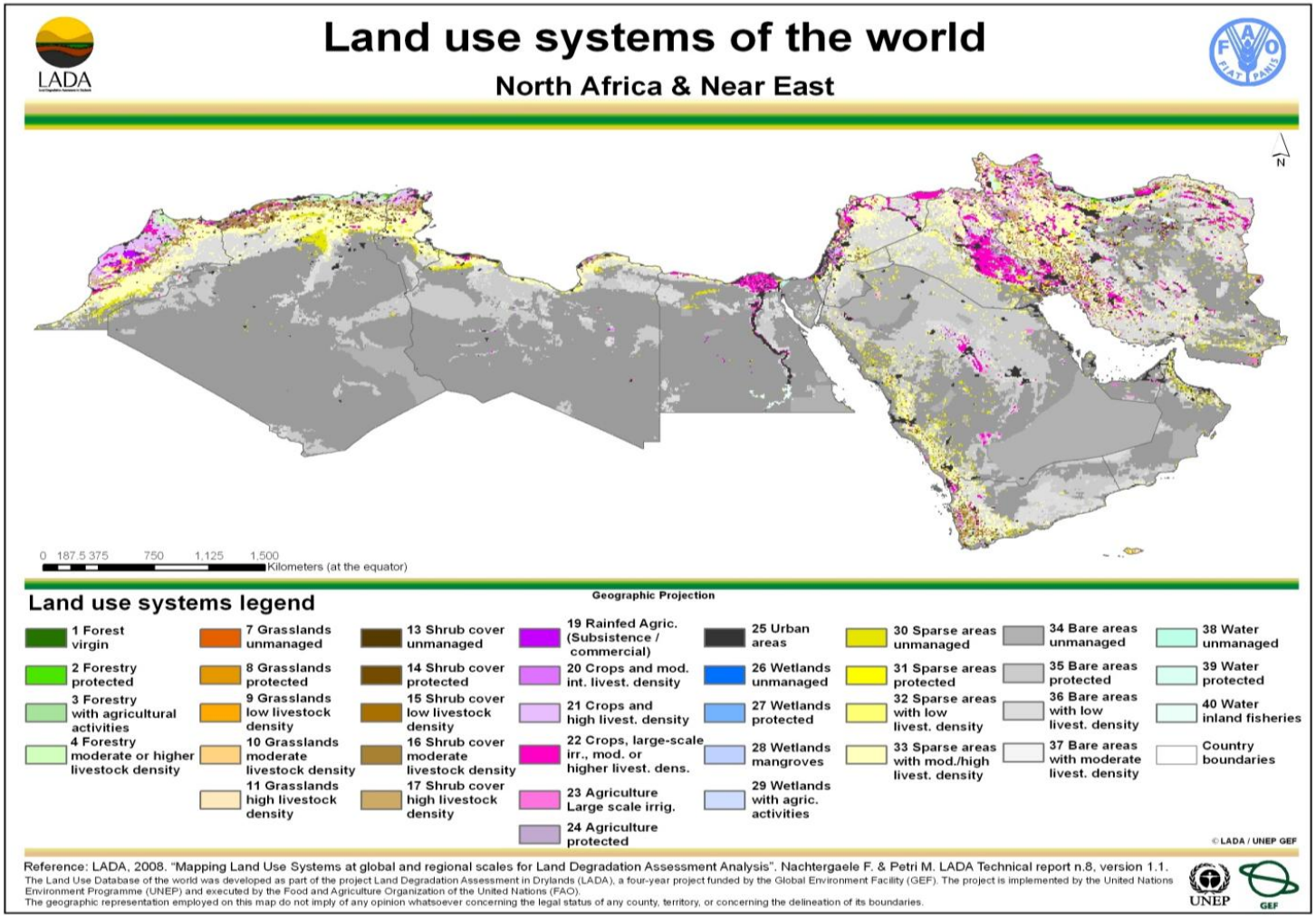
E. Plateau of the South:

12. It is characterized by an altitude ranging from 250 to 800 m and a relatively high level of precipitation ranging between 600 and 800 mm. The useful agricultural area is the order of 35 000 ha of which 16% are irrigated and the numbers of livestock, mostly sheep and goats, is estimated to be 24 000 small ruminant units.

b.5. Land use systems

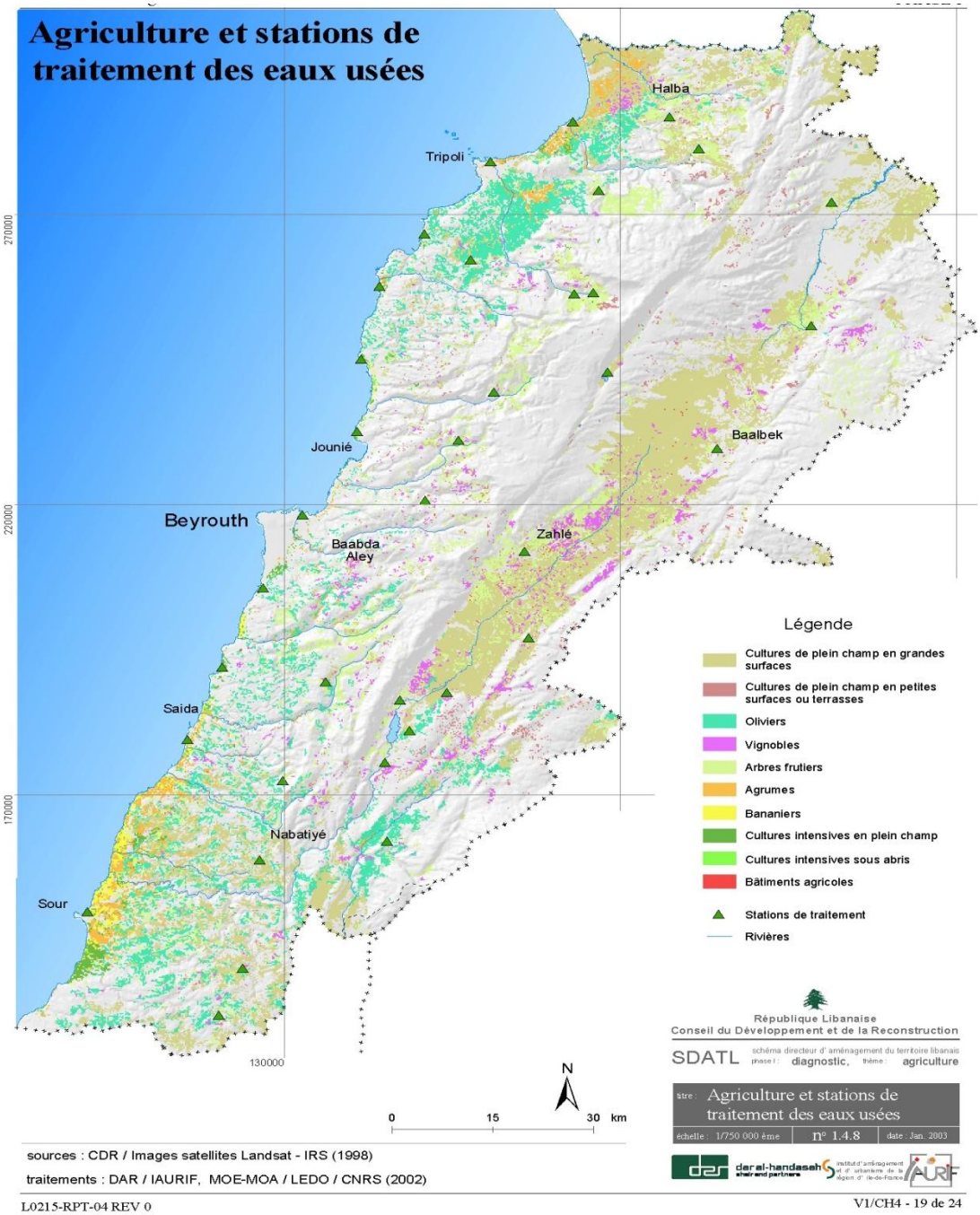
Land use systems developed by FAO (LADA, 2008) consists of 40 units starting from forest, grass, shrubs, rainfed and irrigated agriculture, followed by urban, sparse and bare lands, wetlands, water unmanaged and protected (Figure 8).

Figure 8: Land use for North Africa and Near East system (Source: LADA, 2008)



The land use map of Lebanon published by CDR (SDATL, 2003) showed that the major agricultural areas are located in the Bekaa followed by the Akkar plain and South Lebanon (Figure 9). These are occupied by rainfed and irrigated field crops, irrigated vegetables, grape and fruit trees production. The mountainous areas of Lebanon including the Anti-Lebanon mountains represent valuable source of terraced fruit trees (apple, cherry, peach and others).The olive orchards map produced by CNRS (2010), based on IKONOS 2005, indicated the area of olive to slightly exceed 45000 ha while MoA estimates for 2000 were of estimations 58000 ha.

Figure 9. General agricultural land use map for the Lebanese Republic (Source: SDATL, 2004)



C. Water resources

Lebanon is known by its tremendous water resources and at different scales whether on surface or subsurface media. Also, the annual amount of precipitated water is relatively high and ranges between 300 and 1500 mm. Thus, all elements of the hydrologic cycle exist within the Lebanese territory, since it doesn't include only the conventional sources, but also it includes other aspects of water sources, which may not exist in the neighboring regions (e.g., snow, karstic conduits, submarine freshwater discharges, etc.).

There are many estimates on water resources of Lebanon. According to CDR (1980), UNDP and FAO (1983), Jaber (1995) and Khoury and Droubi (1999), the fourteen rivers in Lebanon discharge more than 3500 Mm^3/year, 1250 Mm^3/year from the issuing springs and 1350 Mm^3/year from ground water reservoirs. In addition, water derived from snow has been estimated at more than 1100 Mm^3/year (Shaban et al. 2004).

c.1. Rivers

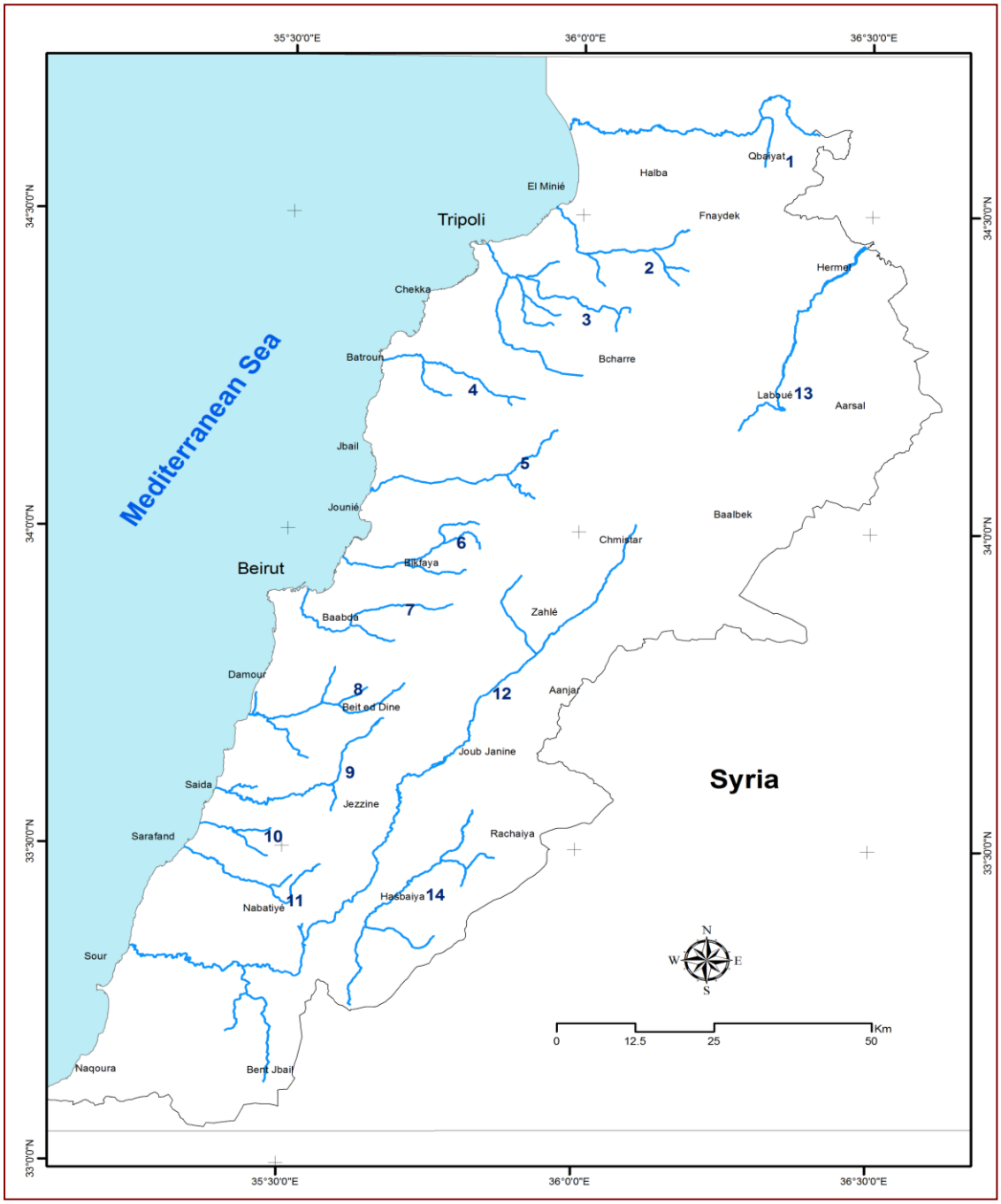
There are fourteen permanent watercourses (rivers) in Lebanon, which are considered of the small-scale type, in terms of spatial area and discharge (Figure 10 and Table 5). The majority of feeding to these rivers is from the melting snow and the issuing springs. Three of these rivers (El-Kabir, Orontes and Wazzani) are shared with the neighboring regions. Whilst, the coastal rivers (Figure 10, No. 1-11) are almost with short length (i.e. <60km) and characterized by steep sloping terrain, which accelerates run-off velocity (5-10 km/hr), thus resulting in uncontrolled discharge of water to the sea.

Table 5. Rivers of Lebanon.

No*	River	Average annual discharge (Mm^3/year)	Watershed Area (km^2)
1	El-Kabir	213	195 (within Lebanon)
2	Al-Bared	168	284
3	Abou-Ali	369	482
4	El-Jauz	82	196
5	Ibrahim	498	326
6	El-Kalb	251	237
7	Beirut	101	216
8	El-Damour	256	333
9	El-Awali	284	291
10	Siniq	111	102
11	El-Zahrani	202	140
12	Litani	387	210
13	Orontes	470	1980 (within Lebanon)
14	Hasbani-Wazzani	190	625 (within Lebanon)

*Number according to Figure 10

Figure 10. Rivers of Lebanon (Source: SDATL, 2004)



c.2. Springs

Lebanon has large number of springs, which are mostly of karstic and fault types. For example, in occidental Lebanon (~ 5000 km^2) there are 853 major springs, in which 60% are located at altitudes over 750 m (Shaban, 2003). The springs in Lebanon are attributed, on average, to the 4th magnitude (i.e. 6.31-28.3 l/sec) according to Meinzer classification, but 3rd class is frequent and there are more than 25 springs 1st magnitude (>2.83 m^3/sec). Table 6 and Figure 10 show example of major springs in Lebanon according to FAO (1970).

Table 6. Major springs of Lebanon

No*	Occidental Lebanon	Discharge (m^3/sec)	Oriental Lebanon	Discharge (m^3/sec)	No*
1	Afqa	4.62	Yamouneh	2.82	6
2	Jeita	4.48	Ain Ez-Zarqa	2.44	7
3	Rouaiss	3.55	Anjar	2.00	8
4	Adoniss	3.37	Berdaouni	1.41	9
5	Antelias	2.20	Labouh	1.00	10

*Number according to Figure 11.

c.3. Lakes

There are no large-scale natural lakes in Lebanon. However, the topographic landforms and depressions make it feasible to construct dams, where lakes are created behind. Hence, six major man-made lakes are known in Lebanon (Table 7 and Figure 11); whereas, the Qaraaoun Lake is the largest (8.52 km^2) and it was constructed in 1962. In addition to these lakes, there are tremendous small-scale lakes, which are oriented as ponds to collect water principally from snowmelt and along run-off watercourses. These "hill ponds", as detected from the space (Figure 12), are estimated at more than 2741 ones in all Lebanese regions with approximate water surface equivalent to 4.25 km^2. Considering an average depth of hill lakes equivalent to 3 m, the amount of water stored in these mountains ponds can exceed 13 million m^3.

Table 7. Major lakes of Lebanon

No*	Lake	Estimated area (km^2)	Estimated capacity (Mm^3)
1	Qaraaoun	8.52	225
2	Qanan	0.023	0.25
3	Joun	0.041	0.32
4	Shabroh	0.165	2.0
5	Wadi En-Njas	0.046	0.7
6	Yammounah	0.004	0.04

*Number according to Figure 11.

Figure 11. Major wetlands and lakes of Lebanon (Source: SDATL, 2004)

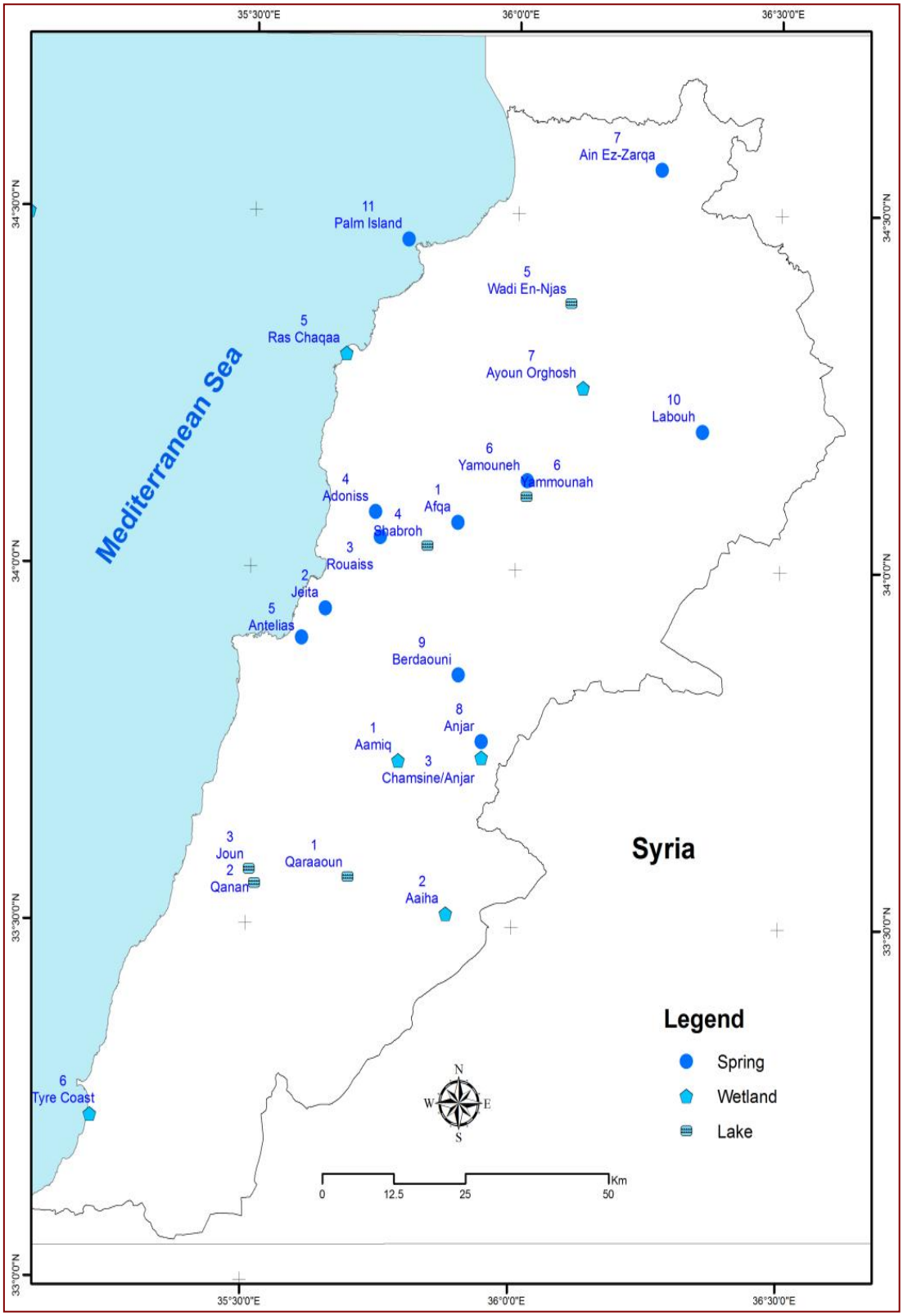
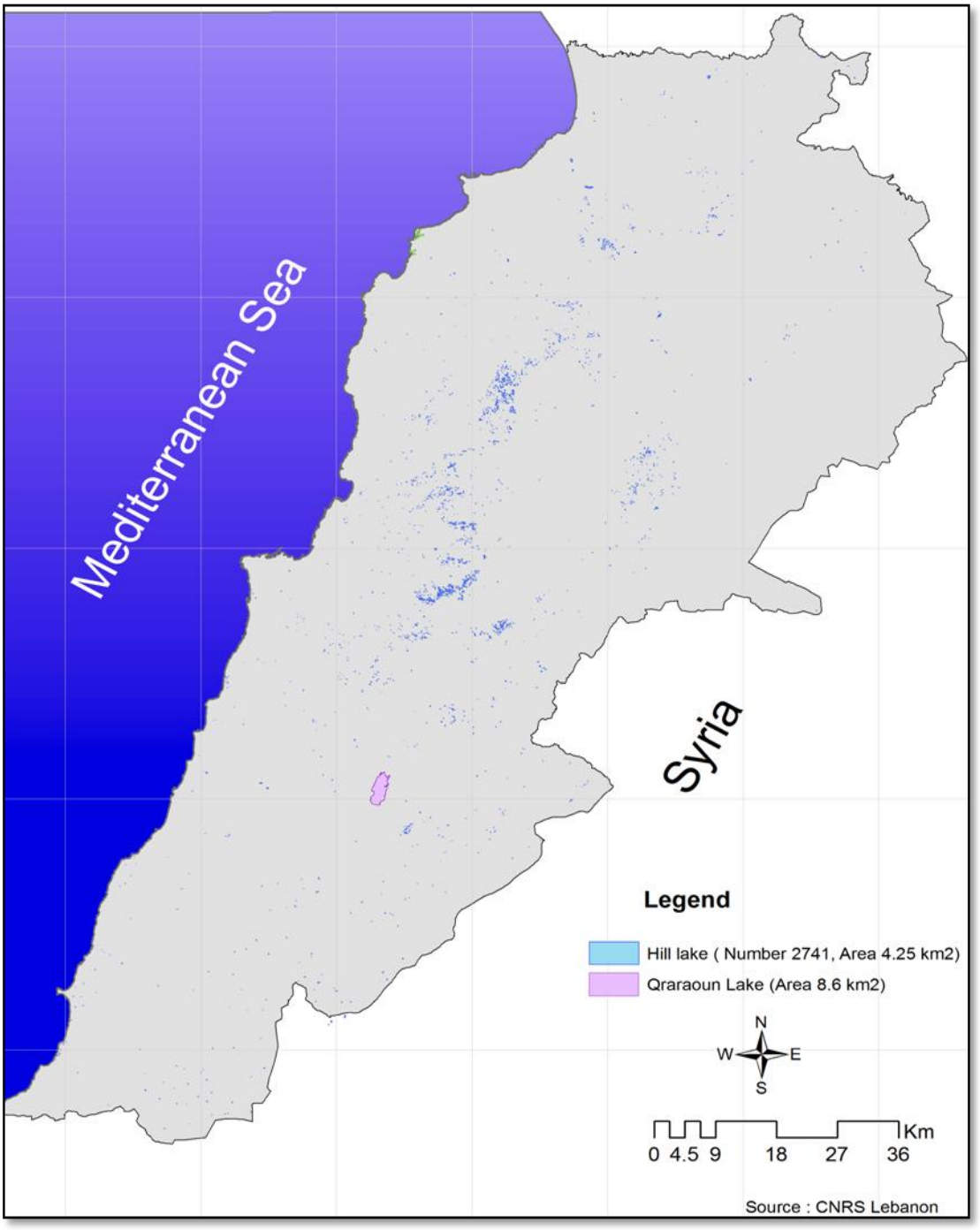


Figure 12. Hill lakes detected from satellite image in 2010 (Source: CNRS, 2011)



c.4. Wetlands

There are many physical elements contributing to the existence of wetlands in Lebanon. Wetlands are viewed mainly from the presence of low-lands, depressions, long raining periods (November-April) and a coast extending along the whole Lebanese territory. Thus, freshwater and saltwater accumulations exist on terrain surface to compose temporary wet landforms of different scales and topographic shapes. Table 8 and Figure 11 show the major wetlands of Lebanon.

Table 8. Major wetlands of Lebanon

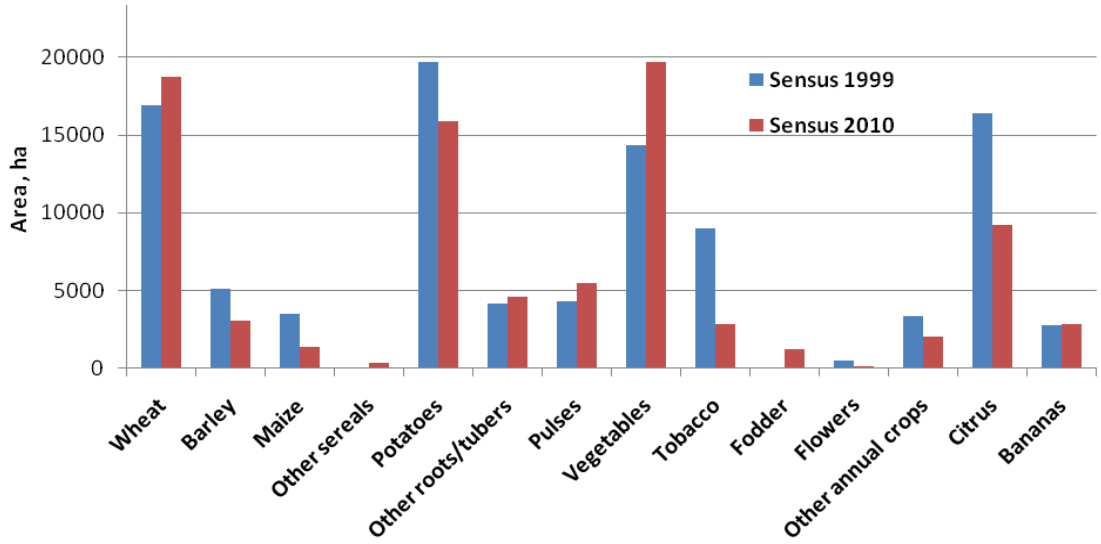
No*	Wetland	Estimated area (km^2)	Description
1	Aamiq	2.8	Several natural ponds of freshwater in the carbonate rocks.
2	Aaiha	3.2	Low-lands where water seeps from the neighboring mountain chains and fill these lands.
3	Chamsine/ Anjar	0.85	Watercourses running water from Chamsine and Anjar spring and feed Litani River.
4	Palm island	5.5	Three isolated islands almost covered by saline water, notably among the karstic ponds.
5	Cliffs of Ras Chaqaa	7.0	Jointed cliffs (~200m) of carbonate rocks adjacent to the sea.
6	Tyr Coast	0.72	Elongated watercourse occurs from a number of artesian springs running water to the coast.
7	Ayoun Orghosh	0.47	Surface water in a depression land. They seep from the adjacent mountains, which fed mainly from snowmelt.

*Number according to Figure 11

D. Cultivated lands

Lebanese agriculture is divided into seven agro-climatic regions with 40 homogeneous agricultural areas (Lebanese Agricultural Atlas, MoA, 2005). The main agricultural products are citrus fruits, banana, grapes, tomatoes, apples, vegetables, potatoes, olives, tobacco, poultry, sheep and goats. The comparison of old and new agricultural census undertaken by the MoA and FAO in1999 and 2010 (MoA, 2011) showed a slight increase (by 11%) in the area of wheat from 16940 ha to 18760 ha with a significant decrease in the area of barley from 5140 ha to 3060 ha and maize from 3490 ha to 1400 ha, corresponding to 40% and 60% respectively. Meanwhile, the area of potatoes and subsidized tobacco was reduced from 19170 ha to 15860 ha and from 8980 ha to 2890 ha corresponding to 20% and 67% respectively (Figure 13).

Figure 13. Comparative review of agricultural census implemented by the MoA and FAO in 1999 and 2010 (Source: MoA, 2011)



The reduction in the area of some strategic crops was associated with a simultaneous increment of vegetable area from 14340 ha to 19690 ha, i.e., expansion equivalent to 37% in ten year period. Although the area of citrus was significantly decreased from 16430 ha to 9210 ha (by 43%), it is not understood why the area of bananas remained almost unchanged, despite the general trend of replacing citrus by bananas on the Lebanese coastal area. A demonstration on landuse change using remote sensing technique is shown in Annex II.A.1.

Parceling and fragmentation of agricultural land under the pressure of heritage and urbanization into small-size agricultural holdings do not allow economies of scale in production and marketing. The census carried out by the MoA in 1999 showed that almost 75% of the total farm holders (195,000 farmers) have an area of less than 1 hectare, and cultivate only 20% of the total cropping area. Around 3,100 farm holders (1.6%) with a holding size of more than 10 hectares cultivate around 30% of the total cropping area. The average national holding size is around 1.27 ha. The output is the mismanagement of fertilizer and water input, low competitiveness of most products, land abandonment and increased land degradation.

The Lebanese agriculture sector is facing weak implementation of policies, globalization, and dominance of temporary labor and aging of operators. Out of the country's 195,000 farmers, only about 66,000 farms full-time using an area of 121,581 ha. Agriculture nevertheless concerns a large number of Lebanese families: the population living solely or partly from farming accounts for 28% of the country's population (MoA, 1999). In addition to the effects of carving up the land, the sector must cope with the rising age of farmers, which is hardly symptomatic of a thriving activity. A breakdown of farmers by age group shows that 169,000 (86.7%) are over 35 and that younger Lebanese workers are presumably shying away from agriculture and opting rather for more productive sectors that pay higher salaries (Hamze *et al.*, 2010).

The map of soil aptitude to agriculture shows that the agricultural land area with high and medium productivity soils is estimated at 524,500 ha, representing half of the country's land mass (Darwish, 2011). Nevertheless, the announced used agricultural area in 1999 was only 248,000 ha. According to recent Agricultural Survey, carried out by the MoA and FAO in 2006-2007, the total cultivated land area in Lebanon in 2007 was 277 000 ha (27 percent of the total land area), of which about 50 percent was irrigated. With the implementation of a number of irrigation and rehabilitation projects in last ten years, the cultivated area increased by 5 percent with more than 23 percent increase in the irrigated area. However, the recent ongoing agricultural census, based on traditional statistics and questionnaires, considering 1000 m^2 as the minimum agricultural area, indicated 235,000 ha of utilized agricultural land of which 119,562 ha are irrigated. This indicates a recent recession of agricultural activities. Nevertheless, the area of irrigated lands in Lebanon increased from 64,100 ha in 1973 (Lebanese Statistics, 1973) to 100,000 ha recently (MoA/FAO, 2004), with 40% of lands located in the Bekaa Valley. Estimates showed that irrigable lands might reach 167.000 ha in 2015 (Comair, 2005). However, comparing these data with the remotely derived information from satellite images of November 2010 showed large discrepancy in the area of cultivated lands.

There is a large reliance on groundwater resources for irrigation. A total of 44% of irrigated land is irrigated by surface water, 22% by ground water and the remainder by a combination of the two techniques (MoA/FAO, 2011).

Irrigation water in the country is still primitively managed. Of all the surface water networks, only two uses pressurized water, whereas all others irrigation schemes use open canals. According to national irrigation experts, the majority of watered lands in Lebanon (67%) are irrigated by gravity feed systems (furrows). Other techniques include aspersion, used on 29% of irrigated land (mainly in the Bekka valley), and localized irrigation, which is used much less (on 9% of land) (Nimah, 1984; Karam *et al*., 2003).

The efficiency of irrigation systems is rated at just 46% for the countries as a whole. Efficiency could be increased by various measures, including the adoption of modern irrigation techniques. Use of modern irrigation systems and deficit irrigation has already led to a 25% saving in water application, but there is still room for further improvement (Darwish *et al*., 2006).

d.2. Cropping pattern and local agricultural practices

Land use in Lebanon might be represented by three different cropping patterns. 1. Vegetable monoculture or land permanently occupied by mint, parsley and other leaf succulent plants; 2. Land occupied by a simple rotation of field crops like potato and wheat; 3. Land under permanent crops - fruit trees or grape production.

The Bekaa Valley is considered as one of the most fertile lands of the country. It is also the major fruit, cereal and vegetable producing region. According to the MoA-FAO census (1999), the Bekaa Valley represented about 42% of the total agricultural area and almost 50% of the irrigated Lebanese land.

Soils of the Bekaa are mostly clayey in texture but improper agricultural practices might place the soils, groundwater and plants under risk of nitrate contamination. Intensive fertilization and excess irrigation multiply the risks of nitrate leaching beyond the root zone. Loss of nutrients from agricultural lands by means of leaching and surface runoff is suspected as one of the important non-point contamination sources (Yang *et al.*, 2007).

Indications show that intensive agricultural practices in the Near East region are far from being sustainable with clear indications for severe ecological damage (Möller *et al.*, 2003). Over-fertilisation, specifically of nitrogen in highly productive agricultural areas, is a major environmental problem, which leads to groundwater pollution and eutrophication of rivers and lakes (Thompson *et al.*, 2007).

The fertilization policy in open field consists of applying large amounts of low solubility compound fertilizers with high salinity index as land preparation phase (Table 9). This quantity is followed by different amounts of N carriers which make N application, for instance, far exceeding the plant growth and development demands and good yield target.

Table 9. Agricultural practices of cultivated lands in Terbol Plain, Central Bekaa.

Crop	Cropping pattern and Fertilization policy	Application Kg/ha/season	N input Kg/ha/ year
Mint monoculture	Mint is planted in monoculture. Fertilizers by soil application and irrigation by sprinklers.	2500 kg Ammonium nitrates fractioned into ten application events.	837.5
Potato/Wheat	Potato is planted in early spring (February-March) or late spring/early summer season. Irrigation by sprinklers or drip. Winter wheat is sowed in November and harvested in June (next year). Wheat receives one or two supplemental irrigation.	Soil application of 1500-2000 kg/ha of complex fertilizers 15-15-15 prior to sowing. Application of 750 kg/ha ammonium nitrates in two fractions during the first 40 days after emergence. I wheat, basal application of 500 kg/ha complex fertilizers 15-15-15	550-625
Grape	Grape is planted with a distance 5 x 5 m (400 trees per hectare). Fertilizers are applied in the soil and irrigation is practiced by minisprinklers. Some fields apply fertigation by drip irrigation.	Fertilization starts from May. Application of 1kg $(NH_4)_2$ SO4 per tree/month (in two applications) followed by 0.3-0.4 kg/tree/month of soluble 20%-20%-20% until October.	550

E. Protected Areas

e.1. Introduction

Extending over 10,452 km^2, Lebanon occupies only 0.007 % of the world's land surface area and is home to 1.11% of the world's plant species (Tohmé and Tohmé, 2007) and 2.63% of the reptile, bird and mammal species. Its sea is home to about 1790 species, representing almost 2.7% of the world's marine species.

As a result of the biogeography, geology, ecology, topography and historic human settlements particular to the Mediterranean basin (Blondel and Aronson, 1999), Lebanon falls within a recognized center of plant diversity that is considered a global hotspot (Myers *et al.*, 2000) and presents a wide variety of habitats ranging from islands, coastal lands, agricultural plain, rivers and high mountains which culminate at 3088 meters. In addition, Lebanon's complex topography, the lasting historical human presence, the position of the country within a global Hot spot for biodiversity, the geology and the prevailing microclimatic conditions have resulted in an altitudinal

organization of vegetation levels with respect to bioclimatic zones. Consequently, Lebanon offers in total 9,119 species of which 4,633 plant species and 4,486 animal species (Jaradi and Khater, 2009). Out of the 2600 terrestrial plant species, 92 are broad endemic to Lebanon, Syria and Palestine. Hence, and with regards to its size, Lebanon boasts one of the highest densities of floral diversity in the Mediterranean basin, which in turn is one of the most biologically diverse regions in the world (Médail and Quézel, 1999).

However, biodiversity in Lebanon is under severe threat of decline and extinction (Sattout and Abboud, 2007) and the major pressures concern habitat loss, habitat degradation, invasive species, unsustainable harvesting, climate change, pollution, and to a lesser extent the threat related to genetic pollution and hybridization between cultivated and wild relatives. In face of those current problems and their devastating consequences on Lebanon's ecosystems thus indirectly on the human life, and recognizing both the value of the diversity of ecosystems and landscapes as well as the various threats related to human development, the Lebanese Government has initiated as early as 1930's a conservation policy based on prevention through establishment of a network of protected areas (PAs) over the Lebanese territory. The establishment and management of protected areas is gaining support as one strategy for the management of lessening and adapting to the impacts of these rapid changes.

PAs are Lebanon's threatened national living museums representing invaluable scientific treasure and economic security. Above all, they are a share of a heritage ought to be kept for future generations to enjoy. The uniqueness of Lebanon lies in its endowment with the wealthy biodiversity of those protected areas. This inherent asset attracts nature-lovers around the world, thereby promoting the flourishing of a new form of tourism in the country - ecotourism.

This report will provide an overview of types of PAs in Lebanon and the institutions that are involved in the designation, protection and management of PAs in Lebanon. It will present the main designated protected areas and their classification in the country and will also highlight some of the main achievements and issues concerning protected areas in Lebanon, and provide some recommendations for improved management of PAs and conservation.

e.2. Definition and types of Protected Areas in Lebanon

A protected area is "a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives" - CBD definition - Hence, protected areas (PAs) forms the cornerstones of national and international conservation strategies by acting as refuges for species and providing space for natural evolution and future ecological restoration. PAs also provide opportunities for rural development and the rational use of marginal lands, generating income and creating jobs for research and monitoring, for conservation education, and for recreation and eco-tourism.

Recognizing the importance of its ecosystems' diversity and appreciating the value these ecosystems embrace to the economy, culture, tourism and quality of life in the country, Lebanon now features more than 25 PAs with legal status which owe their existence to the persevere lobbying of Ministries, Municipalities, NGOs, local communities, experts and environmentalists. Lebanon has been designating protected areas since the 1930's. Responsibility for such designation originally fell under the jurisdiction of Ministry of National Economy. Since that time, this mandate has been reattributed to several parties including the Ministries of Environment, Agriculture, Culture and others.

Existing classification of PAs in Lebanon includes 16 Protected Forests, 10 Nature Reserves, 24 Natural sites/Natural Monuments, 5 Himas (Ancient Arab system of ecosystem's community-based Management), 14 touristic sites, and a multitude of sites that are worth protection. Consequently, there were no legally formal PA categories in Lebanon with any clear rationale or criteria for grouping (MoE, 2006). In this regard, the MoE within the framework of the Stable Institutional Structure for Protected Areas Management (SISPAM) Project has prepared a draft for new categories system for PAs defining criteria for the establishment of each category in addition to their management objectives and model, in order to ensure a better PAs management in Lebanon. Table 10 shows the five existing groups on PAs in Lebanon to date[2].

[2] http://www.moe.gov.lb/ProtectedAreas

Table 10. Existing non-standardized classification of protected areas

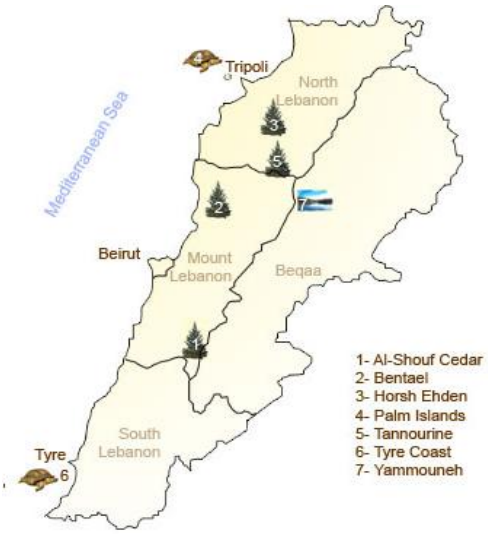
Group	Definition
I	Protected sites established pursuant to Decree No. 434 (28/03/42) modified by Decree No. 836 (09/01/50)
II	Nature reserves (Mihmiyat) established by laws since 1992
III	Protected sites established by MoE decisions on the base of the law of protection of natural sites (08/07/1939)
IV	Protected sites established by MoA decision before 1996 and based on the Forest Code (Law 85 from 1991)
V	Based on the Forest Code (Law 558, dated 24/07/1996) and MoA ministerial decisions

An important group of PAs in Lebanon are nature reserves (NRs) (Group II in table 10) which were established since 1992 by laws voted in the parliament upon suggestion of the MoE[1]. At present, 8 nature reserves are declared in Lebanon: 6 terrestrial forest nature reserves, 1 marine and 1 coastal (Table 11 and figure 27). Aiming to increase area under protection, the MoE has drafted the legal text for the declaration of two additional NRs. Table 17 shows the NRs types and regulatory designation in Lebanon.

Table 11. Nature Reserves types and regulatory designation in Lebanon[3].

Nature Reserve	Type	Law and year
1. Palm, Sanany and Ramkeen Islands	Marine/Islands	Law 121 of 1992
2. Horsh Ehden	Forest	Law 121 of 1992
3. Al-Shouf Cedar	Forest	Law 532 of 1996
4. Tyre Coast	Coastal zone	Law 708 of 1998
5. Tannourine Cedar	Forest	Law 9 of 1999
6. Yammouneh	Forest	Law 10 of 1999
7. Bentael	Forest	Law 11 of 1999
8. Karm Chbat (Figure 16)	Forest	Decision No 14 of 1995

Figure 13. Distribution of Nature Reserves in Lebanon.



[3] http://www.moe.gov.lb/ProtectedAreas/categories.htm

In addition to the nationally recognized types of protected areas, many sites in Lebanon benefit from international designation such as RAMSAR sites (4); Important birds areas (15); Specially Protected Areas (RAC-SPA) (1); Man and Biosphere Reserves (3): Al Chouf and Ammiq wetland; Jabal Rihan and Jabal Moussa (Figure 15); UNESCO cultural heritage sites (5): Anjar, Baalbek, Byblos, Ouadi Qadisha (the Holy Valley) and the Forest of the Cedars of God (Horsh Arz el-Rab).

This new system is being fine-tuned in order to better fit the natural ecosystems in Lebanon. Hence, as PAs designation in Lebanon has not followed any criteria or procedure, this process has unfortunately excluded many of the Lebanese unique and valuable ecosystems, landscape, and habitats with all what they endow of beauty and biodiversity of any legal or pronounced protection. This stato de facto has exposed Lebanese lands to various threats aggravated by population growth, urbanization and industrialization leading to desertification, deforestation, infestations, erosion, and destruction of the ecosystems and habitats.

Figure 15. Broadleaved forest in Jabal Moussa Biosphere Reserve

Figure 14. Juniper and Fir trees in Karm Chbat Nature Reserve

Affirming the need to have a clear vision for the protection of the Lebanese lands, ecosystems, landscape, habitats and biodiversity to conserve the natural resources and ecological services on which our survival depends, MoE within the framework of the Stable Institutional Structure for Protected Areas Management (SISPAM) Project prepared a PAs category system for Lebanon.

As this issue is a national responsibility, it must be shared by all relevant PAs stakeholders and the community at large. For this purpose, a large number of key stakeholders were consulted such as ministries (Environment, Tourism, Transport, Culture, and Energy and Water), universities, Nature Reserves Committees and management teams, municipalities and independent experts.

The suggested national category system for PAs in Lebanon is consistent to the IUCN category system. It is composed of:

1. National Park (IUCN Category II),
2. Natural Monument (IUCN Category III),
3. Habitat/Species Management Areas (IUCN Category III), and
4. Protected Landscapes/Seascapes (IUCN Category IV).

Hima System

Although this classification has not been yet adopted as it has been retarded by political turmoil after the 2006 war on Lebanon, the MoE is currently revising this classification for final modifications to follow recent developments in terms of land use planning and private (NGO) initiatives in Lebanon before re-submission for Government approval.

F. Forests

f.1. Introduction

Lebanon is part of the Mediterranean biodiversity hotspot, one of 25 such areas identified around the world (Regato and Asmar, 2011). Lebanon is a "hotspot" because its terrestrial and aquatic biological resources are seriously threatened (primarily) by human activity and the growing threat of climate change. The most recent Lebanon national report to the Convention on Biological Diversity (Jaradi and Khater, 2009) noted that the country is home to about 2,600 terrestrial plant species with 8.5 % being broad endemic (endemic to Lebanon, Syria and Palestine) and 3.5% endemic to Lebanon. Therefore, being a highly mountainous country (highest peak at 3,090 m), with extreme variability in climatic conditions, soils and socio-economic status, Lebanon hosts very particular forests in their variation and characteristics thus representing a unique feature in the arid environment of the Eastern Mediterranean.

In 2002, Forests covered 139,376 ha while Other Wooded Lands (OWLs) covered 108,378 ha, 13.3 percent and 10.37 percent of the surface area of the country respectively. Other lands with trees (including fruit and olive trees) covered a surface of 116,210 ha (11.1%) of the surface of the country (MoA/FAO, 2005). The forest cover is broadly divided into three main classes: Mixed Forests, Broadleaves and Coniferous. On the other hand, OWLs are divided into the following classes: coniferous shrubs, broadleaved shrubs, mixed shrublands and grassland with trees (MoA/FAO, 2005).

The main forests widespread in Lebanon are *Quercus calliprinos*, *Quercus infectoria*, *Quercus cerris* (mostly referred to as *Quercus spp*), *Juniperus excelsa*, *Cedrus libani*, *Abies cilicica*, *Pinus pinea*, *Pinus halepensis*, *Pinus brutia* and *Cupressus sempervirens*. In addition, Lebanese forests contain a wide range of aromatic, wild and medicinal plants (Asmar, 2005). However, as a result of unsustainable forest practices and neglect of forested lands, and as a result of the decline of controlled grazing in forest understory, oak and pine forests have become highly susceptible to fire events (Masri *et al.,* 2006). In contrast, cedar forests have received national, regional and international attention due to their historic, symbolic and biological value (Sattout *et al.,* 2005) even if they just constitute 1.58% of the total forest cover (MoA/FAO, 2005). Lebanon has 10 nature reserves, 3 biosphere reserves, 16 protected forests, 16 protected natural sites/ landscapes, 4 Ramsar sites and 5 World heritage sites.

f.2. Definitions

According to the Food and Agriculture Organization's (FAO) Global Forest Resources Assessment (FRA) 2005, "a Forest is a land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land

that is predominantly under agriculture or urban use". Areas under reforestation that have not yet reached but are expected to reach a canopy cover of 10 percent and tree height of 5 m are included, as are temporarily unstocked areas, resulting from human intervention or natural causes, which are expected to regenerate. This definition excludes tree stands in agricultural production systems as well as trees in urban parks and gardens.

OWL is considered as land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10%, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10%. It does not include land that is predominantly under agricultural or urban land use. The forest bioclimatic zones and distribution are shown in Annex II.A.2.

f.4. Distribution of forests types

Based on the FAO-FRA (2005), forests in Lebanon cover 13.2% of the country's territory. OWL adds an additional 11.3% of the territory, yielding a total of 24.5%.

Figure 17 and Tables 12 and Annex II.A.2 illustrate the forest distribution and show how the forest cover and types are distributed throughout the country. About 57% of the forest cover is broadleaved species (primarily oaks), with coniferous species (mainly pines) contributing about 31%. The remaining portion is mixed broadleaved and coniferous forests (ECODIT, 2009).

Table 12. Distribution of Lebanese forests by type

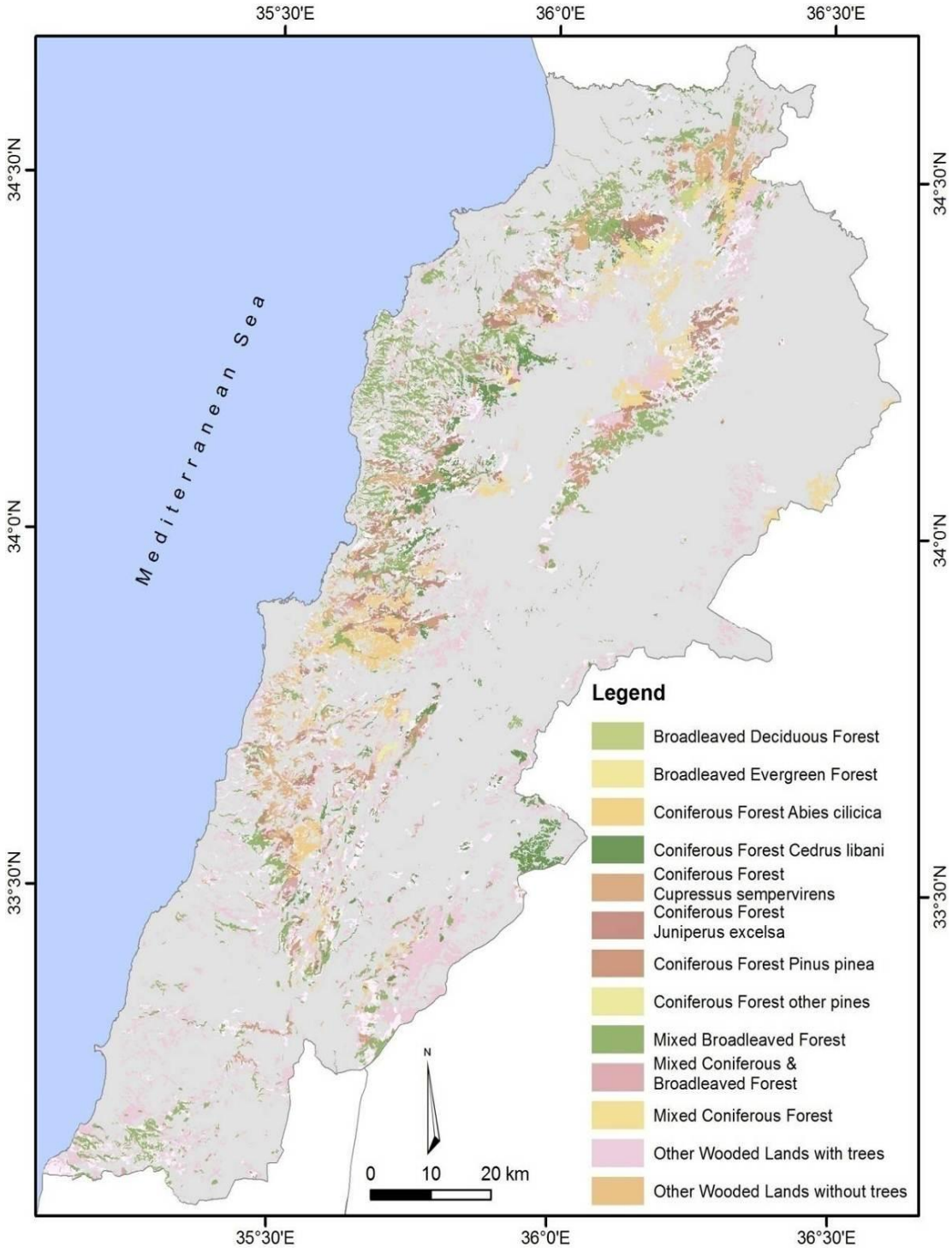
Forest Type	Areas (ha)	Percentage of total forest cover (%)
Cedrus libani	2,125	1.58
Abies cilicica	1,613	1.2
Cupressus sempervirens	318.75	0.23
Juniperus excels	11,318	8.47
Pinus spp	27,273	20.28
Quercus spp.	61,325	41.61
Mixed forests	30,398	22.61
Riparian forests	58	0.04
Total forest cover	**134,430**	**100**

Source: MoA/FAO, 2005.

f.5. Forest land ownership

The forest ownership in Lebanon is almost equally distributed between the private sector, the public sector and the religious communities under several tenure systems (AFDC, 2007). However, cadaster is not always updated and surface areas and boundaries are not always clearly set. Moreover, the users of the forest areas may not be the owners.

Figure 17. Lebanon's derived forest map (Source: MoA/FAO, 2005)



The different land tenure systems are the following:

- The Waqf, which are usually lands owned by religious communities or by extended families.
- The Macha'a, which are communal lands owned by a municipality and managed by the municipal council.
- The Amiri, which are lands owned by the state.
- The Mulk, which are private lands, owned by individuals.

The lands owned by the religious communities are included in the private group. Table 13 illustrates the ownership of forested lands in Lebanon according to the TCP on National Forest and Tree Resources Assessment (2003- 2005).

Table 13. Ownership of forested and other wooded lands in Lebanon, 2004.

Ownership type	Forest (ha)	OWL (ha)
Private	84,183	86,702
Public	53,799	14,956
- State	38,189	-
- Municipal	13,938	-
- Communal	1,672	-
Unknown	1,394	6,720
Total	**139,376**	**108,378**

Source: FAO, 2005.

f.6. Social and economic importance of Lebanon's forests

The forestry sector remains a relatively small employer nationwide; it contributes to 0.02 percent of the total labor force. Lebanese people in general and rural communities in particular have traditionally benefited from forest resources in various ways: forest flora exploitation, beekeeping, pine nuts production, wood collection and charcoal are valuable sources of income (AFDC, 2007). However, the forest sector remains a relatively small employer nationwide. Similarly, wood production represents a minor activity in Lebanon since it is a banned activity. Some decrees were issued to regulate and organize the harvesting and export of some aromatic/medicinal plants. These decrees ensure the sustainability of the species, thus being a good tool for rural development and nature conservation at the same time. The economic value of the different forest ecosystems in Lebanon are estimated at about $131.5 million following a social survey to assess the WTP (willingness to pay) for forest conservation. The contribution of the forest sector to Lebanon's gross domestic product (GDP) was 0.93 percent in 2001 (Sattout *et al.*, 2005).

f.6.1. Wood Products

Despite the fact that some of the Lebanese tree species like the cedars, the junipers and some oaks could produce wood of good quality, wood production is a minor activity of the forestry sector in Lebanon as in most Mediterranean countries. The present structure, cover and distribution of forests do not allow for such a production. Wood is only exploited as fuel and charcoal by some rural communities that use it as a source of energy for cooking and heating (Asmar, 2005).

f.6.2. Non-wood products

Non-wood forest products are the main income-generating activity from forests as several rural communities depend on these products for their living. The main wild products collected are:

- Pine nuts collected from pine forests (*Pinus pinea*) on the coastal slopes of Mount Lebanon from sea level up to 1,500 m. According to the MoA (2007), the production of pine seeds was 1,200 tons for the year 2004. With reference to Masri et al. (2006) as well as values adopted by the "Syndicate of pine growers in Lebanon", each 100 kg of seeds results in 22 kg of edible nuts; the price of 1 kg of edible nuts is equivalent to $22. Consequently the potential revenues generated by the 1,200 tons would be of $5,808,000. In 2011, the cost of 1 kg of edible nuts raised until $40 with a total revenue exceeding $10,500, 000.
- Carob pods collected from carob trees (Ceratonia siliqua) found on the coastal slopes up to 800 m. According to MoA, the production of pods (for the production of molasses or row carob pods) was 3,300 tonnes for the year 2004 (MoA, 2007).
- Medicinal and aromatic plants are estimated at more than 365 species (MoE, 2009). Plants like the wild Origanum syriacum, Salvia sp., Rosa canina, Ferrula hermonis (known as the Zallouh root) and many others are extracted from forests for culinary, medicinal or aromatic use (MoA, 2005). The potential estimated market value of medicinal and aromatic plants assessed by market analysis

(sales of herbs and teas) and not by direct estimate of forest ecosystems production, was $ 29,600,000/ year (MoE, 2009).

f.6.3. Other economic activities and services

The appropriate management of forests and other wooded lands would play a very important economic role, allowing the provision of services with a high market value such as eco-tourism, agri-tourism and rural tourism. Over the last decade, ecotourism activities have been expanding in Lebanese forests, attracting local and foreign tourists (MoA, 2005).

Grazing has always been considered not only as an interesting economic activity related to forested lands, but also a powerful management tool that has shaped and defined the structure of Mediterranean forests. Grazing activities in and around forests occur in Lebanon during summer. Shepherds traditionally move their sheep and goats to the coast in winter (AFDC, 2007). Unfortunately, little data is available in Lebanon on grazing as an economic activity and the common figure given by the MoA reflects that goat herds are more important than sheep herds.

Honey production is a significant trade in Lebanon, whereby the number of beehives is 131,000 distributed throughout the country. These beehives produced 1,070 tons of honey evaluated at around $14.67 million (MoA, 2007). The common practice in honeybee management in Lebanon consists of transporting beehives in winter to lower elevations, where they are usually placed in fruits orchards and other cultivated lands (Sattout et al., 2005).

As for hunting, it is an important socio-economic activity in the region, particularly in rural areas. Hunting in Lebanon involves hundreds of thousands of population and hectares, and supports a variety of groups (Jreissati, 2010). Sport hunting has become particularly widespread in the region in recent years (AFDC, 2007). The overall value of hunting based on the number of legal and illegal hunters is estimated at around €12 million (Sattout *et al.*, 2005).

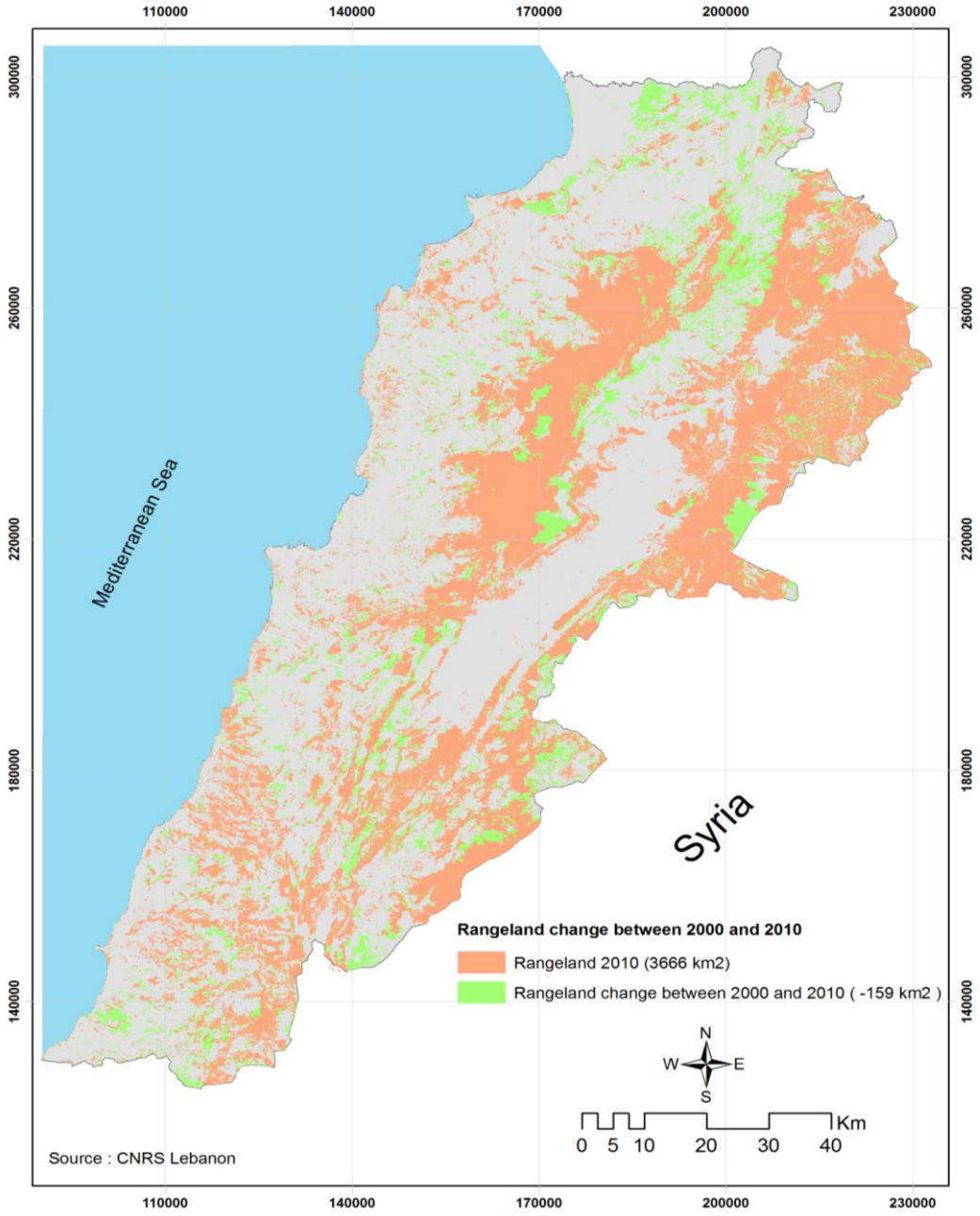
Recreation and tourism ranks as the third most exploited service in the forest sector. A number of associations offer different forms of tourism and recreation trips in the country's forests. Their offered activities include climbing and rappelling, rafting, canoeing, cross-country skiing, mountain biking, speleology, paragliding, and camping. As for ecotourism, it is a growing activity in Lebanon in general. An increasing number of organizations are specializing in organizing eco-tours throughout the country. While there is no single definition for ecotourism, different organizations have put characteristics defining it. The ecotourism sector in Lebanon is operating on a small scale and actively contributing to the economic benefit of local communities. Moreover, it minimizes negative impacts on the natural and socio-cultural environment and supports the protection of natural areas. Lebanon's rural eco-tourism sites represent a great tourism attraction for local and international tourists due to their diversity. Forests in Lebanon are major players in ecotourism (AFDC, 2007).

Forests in Lebanon also provide sources of employment which come in different forms. Some common forms of employment are in wood and non-wood product exploitation, such as pine nut collection, charcoal production, timber production and medicinal/aromatic plants extraction. Other forms of employment in forests include tourist guides, forest guards and scientists. No data is currently available on the number of people working in the forests and in forest related activities except for forests guards that are employed by MoA.

G. Rangeland

In 2000 the area of rangeland in Lebanon was 4066 km^2 consisting of grassland (400 km^2), shrubland land and land with little or no vegetation represented 3825 km^2 (MOS, 2000). In 2010, the area was reduced until 3666 km^2 (Figure 18). The changes were caused by land use change, urban expansion, rehabilitation into terraces and quarrying. The bulk area of rangeland is located on the highest peaks of West and East Mountains, and in North and South Lebanon. Rangeland development in Lebanon is faced with two main problems: water erosion and uncontrolled grazing. According to our results based on land capability classification, the estimated area of marginal land which can be used for grazing and reforestation is 388200 ha. The area of non arable lands exceeds 165000 ha.

Figure 15. Rangeland distribution in Lebanon (Source: CNRS, 2011)



However, these rocky lands are usually not continuous, and certain soil material is usually deposited between the rock outcrops supporting sparse vegetation. Therefore, 10 to 20% of this area can be considered as rangeland. This applies notably to the mountain slopes where animal can spend at least three to six months depending on altitude, climatic conditions and carrying capacity of the lands. Therefore, not more than 400,000 ha can be considered as rangelands, which are equivalent to 38% compared to previous estimation of 52% (FAO, 1980) of the total Lebanese area. This means two things: 1. A reduction in the available rangeland area due to erosion, agricultural expansion and urbanization and 2. Considering the poor productivity of Lebanese rangelands and managing their carrying capacity for small ruminants, estimated to be below 2 head/ha (Hamadeh, 2005), the carrying capacity of rangeland in Lebanon does not exceed 800,000 small ruminant heads.

The buildup of seeds in the soil of marginal lands is an essential step towards the improvement of degraded pastures, which form a large part of the land surface in Lebanon and on which small ruminant production largely depends. Sowing four Mediterranean annual legumes and top-dressing with super-phosphate were studied near Terbol in Lebanon for four years (Partial protection from grazing for one

or two months in late winter and spring) more than doubled the number of legume seeds in the seed bank compared with full protection and open grazing (Osman and Cocks, 1992).

H. Land use planning

h.1. Challenges

Lebanon is considered amongst the ten most densely populated countries in the world. The change in scale resulting from the transition from a country of one million inhabitants during the independence to a country (1943) of four million inhabitants in the year 2000, living in the same area, and expected to exceed a number of five millions in two or three decades should be taken in consideration. This variation has a significant impact on the use of the nonrenewable resources, as well as drastic changes in land cover that have taken place and are expected certainly by chaotic urban expansion (e.g. reaching in some cases 80% or more between 1987 and 2000 in the Bekaa valley), at the expense of agriculture, forestry and natural resources (Jomaa and Khawlie, 2002; Masri *et al.*, 2002). These changes lead to various environmental stress processes, in particular the land degradation, as a result of mild deterioration of green cover (Khawlie *et al.*, 2002). Therefore, there is a definite and urgent need in Lebanon for land use planning based on continuous upgrading of the changes occurring in land cover, land use in order to select and adopt the best land use options that meet the needs of the people while safeguarding resources for the future.

h.2. Responses

h.2.1. SDATL main categories

The national territory is the collective heritage of the Lebanese people. Every generation has thus the duty to transmit it, in its entire wealth, to future generations, after using it rationally and developing it in a way that would not affect its character or its potential. In this perspective, the Lebanese National Master Plan marks a turning point in the action of the public administrations in Lebanon. For the first time since the country's independence, the fundamental principles of land use and of spatial organization have been posed. For the public administrations in charge of territorial policies, the "National Physical Master Plan of the Lebanese Territory-NPMPLT" (SDATL) is now a central reference for the programs and actions to be undertaken. Published by the CDR of Lebanon in 2004 and voted in the council of ministers in June 2009, it focuses on the territorial organization and equipment of the country and governs documents of planning.

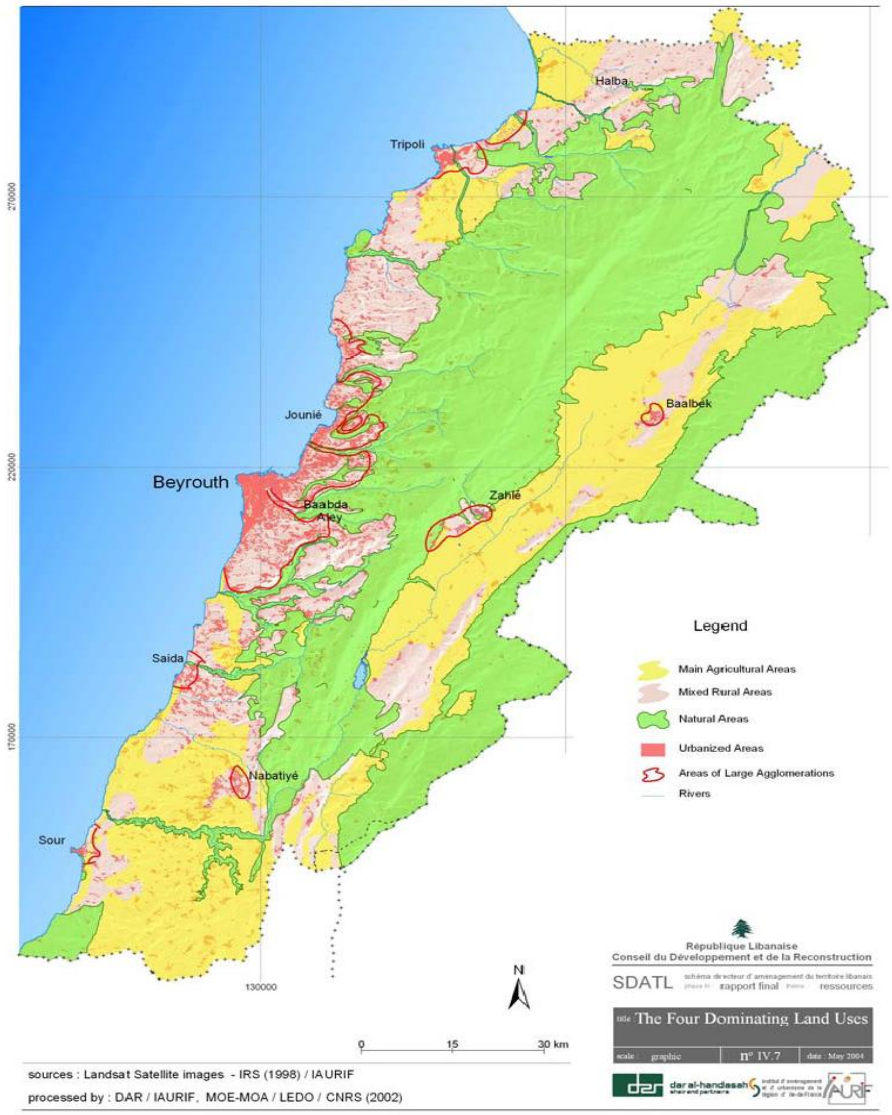
In land use planning, the territory is an essential feature to be taken into consideration. The spectacular topographic features of Lebanon take part in defining climatic and agricultural zones, and forest land categories in dividing lands and imposing constraints (slopes, obstacles) for constructions. Therefore, based on objective scientific analyses, the NPMPLT determined the preferential uses of the territory's various parts in 4 categories: agricultural domain of national interest, urban regions, mixed rural regions and natural sites of national interest (Figure 19).

h.2.1.1. Agricultural domain of national interest

It includes the best agricultural lands of the country where irrigation networks either exist or are planned. The use of these lands for agricultural production purposes is a stake of national interest. The identification of these regions has been made using the maps of soil classification and irrigation perimeters. The analyses carried out, in the framework of a joint research program between the CNRS-CRS and experts in charge of the NPMP, have taken into consideration multitude of criteria to produce the soil classification map, including: soil nature (pedology), soil depths, acidity, slope, irrigation possibilities, etc. The soils have been classified into 5 classes, according to their suitability: Unsuitable for agriculture; Mediocre; Average; Good; and Excellent. The NPMP has adopted the 3 best classes (average, good, excellent) for the selection of the core of the agricultural domain of national interest.

Lebanon is endowed with a significant capital of valuable lands for agriculture. 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 (Bekaa, 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.

Figure 16. The four dominant land uses in Lebanon suggested by the SDATL 2004



h.2.1.2. Urban regions

This corresponds to the country's large agglomerations. These areas were defined taking into consideration their expansion for the coming 25 to 30 years. At present, they already contain 2/3 of the resident population of Lebanon, and the majority of industrial and tertiary activities of the country.

h.2.1.3. Mixed rural regions

These are the regions that accommodate small cities and villages that are not attached to large agglomerations, as well as agricultural areas of unequal quality in addition to natural spaces that are not part of the important agricultural and natural entities of national interest.

h.2.1.4. Natural sites of national interest

It resumes the "green and blue network". They are regions that constitute a national importance for the conservation of water resources, forests and biodiversity. Land use in these areas is necessarily restrictive since three entities are distinguished; the high mountains above 1 900 m altitude, the Cedar and mountain tree plantation corridor (between 1 500 and 1 900 m) and the valleys, forests of quality in addition to other zones of ecological continuity.

h.3. Assets

The NPMPLT selected sites and regions of great importance considered as assets and which is essential to preserve and exploit, therefore land uses at the edges or inside these sites should take in consideration this must. The landscape assets comprise 11 perimeters of "major physical landscapes" that constitute its identity, its quality of life and its tourist attractiveness such as the high valley of Nahr Abou Moussa/Nahr el-Bared in Akkar, the valley of Qannoubine (Holy valley), the valley of Nahr Litani between Qaraoun lake and bridge of the Qaaqaaiyeh, the highlands of Mount Hermon, the hills of the South (Caza of Bent Jbayl). Land use in all these regions should take into consideration the need to preserve this natural wealth. This should be done through the implementation of strict rules on construction heights, materials and construction development. In addition, landscape assets include "picturesque villages" and natural wonders or "important natural sites". Urban expansion should be severely controlled within the picturesque villages as well; strict protection of the natural important sites (natural pound, waterfalls, chasms…) must be ensured in a restricted perimeter, and valorized in a larger perimeter.

The historical heritage, whether it is archeological or recent, has vital importance in the tourist economy and in contributing to the country's history. The local urban plans should preserve these sites with strict measures by identifying protection perimeters around them. Finally, the major assets offered by the coast line include, sandy beaches, 2 exceptional sites (Anfa and Ras-Chaqaa), remarkable natural sites, natural shorelines with high ecological and landscape values, urban seashore promenades and cornices and picturesque ports. The NPMPL set a series of recommendations for the preservation of these assets based on a severe redefinition of possible and expected coastal land use, especially on maritime public domain and neighboring lands.

h.4. Constraints

Another criterion for land use includes the constraints related to natural hazards: flooding, landslide and ground water pollution. The NPMPLT has mapped the flood hazards prone areas. They are mostly located on agricultural plains (the Bekaa and Akkar plains for example) where water level is likely to rise as a result of significant water runoff, as well as on river banks (Abou Ali and El-Kabir rivers). Within these perimeters, constructions that render the soil impermeable and would increase the flood intensities and create obstacles to water flows are to be avoided.

Landslides prone areas were mapped as well; these areas are mainly located along fault lines where urban development should be avoided. Additionally, it is imperative that urban planning regulations reduce the possibilities of construction on higher than 10% natural slope lands. Since excavation and filling works would decrease the slope and thus increase soil slippage. Finally, the zones of faults and fractures represent an extreme danger for groundwater pollution and consequently, for water resources that supply domestic and potable water demands. Therefore, it is avoided to implement industries and discharges around these areas.

h.5. Implementation of land use planning

h.5.1. Agricultural homogeneous zones

Agricultural Homogeneous Zones study in Lebanon was conducted in 2006 by the MoA in collaboration with the Agricultural Census Project which is technically executed by the FAO. Local players shall homogenize their actions from both private and public sectors, around a common development project addressed to the whole area or to the zone under study.

Lebanon has been divided into 40 Agricultural Homogeneous Zones distributed on seven regions corresponding to administrative units: Mount Lebanon, Akkar, the rest of the North, Baalbek-Hermel, the rest of the Bekaa, South and Nabatiyeh. The classification was based on many criteria which constitute the basics for the identification of any agricultural homogeneous zone (Jammal, 2006):

- The region's landscape: topography, altitude, geomorphology, roads.
- The cultivated agricultural area: crops' diversity, use of water irrigation in agriculture, areas under protective covers.
- Agricultural production practices: either primitive ones according to the geographical topography of the zone and the inherited customs which aim to self sufficiency or modern ones relying on the

mechanization and scientific technology which aim to intensive production destined for the markets.
- Population: emigration and migration movement, labor youth and their professional skills as well as their attachment to their lands.
- The zones' size.

Therefore, the Agricultural homogeneous zones are considered to be the product of their history and a reflection of their present, whilst at the same time harboring the conditions for their own future. Indeed, the goal of adopting the agricultural homogeneous zones' concept is to focus on the achievements that match with each zone's specificities at the development process level (Chami, 2006).

h.5.2. Actual situation in Lebanon

The actual results of land use planning and arrangement in Lebanon are not compatible with the enormous potential given by the law to the public authorities. The first independent and integrated law for urban planning in Lebanon was issued on 24 September 1962 and was operational for 20 years, and then it was replaced by the currently active decree law for urban planning number 69 on 9/9/1983. The general considerations of landuse planning in Lebanon are discussed in Annex 3. Despite the existing laws and concepts, the implementation remains weak due to the following reasons:

h.5.2.1. Unplanned Urban Expansion

Population growth is increasing demand for housing; wealth and changing lifestyles are increasing demand for secondary housing including mountain retreats and beach chalets. Cities are consequently growing both vertically and horizontally and are spread without harmonization, leading to the deterioration of architectural perspective of the street. For instance, developers are erecting buildings in vacant plots (often used as paid parking areas) or in lieu of old buildings which are torn down (sometimes illegally) and replaced with new housing units. Horizontal growth is happening at the expense of forested areas (Metn areas including Beit Merry, Broumana, Baabdat and Bharsaf), natural areas of unique environmental significance (Faytroun in Kessrouan, Fnaideq in Akkar) and agriculture fields (Al Bassatine in Tripoli) (Stephan, 2006).

Changes in land use and urban expansion were monitored in Tripoli. Aerial photos at 1:10000 scale from 1964 were used as baseline data, then the area was classified through analysis of satellite imageries from Landsat TM (1997) and Spot (2000). Table 14 shows an enormous increase in urban expansion and gardens from 1964 to 2001 accompanied with a critical reduction of agricultural lands (50% of fruit trees, 65% of olives and 25.5% of citrus).

Table 14. Monitoring of land use changes in Tripoli-Mina, Ras Maska and Baddaoui area

Year	Urban		Forest		Gardens		Fruit trees		Olive		Citrus	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1964	333	100	66.6	100	0.89	100	2220	100	1324	100	896	100
2001	999	300	16	24.5	5.14	577	1105	50	868	65		25.5

Source: Darwish *et al.*, 2004.

h.5.2.2. Construction problems

Fertile and irrigated agricultural lands in addition to lands viable for irrigation (which constitute only about 12% of the Lebanese territory) are often used for construction. Thus the necessity of additional works for the reclamation of new lands for agriculture whose productivity will remain below the level of lost agricultural land.

h.5.2.3. Informal building

Even though constructions must be avoided in the flood hazard prone areas, informal buildings were found in the southern Bekaa Valley and in the plain of Akkar; therefore the intervention of the State in winter to the rescue of the inhabitants and their compensation is a general rule.

h.5.2.4. Anarchic buildings

Lebanese are proud of their historical monuments that are part of world heritage, but they build skyscrapers above them like in Sour and they conceal Baalbek Castle by huge buildings around, beside the large demolition of heritage buildings for other construction purposes.

h.5.2.5. Lack of legal measures

Public authorities do not use legal measures set for land use options. Accordingly, the actual situation is critical and it is getting worse with time since it is impossible to get rid of the damage that will remain for the future: agricultural fertile land lost along the cost cannot produce again, demolished heritage buildings will not be rebuild, distorted natural sites like Faytroun rocks and Harissa horsh will never regain their beauty (Fawaz, 2011).

h.5.2.6. Problems from abandoned quarries

Quarries destroy the mountains and distort the environment: In 2010, the MoE and UNDP reviewed and inspected 150 quarry applications and operations. The study showed many types of violations: excavation extends outside the designated license area; operators don't respect the stages of the quarry license, cliffs and quarry faces exceed allowable heights and no sites rehabilitation after closure were observed (Stephan, 2006).

h.5.3. Opportunities and constraints

h.5.3.1. Lack of data validation and public participation

Data validation and public participation are usually lacking in the urban planning process. The current system is not immune to political interference and is often geared towards maximizing land use coefficients. Naturally, there are positive exceptions. For example, the land use plan of Saghbine (West Bekaa) designated a plot in the vicinity of the Qaroun Lake to establish a Wind Farm (HCUP Decision No. 19 dated 21/5/2010). This initiative can and should be replicated in other urban plans based on the findings of the recently published Lebanon Wind Atlas (Stephan, 2006).

h.5.3.2. Application of the Strategic Environmental Assessment

Another alternative to conventional land use planning is the application of the Strategic Environmental Assessment (SEA). Indeed, a pilot land use planning project under the guidance of the MoE/UNDP was funded by the EU for the region of Tannourine. The planning activity engulfed the nearby site of Baatara Sinkhole in Chatine (protected by MoE Decision 8/2004). The pilot project applied the SEA process to a regional development plan that is based on sound land use planning. The pilot produced encouraging results and was a learning experience for all including the municipality of Tannourine, the regional department of urban planning, and the MoE. The project should be replicated in other parts of the country as part of a national effort to go from physical master planning to strategic planning (Taleb, 2006).

The lately adopted laws by the Council of Ministers concerning solid waste management and environmental impact assessment can allow for better protection of environment. Also, the adoption of law for the creation of Environmental Prosecutor and Environmental Police Unit which are given the power to impose and execute penalties to responsibles in environmental deterioration require the fast action of the Lebanese parlament to implement these laws.

h.5.3.3. The Investment Development Authority of Lebanon

The Government of Lebanon launched in 1994 the Investment Development Authority of Lebanon (IDAL), a public institution enjoying independent legal personality with financial and managerial independence, under the direct administrative authority of the Prime Minister. It regulates the investment promotion of domestic and foreign entities and strives to stimulate Lebanon's economic and social development and enhance its competitiveness (Stephan, 2010). IDAL inaugurated in 2001"the Export Plus Program" by (Decree No 604/2001) to support exporters in marketing their agricultural products in regional and international markets (Syria, KSA, Kuwait, Egypt, UAE, Jordon, Quatar, Oman, Iraq, Bahrain, Yemen and North African countries). From 2001 until 2006, the program subsidized a large portion of transportation cost. In 2006, it was stopped for 2 months, than extended

for the next 5 years; with a reduction of 20% of the subsidy each year to be stopped by the end of 2011, when exporters will be able to rely on themselves. Currently a total number of 145 exporters (62 from Bekaa, 30 from the North, 23 from the South, 27 from Mount Lebanon and 3 from Beirut) benefit from this program. Products that receive the subsidy include fruits (apples, cherries, grapes…) vegetables (potatoes, onion…), table eggs and cut flowers. Only regions that respect the homogeneous agricultural zoning strategy were supported.

h.5.3.4. Success of urban planning

According to Fawaz (2011), success of urban planning requires the presence of three integrated components: policies of urban planning approved by the State, department of urban planning for the implementation of the policies and urban law for the organization of the work. The major problem in Lebanon for the application of appropriate land use planning is the absence of a political decision for urban planning: any design in urban planning in general and land use planning in particular, ratified and become effective under the decree of the Council of Ministers. In Lebanon, since political decision for an appropriate organization is absent, land use planning projects are ratified in general if they respond to the yearning of landowners and merchants building. As an example, the decree for construction law which organizes constructions all over the Lebanese territory was repealed few months after its release in 1992 at the dealer's desire to create a building in Beirut as he wants.

h.5.3.5. Urban planning and development

It seems that there is in Lebanon contradiction between urban planning and developments, moreover there is a tendency to sacrifice urban planning for the sake of the development. As an example, encouragement for the establishment of luxury hotels became possible after exemption from the rules and regulations of urban planning and construction.

h.5.3.6. Provisions of the Construction Law

Article 17 of the construction law allows constructions in unclassified land with specific investment factors. Thus owners of these lands which constitute about 70% of Lebanese territory oppose any land use planning in the concept of urban planning for fear that classification of these lands for agriculture can reduce their personal interest.

h.5.3.7. Role of local authorities

This role remains secondary in the domain of land use planning. Some villages don’t have municipalities. In others, municipal councils behave as they are not responsible for the planning of the village.

h.5.3.8. Bad practices

Even though the homogeneous agricultural zoning study includes an organization of the agricultural sector and practices, most of the villages don’t respect the recommendations presented and landowners are persuaded that they are using their land in the right way even if it is not the case.

h.6. Conclusion and recommendations

Despite the fact that the SDATL has been voted, it is not yet followed nor strictly implemented and is still considered as a guiding document. A governmental policy based on an integrated approach involving land quality, landuse requirements, land vulnerability to degradation upon a given landuse option, considering the socio-economic conditions and involving different stakeholders, must secure long term sustainable landuse and answer the old question: Is land an inherited personal right or is it a common legacy and asset to be transmitted with its added economic, human and environmental values to future generations?

Results shown in this part allow for the elaboration of the following recommendations:

- Implement land capability and land suitability assessment for the whole Lebanese territory.
- Conserve agricultural lands, river outlets, forests and natural sites to sustain healthy environment, maintain natural habitats, biodiversity and eco tourism.

- Organize urban planning with respect to built area and percent of exploitation respecting the need for space and green areas.
- Protect the historical and legacy sites and space around them.
- Reconcile land use planning laws and regulation set in Lebanon with the Lebanese concept of individual property and freedom. Private property shall not undermine public interest and community rights.

I. Sustainable land management, best practices and other new interventions

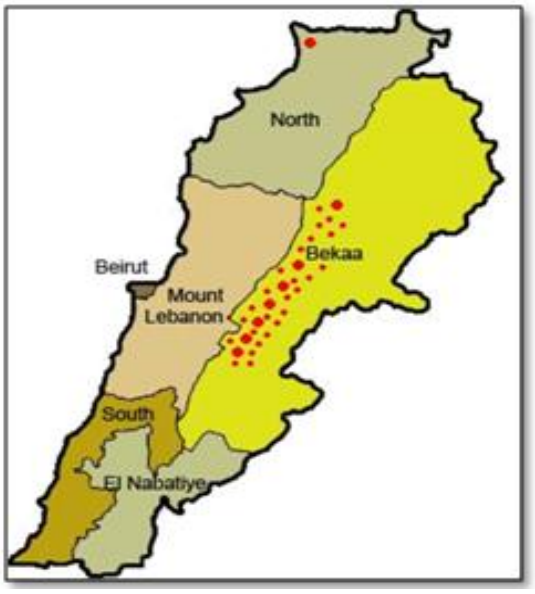
Likewise many SNO countries, Lebanon is witnessing an increase in population growth (FAO, 2010) accompanied with an increasing demand of agricultural productivity (Zurayk, 2003). To satisfy this utmost important need, intensive agricultural practices are replacing traditional ones (Farjalla and Khoury, 2007) resulting in degradation of land resources (CASA, 2005). In other words, through time agriculture has changed considerably with the advanced agricultural practices that rely on using huge amount of fertilizers, involvement of agricultural machinery and use of sophisticated irrigation systems. All of these schemes resulted in giving new impulse to agriculture but at the same time created new environmental problems (Chartzoulakis and Bertaki, 2001). Hence improper and inadequate agricultural practices are one of the main driving forces to land degradation (ESCWA, 2005).

Therefore, to attain the balance between high agricultural production and adequate and proper agricultural practices, a sustainable agricultural plan must be respected. In this perspective, CA is a cornerstone to achieve the goal of a sustainable agricultural production. In this regards, it seems of a great importance to describe the CA practices available at the national level that will enable highlight the management status of these resources. The following part discusses the modest practices (zero tillage, organic production, use of Vetch, IPM) followed by Lebanese farmers, institutions, research centers, ministries and NGOs in order to attain what is known by conservation agriculture. It comprises available instructions, difficulties, constraints and economical benefits for each practice.

i.1. Zero tillage

Tillage is known as an old agricultural practice applied in order to prepare the field for the next crop. Unwanted plants are destroyed and buried to assure proper water drainage and soil aeration. On the other side, when tillage is inappropriate, it destroys the soil structure and makes it prone to air and water erosion (Chartzoulakis and Bertaki, 2001). A no-tillage/direct planting system was applied by the German Development Cooperation (GIZ) in cooperation with ACSAD and MoA on Lebanese farms. Acreage for this application increased from 40 du (2 farms) on 2007 to reach an area of 5620 du by the year 2010 (20 farms). Figure 20 shows the distribution of farms under zero tillage on the Lebanese territories (Jouni, 2011).

Figure 17. Distribution of farms under no tillage (Source: Jouni, 2011)

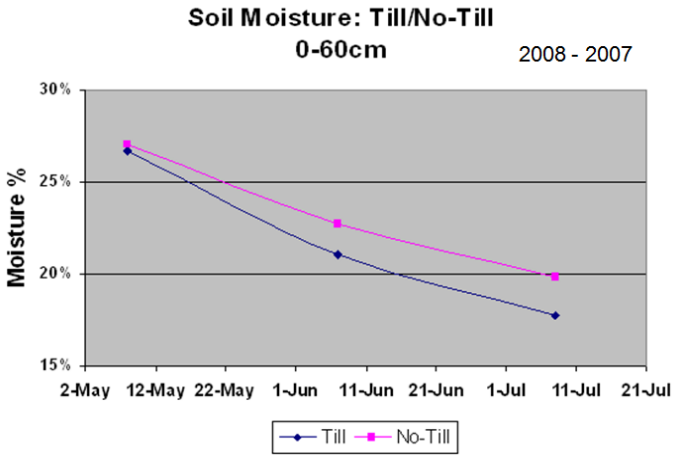


Meanwhile research, analyses and comparison with tillage plantings were carried out at the AREC and LARI stations and the results of no-tillage practice showed the following advantages:

- Reduction of losses through evaporation of rain and irrigated water. An increase of soil moisture by1.92% at a 0-60 cm soil depth was detected (Figure 21).
- Decrease of weed infestation. As for example, a decrease in papaver sp. from 4 to 1 plant/m^2 and of raphanus sp. from 14.5 to 5 plant/m^2.

- Enhancement of biological activity: the number of earthworms increased from 1 to 5.7 earth worms/m^2 within 2 years.
- Reduction of 350 $/ha in the production cost for fields crops.
- Increase by an average of 32% of vetch yield.
- Improvement of the quality of yields (example of corn cultivation in Figure 22).

Figure 18: Soil Moisture improvement under no till cultivation (Source: Jouni, 2011)



i.2. Use of Vetch under orchards

Vetch (or *Vicia sp.*) is recognized as an herbaceous plant of the Fabaceae family. It has many benefits such as providing adequate nitrogen nutrition to trees, playing the role of an insectary plants that brings in beneficial insect and spiders that feed on pest, reducing dust, improving water infiltration and among all being cost effective (Thomas *et al.*, 1998). GTZ with the association of LARI, designed a new CA practice based on the use of Vetch under orchards (cherries, olives and apple). It was applied on different Lebanese farms as shown in Table 15.

Figure 19: Example of corn cultivation in the Bekaa showing Improvement of corn growth under no tillage practices (Source: Jouni, 2011)

Table 15. Distribution of farms under CA (use of vetch).

Areas under CA (use of Vetch)								
Mouhafaza Regions	**South**		**Mount Lebanon**		**North**		**Bekaa**	
	Roumeen	10	Deir Koubel	12	Koura	12	Zahleh	6
	Zawtar	4	Tarsheesh	3	Akkar	10	Housh Rafika	6
	Bint Jbeil	6			Bsharri	8		
Total (Du)		**20**		**15**		**30**		**12**

Source: Personal communication of Jouni 2011.

For this purpose, 20 Kg/du of vetch seeds were spread without ploughing after removal of all existing weeds. (Weeds are removed for the first year only. In the next year, vetch is used with the amount of 5Kg/du due to regeneration). Once germinating, vetch covers the entire soil surface replacing by this mean the existing weed (Figure 23). After the winter season, vetch will dry and seeds will fall down and germinate in autumn. Prior to harvest, vetch will be present and will fall down while weeds and thorns remain absent (Jouni, 2011).

According to the GTZ (2008), the benefits of using vetch are:

- Farmers can easily get access to their field during early planting and late harvest periods without mud problems.
- For 3 consecutive years, farmers save an amount of 270.000 LBP/du, equivalent to 1800 $/ha).
- Suppression of weed community (Figure 24 shows the aspect of a field after using vetch).
- Increase in yield (10-20%), soil moisture and organic matter.
- It is an easy practice that requires only one farmer.

Figure 20. Vetch germination and coverage the soil surface (Source: Jouni, 2011)

Figure 21. Vetch cover under olive trees can enrich the soil with green manure and help conserving soil moisture (Source: GIZ, 2011)

i.3. Organic farming

The concept of organic farming (OF) started in Lebanon after the civil war upon the demand of the local farmers (Estephan, 2002, Al-Bitar, 2004). It started without any legislation and certification (Khoury, 2004). In 1982, MECTAT was the first NGO that started promoting the concept of OF through dissemination of information, training and demonstration, marketing research, establishment of a certification body and organizing the organic growers and traders network in Lebanon[4]. Then with Greenline, a Lebanese scientific and environmental NGO, the OF Committee was formed in 1999. Since that time, OF projects were established and spread the organic procedures for pest control, training and the establishment of the first coop (Biocoop Lubnan) for organic farmers in Lebanon based in Beirut to serve all over Lebanon[5].

Since 2001, the AUB started a project aiming at promoting organic products within a healthy basket project where fresh and certified fruits and vegetables by LibanCert, produced by small farmers throughout Lebanon, are sold weekly[6] (Figure 25). Detailed description of Institutional success in OF is exposed in Annex II.A.3.

Figure 25. Healthy basket provided by AUB can be replicated and disseminated.

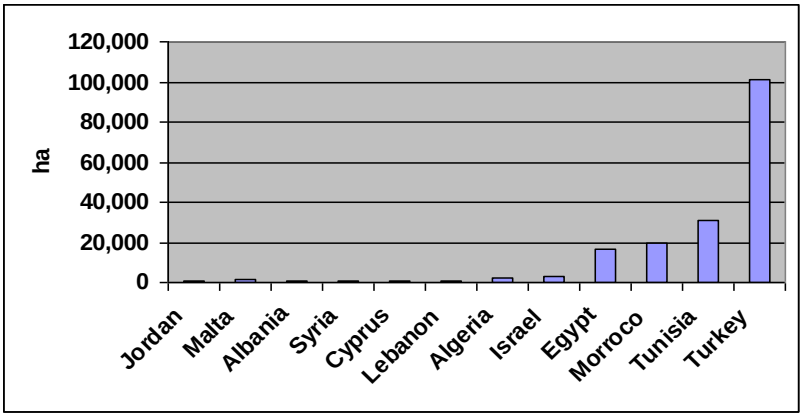
[4] http://www.mectat.com.lb/mectat/projects/projects.htm
[5] http://www.greenline.org.lb/new/english/milestones/1996/organic_farming.html
[6] www.healthybasket.org

In 2006, World Vision Lebanon (WVL) designed and implemented a three-year organic agriculture project in Lebanon, mainly funded by the USAID. The project's main aim was to support and boost BioCoop Lubnan, in helping BioCoop farmers to become certified as "organic" by the Mediterranean Institute for Certification (MIC) according to the EEC Reg. No 2092/91 and to enable the cooperative to access national and international markets. As a successful result around 160 farmers are currently enrolled in BioCoop Lubnan. Currently, with the help of foreign organizations and universities, the number of organic farms is increasing (Khoury, 2004) while the government does not consider this issue as one of its priorities (Touma, 2003). Organic land area increased from 300 to 758 ha between 2002 and 2004. But comparing to other Mediterranean countries (Figure 26), Lebanon is still the smallest organic producing country (Al-Bitar, 2004). Recently two inspection bodies are inspecting the organic Lebanese farms:

- MIC, a private company.
- Libancert, a national certification body.

In 2008, within the frame of TERCOM project funded by the Italian cooperation in collaboration with IAM Bari and CNRS Lebanon, the MoA developed the first guiding approach to farmers who intend to convert their production into organic or to follow the IPM practices. In this regard, four guidelines were established for organic production and IPM respectively for four selected cultivations: oregano, tomato, potato and olive (MOA, 2008).

Figure 22. Land area under organic production in some Middle Eastern countries (ha)
(Source: Al-Bitar, 2004).



A website was developed to encourage ecotourism and agro tourism with the participation of local action group (LAG) where different maps and information is exposed at **tis.cnrs.edu.lb**.

i.4. Integrated pest management

Accurate identification of pest, cultural practices, scouting, monitoring and mechanical, chemical and biological control are needed before any treatment.

i.4.1. Achievement of MOA in the IPM field (MoA, 2008)

Relying on the guidelines of the MOA, the phytosanitary products shall be used only when the pest infestation overcomes the economic threshold. Products can be made up from two or more active ingredients registered in the protocol and with a strict compliance with the indicators reported in the label. Adequate fertilization and common pest and weeds and the corresponding management for chosen four cultivations can be summarized as shown in Tables 16.

i.4.2. Achievements of LARI in the IPM field

In 2010, LARI started a new service, called: "Early Warning Notification", aiming at helping Lebanese farmers to select appropriate pesticides for their crops. Relying on experts and agrometeorological based models, forecast of all diseases and pest on Lebanese cultivations were prepared. Then a short message service (sms) is sent to farmers to inform them about the current situation and advice them

about adequate preventative measures to take. Number of farms participating in this program reached 2000. This system stopped in April 2011 because of lack of monetary funds. Only LARI in the Abdé region is still working on this service.

Table 16. Instructions for IPM

Cultivation	Fertilization	weeds	PM	Pest	PM
Potato	- Animal manure - Sluge	- BLW	GAP[7] - crop rotation - good seed bed preparation	- Cutworm - Aphid	- Cypermetrin
				- Leafminer	- Cyromazine
	Required Nutrient - N (15kg) - P_2O_5(12Kg) - K_2O (24Kg)	- BLWs[8] - Grasse	- Metribuzin - cycloxidim	- Tuber Moth	- Malathion - Deltametrin
Oregano		- BLWs	- Glyphosate	- aphids	- Dimethoate - Endosulfan.
				- Witeflies	- Imidacloprid
Olive		- BLWs	- Glyphosate - oxyfluorfen	Fungi - silver leaf	- Copper compounds
Tomato	- Crop rotation		- soil solarisation - hand weeding	Disease - Early/light	- Mancozeb

Example of sms sent on 6th August 2011: LARI recommends farmers on the need to apply controlling and preventive measures against spotting disease on apples because of suitable weather conditions for pest infestation using: Flint, Scor, Dmark ® (personal communication Jomaa, 2011).

i.5. Related projects and research

i.5.1. Research aspects

In this domain, numerous researches and studies were conducted in order to get CA:

- Using municipal compost (based of fertilized tomatoes with a 5% concentration) serve as an organic manure for soilless and vegetables cultivations (Darwish *et al.*, 1987).
- Solid municipal compost could have an important role in Lebanese agriculture and reduce the need for commercial fertilizers (Khuri *et al.*, 1987).
- The introduction of new hydroponic systems, "Pouzzolane" instead of the traditional use of "Perlite" help improving the production of cut roses in Lebanon (number of cut flower, length of flower stalk and plants, leaf surface area) (El. Khoury *et al.*, 2004).
- Using drip irrigation system helps saving 30% of irrigated water in potato cultivation (Darwish *et al.*, 2006).
- Using biosolid and composted banana residues increases the soil nitrate concentration 19 months after the single application (Atallah *et al.*, 2011).

i.5.2. Implementation projects

i.5.2.1. Forage production-Conservation Agriculture

GTZ showed that water use can be reduced by approximately 60% when drip irrigation is applied compared to sprinkler irrigation in Terbol and Amiq wheat plot (Jouni, 2011).

[7] GAP: Good Agricultural Practices
[8] BLWs: Broad Leaved weeds

i.5.2.2. Tercom project

In 2007, a project entitled "Tercom", implemented by IAM-Bari and funded by the Italian Ministry of Foreign Affairs DG Cooperation, started. This project aimed at supporting the income of the Lebanese Communities affected by the war events of July 2006 by:

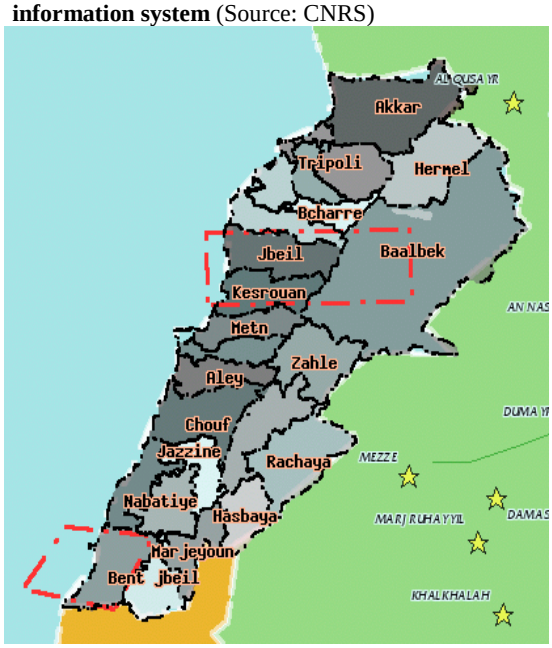
- Providing technical assistance for the improvement of agricultural production quality;
- Supporting the creation of pilot initiatives for the promotion of local products and land enhancement;
- Support the activation of initiatives on marine environment and fishery sector.

Some of the realized activities are:

- Elaboration of protocol of production IPM andOrganic Production standards guidelines for four important cash crops: olive, tomato, potato and thyme.
- The production of booklet for the promotion of integrative rural development in TYR, Baalbeck and Byblos regions where location of the country, traditional products, handcrafts, archeological resources, and the establishment of LAG center for the promotion of integrated rural development.
- A territorial Information System (TIS) with web address: **tis.cnrs.edu.lb** has been set up by CNRS with the assistance of IT Synergy and MoA in order to provide a substantial support through the available data processing. The CNRS and the MoA provided most of the spatial information, including high resolution satellite images, while IT Synergy was sub contracted by IAM-Bari as one of the key players in the GIS field to provide the TIS software platform and training.

This pioneer tool is based on "Open Source" (free of charge) software; it is therefore fully accessible to everybody since no special hardware or software is required. CNRS and MoA staff was thoroughly trained to be able to keep update and enrich the information collected in the TIS ensuring the sustainability of this initiative.
The tackled by TerCom project areas were: Tyre, Baalbeck and Byblos and part of Baalback cazas (Figure 27) and in the future the system developed could be expand in order to cover other areas Lebanon with the contribution of other interested sectors to sustain eco tourism and agro tourism.

Figure 23. Pilot areas chosen to develop territorial information system (Source: CNRS)



i.5.2.3. Integrated pest management program in the Near East

The FAO Regional Integrated Pest Management Programme - GTFS/REM/070/ITA - funded by the Italian government, is operating in Lebanon similarly to other regions. The program aims to improve sustainable intensification of agricultural production reducing the use of pesticides[9] to achive:

- Reduced environment and health risks.
- Community empowerment.
- Better access to local and international markets.
- Sustainability.
- Improving interaction between farmers and NGOs.

[9] http://www.ipm-neareast.com

i.5.2.4. Lebanese Observatory for Agricultural Development – LOAD -

LOAD is funded by the Italian Cooperation and executed technically by the FAO. The national counterpart body is the MoA represented by the Directorate of Studies and Coordination. Some of roles played by LOAD[10]:

- Enhancing synergies between public and private sectors involved in the agricultural sector.
- Providing adequate supervision (follow-up, monitoring and evaluation) of agricultural development programs and projects for their implementation and execution to be in line with the Lebanese agricultural strategy and policy.

One of the first outputs of this body was the updating of Lebanese agricultural statistics in 2010 and the production of the olive orchards map of Lebanon at 1:10.000 scale.

i.5.2.5. South Hydro-agricultural project

The Litani River Authority (LRA) has initiated a pilot project called "Hydro Agricultural Development Project of Marjayoun", aiming at bringing water from Bekaa to south Lebanon to increase water resources used for irrigation. The Spanish government is financing the initiative via the Lebanese Recovery Fund and the project is conducted under the United Nations Development Program. The project will focus on land reclamation by constructing infrastructure for irrigation networks and improving the quality of the soil while providing wheat seeds to farmers to be cultivated for two consecutive years. The project will also advocate for a law establishing a Water User Association in order to ensure good management and better water use efficiency as well as the operation and maintenance of irrigation networks.

i.6. Role of Women in Agriculture

Many researchers emphasized on the crucial role that women plays in agricultural despite the fact that her work is mostly unpaid. Some defines it as a backbone of agriculture workforce (ICAR, 2004). Other finds it as a pivotal in agriculture and rural development. But we can't forget that women in Lebanon shoulder a significant proportion of agricultural work. From 12.7 million no permanent working days in agriculture, women execute 52% including the contact with chemical and potentiel pesticide exposure. Lately, in 2008, TerCom officially launched the National Observatory for Women in Agriculture and Rural Areas (NOWARA)[11]. The project aims at carrying on and empowering what has been done by TERCOM project and, in the specific will reinforce the NOWARA and will support the Local Action Group in Tyre for the improvement and development of South Lebanon communities and territories.

Not recently, with the help of Women's Association of Deir el Ahmar (WADA), women's role is agriculture is becoming valuable and respected. WADA is a Lebanese non-profit, NGO, established in 1994[12]. WADA aims to promote women's role in rural development and welfare of society in the region around Deir el Ahmar and focus on a 157 km^2 area, including 33 municipalities around Deir el Ahmar, Baalbeck and Hermel, in the north of the Bekaa valley of Lebanon. To achieve this target, WADA applied several projects among all:

- The establishment of a Rural Development Center (for local community trainings)
- Training sessions for rural women in handcrafts, agro-food production, agriculture and equipments for agro-food production, sewing, and knitting.
- Environmental awareness and capacity building programs.

i.7. Green Plan

The Green Plan (GP) (Decree No 1335-10/7/1963) is a government ecological body under the MoA. It has played many roles mainly in preserving green areas in Lebanon.

The facilities provided by the GP to the farmers are limited to:

[10] http://loadleb.org
[11] http://www.gewamed.net/index.php?mod=events&idc=2&idp=41
[12] http://www.wadalebanon.org

- Agricultural land reformation,
- Road building, land cleaning ,
- Water reservoirs construction.

In order to accomplish these tasks, GP employed more than 350 forest, agricultural and civil engineers as well as civil staffs. But, this number decreased to less than the third due to the tragic events that added additional responsibilities on the project, affecting its performance.
Since its inauguration in 1963 and until 2008, the Green Plan has assisted 62,832 Lebanese farmers and rehabilitated 38,840 ha of marginal land including 1,100 ha of irrigated lands (Figures 28 a, b). For this period, more than 6 Million m^2 of earth reservoirs and 365,500 m^2 of cement reservoirs and a total of 271 agricultural roads with a total length of 740 km were constructed.

New irrigation techniques were adopted and irrigation canals were constructed. GP provides services to farmers by its 8 branches that cover the entire Lebanon.

Figure 24a. Water harvesting structures constructed by the GP (Source: Green Plan)

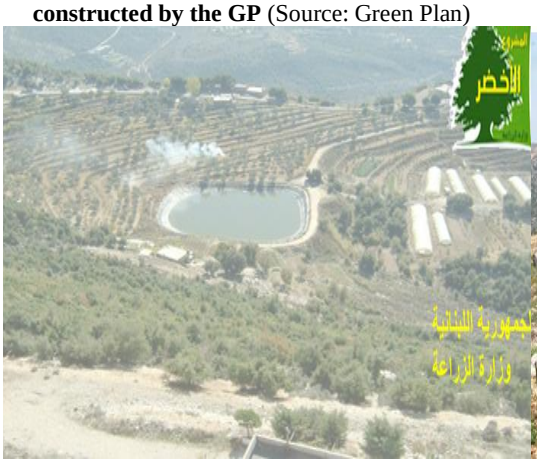


Figure 28b. Terracing works done by the GP (Source: Green Plan)

i.7.1. Problems and constraints

- Reduction in the agricultural surfaces (Urban encroachment, road construction…)
- Low production and economical benefit because of non available water.
- Funds are not relatively enough for the huge numbers of applicants
- Vacancies in the post taken by engineers which are irreplaceable.
- Lack of laws that protect agricultural lands and forbid the constructions on plains and pastures.
- Absence of necessary equipment for technical operations.
- Land degradation and reduction of land productivity due to ecosystem deterioration especially in rain fed lands.
- The increase in the cost of construction materials and fuels, lessening the value of the work provided by the GP.

i.7.2. Solutions and recommendations

- Further reclamation of marginal land,
- Establishment of dams to protect high lands against soil erosion and low lands against sedimentation,
- The promulgation of laws that protect agricultural land and encourage the construction on rocky terrains,
- Best investment of water resources by creating ponds and reservoirs to collect rain water,
- Encourage the adoption of modern irrigation techniques,
- Increase the value of the assistance provided by the GP,
- The adoption of new crops with higher economical benefit,
- Better access to funds and loans,
- Enhance the construction of agricultural roads,
- Supplement the necessary technical elements to fill the vacant positions.

i.8. Conclusion

Being conserved, however land resources are not only the first beneficiary from CA implements, but they also extend to protect human being including his health and life style. In this context, it is crucial to raise awareness and education campaign in term of pesticide safety, for example, in order to induce protective behavior among agricultural worker as reported by Salameh *et al.*, in 2004. Also, it is crucial to improve stakeholders and public awareness regarding the public health and environmental hazards of pesticides and nitrate residues found in the soil-groundwater-food chain.

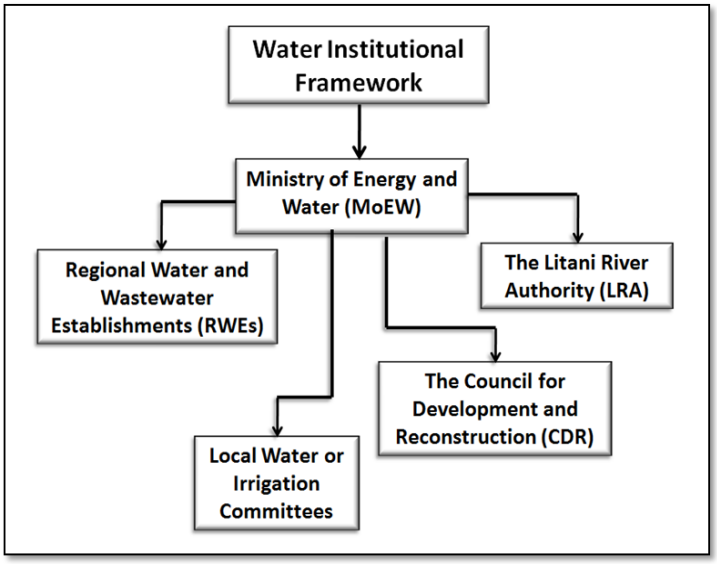
II.3. State policies

II.3.1. Water resources

a. Challenges

In Lebanon, the responsibilities in the water sector are fragmented amongst several institutions. Under the Law 221 in 2000, the MoEW has become the primary responsibility for master planning and project implementation. In order to improve the governmental water policies; however, other public institutions have also been given the authority to design and implement tasks on water (Figure 29). The MoEW has several responsibilities for water resources management, including mainly: 1) setting the general vision for water resources management and developing plans for expanding, 2) improving service delivery, 3) coordinating projects and monitoring services delivered by the private sector.

Figure 25. Institutions concerned with water implementations and management in Lebanon.



b. Responses

b.1. Legislation

In Lebanon, several laws were issued within the water sector policy reform (ESCWA, 2007). They can be summarized as follows:

- Law No. 221/2000 regrouped the 22 Offices and 210 Committees of water in 5 regional Establishments.
- Law No. 241/2000 decreased the number of Water Establishments to four,
- Law No. 337/2001 transformed the Ministry of Hydraulic and Electric Resources (MHER) into the MoEW.

In addition, the main legal texts covering water protection as indicated by Darwish (2004) include:

- Order No. 144/1925: Protection of Surface Water and Groundwater Resources.
- Order No. 58735/1974: Pollution from Solid and Liquid Waste.
- Law No. 64/1988: Pollution from Hazardous Waste.

- Decision No. 2528/C/1996: Protection of Groundwater at El Kneisse Mountain.
- Decree No. 680/1998: The Preservation and Protection of boreholes.

b.2. National Strategic Plan

The MoEW has developed a 10-year water strategy designed to promote integrated water resources management, including controlling unlicensed wells, updating antiquated distribution mechanisms - such as exposed canals that lose water to evaporation - and addressing the lack of wastewater treatment facilities for water reuse. The 10-year work plan contains plans, strategies and policies relevant to potable water, irrigation and wastewater, and was endorsed by the Lebanese Government and Parliament. The objective of this 10-year plan is to secure and implement studies and projects to satisfy the water needs of the population in the following sectors:

- Additional water resources based upon the construction of dams and the water recharge of aquifers.
- Potable water projects, based upon the rehabilitation and network development and the reduction of unaccounted for water.
- Irrigation projects, rehabilitation and new development schemes.
- Wastewater projects: sewer lines, wastewater treatment plants and sea outfall.
- Project of alignment and rectification of rivers for flood mitigation.

Updating the 10-year Water Strategic Plan along with preparing an integrated Water Sector strategy with a clear vision under the concept of the Law 221, its amendment and the by-laws published in 2005.

- Preparing and approving a National Water Master Plan and a "Water Code".
- Improving the water sector governance by ensuring that all the necessary tools are put in place.
- Strengthening the capacities of the MoEW and regional water establishments to enable them to carry out in an efficient and optimal way the tasks entrusted to them.
- Ensuring that Operations and Maintenance of the water supply and sanitation services are contracted out to private operators and that the operation and management of the irrigation small and medium schemes are gradually transferred to Water Users' Associations (WUAs).
- Adopting an adequate tariff structure that would be based on costs and volumetric consumption taking into consideration an equitable tariff for the needed population.
- Preparing a short and medium term investment plan for the water sector taking into account the priorities and available funds.

b.3. Water sector rehabilitation

Despite Lebanon's adequate water supply, many skeptics and experts fear that the major water crises will hit Lebanon soon. This is not going to be primarily due to climate change lowering water tables, but rather due to the excessive mismanagement (Mahfouz, 2010). Water crisis is mainly attributed to the state of existing water sector in Lebanon, which has been established since a couple of decades, and thus ignoring adaptation with new institutional frameworks, advanced methodologies and technologies for water assessment.

To respond to the growing demand, the government has directed its efforts toward both rehabilitation of existing systems and building new ones (Macksoud, 1998). Thus, restoration and rehabilitation of water sectors is an essential aspect of successful water management. This has been considered recently in Lebanon and can be said it is an on-going instrument to enhance the water sector. It is going to be implemented on individual and institutional basis.

b.3.1. Rehabilitation on individual basis

- Trainings and workshops have been carried out to enhance the capacity of employers in water sector, and trained them on new technologies and advanced procedures.
- Establishing awareness programs on effective water-use and resources conservation.
- Linking activities with the existing water organizations, stakeholders and networks.
- Controlling productivity and formal implementations of individuals in the water sector.

b.3.2. Rehabilitation on institutional basis

- Reforming several frameworks in the water sector and the most important one is that obtained by the central government, which recently reformed the administration of water from twenty institutions to four.
- Enabling institutional framework, including legal roles and responsibilities of institutions and their interrelationship (ESCWA, 2001).
- Consultation and coordination between different governmental water sectors.
- Support information on the applications and projects on water at national and regional levels from lessons learned from successful stories, notably on monitoring approaches.

c. Critics

Comparing the previous obtained works on water resources in Lebanon with current ones; however, it is obvious that the previous works are much more potential and useful. Hence, it is not exaggeration to say that previous obtained works in water are still the basis of water works in Lebanon. Despite there are new challenges of climate change and population growth, yet recent implements are still inadequate to follow these challenges.

Previous and recent implementations on water resources are concerned mainly with the quantity of water collected and supplied to individuals. This is of course for water with safe quality. Table 17 shows a comparison between previous and recent implementations at different levels.

Table 17. Previous and recent implementations on water resources in Lebanon

Level of application	Implementation	Previous	Recent*
National level	Large-scale lakes and dams	Qaraaoun Lake	Shabrouh Dam
	Hydropower	Qaraaoun, Kadisha, Joun, Aalay hyderpower stations	**
District level	Small-scale dams	Qnan and Joun lakes	Wadi En-Njas and Yammouna lakes
	Water supply systems	Almost previous ones	Almost maintenance implements
	Collective water wells	-	In several regions
Community level	Water tanks	Almost previous ones	Few number of tanks
	Water wells	Several boreholes over long period	
	Supporting execution of Local ponds	Local earth ponds	Hill ponds
	Local supply systems	Several local supply systems over long period	

* Recent implementations are considered since the last ten years.
**Nothing remarkable has been done recently.

There is always a consistency between the dimensions of the implemented works on water resources and their sustainability; thus large-scale works are done for long period of time, whereas small-scale ones are usually figured out only for few years. This is clear in Table 6 where the giant implements on water resources in Lebanon (e.g. Qaraaoun Lake and hydropower stations) have been made since several decades and they still operational successfully.

In Lebanon; however, these implementations have a number of constraints, which mainly imply the need for maintenance and development, and this requires financial resources and expertise. Also, it must be accompanied with plans for increasing the storage and supply capacity, as well as creating a strategy for development and sustainability within a management framework.

Built on the development strategies and management approaches for the implements on water resources; however, opportunities will be created for new expertise, notably those who are familiar with the new advanced techniques for monitoring and analysis. This is the case in Lebanon where most of previous large-scale works on water resources are still implemented by old expertise and approaches.

II.3.2. Agriculture

a. Challenges

A structural crisis has been affecting the agricultural sector in Lebanon since the mid 1960s. This makes it necessary to carry out radical calendar for many components and provide the appropriate institutional framework. There is a need to focus on the quality of growth and not only on the rates, and develop interest in issues of human-oriented development and living conditions, reforms, including the role of the state and the organization of the agricultural area. There must be a new vision in relation to the agricultural sector to identify the appropriate reforms and to integrate various official and private actors and stakeholders.

The agricultural sector secures 7% of national income, 20% -30% of employment and represents about 17% of the value of exports. However, 20% of national debt is due to imported agricultural products with a failure of the food bill averaging 6 billion US $ annually between 2000 and 2003. Since then, the challenge is: a. How to achieve product competitiveness in view of globalization and open border; b. How to secure food security and to cover the gap between import and export of agricultural materials.

Based on these considerations, the general objectives of agricultural development strategy in Lebanon consist of:

1. Ensuring rational and sustainable use of natural resources.
2. Achieving food security.
3. Developing rural and poverty prone areas.
4. Increasing farmers ' income and employment.
5. Improving competitiveness of agricultural products.
6. Contributing to improving the balance of trade and fiscal balance.

Achieving these goals remains linked to the possible developments of material means and the technical, economic and political, effective organization of available resources at the level of space and time. This effort seeks to elaborate agricultural policies in Lebanon and dealt with:

1. Lebanese agricultural realities.
2. Drawing possible solutions in light of the basic national options.
3. Conceptualization about the necessary programs and implementation mechanism.

Any exploration of the future of agricultural and rural sector in Lebanon must be linked to the concept of sustainable development, which affects many aspects including the economic to include social and environmental dimensions. It requires the development and coordination of the work of official and private institutions to make them part of the overall community policy. In this sense, the concept is based on agricultural sector development on three dimensions:

1. The economic dimension requiring economic system that can provide products that meet the adequate domestic demand and can be competitive to enter foreign markets. Goods and services are produced in a systematic manner and based on rational use of available resources. The activation of the economic dimension will lead to agricultural income growth in the national income and employment and reduce food bill on a sustainable basis.
2. The environmental dimension requires increased attention to the environmental consequences arising from population density and movement of rapid economic growth. This is based on land conservation and the rational use of natural resources and pollution control. It focuses on developing sound agriculture which takes into account the environmental balance and human health aspects. These are oriented to the adoption of standards, organic agriculture, agro-tourism and eco-tourism and stopping the shrinking of farmland. They also include the mitigation of growing desertification risks and declining area of forest and vegetation and pollution of rivers and coasts and the deterioration of soils and groundwater quality.

3. Social dimension consists of reducing the rural exodus and ensure equitable development, fighting poverty and malnutrition, providing the concept of food security in terms of quantity, quality and prices. Problems like the widespread poverty and social exclusion and the need for youth participation in development and dissemination of knowledge, and promote the role of women in society must be treated. Attention to social development requires interface: revitalization of civil society, and entrenching the cultural face associated with agricultural and rural area in Lebanon. There is a need to preserve family ties strong bridges and create widespread communication between family members who usually migrated to the city or abroad in pursuit of a livelihood and opportunities for success.

b. Responses

The official policy consists of better utilization of lands to maintain soil fertility and reduce soil erosion and to prevent pollution and desertification. The most important problem that must be met is land fragmentation and its legal status, which can be resolved only gradually over the long term. It is possible to adopt some means and possibilities that would put the foundations for any positive real estate development.

The general policy of the Lebanese government consists of:

1. Ensuring status mortgages and real estate management.
2. Stimulating the real estate market (movement for the sale of land) work to establish a mechanism for long-term agricultural real estate.
3. Maintaining soil fertility and resistance to erosion and soil erosion and pollution control (including combating desertification).
4. Reduce physical expansion into agricultural land.
5. Develop a mortgage on agricultural land allocated to real estate registry, soil conservation, and finance projects linked to agriculture, merging and sorting.
6. Provide the credits necessary for the proper use of land both in the medium or long term.
7. Strengthening and disseminating real estate registration and conducting annexation and sorting.
8. Revitalizing the work of green project and activation session at the level of soil conservation (terracing, afforestation, mountain lakes and watershed rehabilitation).
9. Updating legislation and regulations (land leases, land fragmentation, transmission of inheritance, annexation of land) and accelerate the solution of legal issues and disputes over land ownership.
10. A tool for providing information about peculiarities of the land and soil suitability for specific crops.

Recent incentives and different projects related to improve the agricultural sector are documented in Annex II.A.5.

c. Critics

The MoA still unable to face these challenges due to:

1. The low annual budget of the MoA which does not exceed 0.5% from the national budget,
2. Weak coordination between the MoA and other involved in rural development ministries and donors like the MoE, MoEW, GP, LARI, MoF, MoEc which create overlapping of responsibilities and fragmentation of development work.
3. Absence and/or weakness of agricultural policy and outdated regulations.
4. The agricultural sector still unable to attract additional funding and young labor forces due to underdeveloped infrastructure and outdated concept interfering with the large production of high added value products.
5. Weak promotion of the specialization of Lebanese regions in given products carrying the trends of "terroirs" and having own label.
6. Dominance of traditional irrigation techniques and lack of collective irrigation schemes restrict the efficient water use.
7. The dominance of temporary labor interferes with the formation of skilled and trained workers. Up to 75% of farms use only temporary workers. Coupled with farmer's illiteracy, this restricts the upgrading of farmer's skills for sustainable agriculture.

8. The abundance of fragmented plots restricts the economic return from agriculture.
9. Absence of integrated rural development projects ensuring the basis for development and income generating activities.
10. There is a need to develop standards and tracing back of products to secure stable external markets.
11. Weak structure grouping the farmers and producers of agricultural products.
12. Restricted access to information and loans.
13. While sustaining preventive and reactive policies to manage incidental decisions related to the organization of import and export of some products affecting public health and environment, the MoA needs to maintain proactive policies addressing the integrated development of the agricultural sector. The main guidelines of this policy are explained on the MoA web (http://www.agriculture.gov.lb/arabic/index_strat_a.htm). But updating of laws and regulations including decisions specifying the mechanism of implementation and defining the stakeholders are still lacking.

II.3.3. Forests

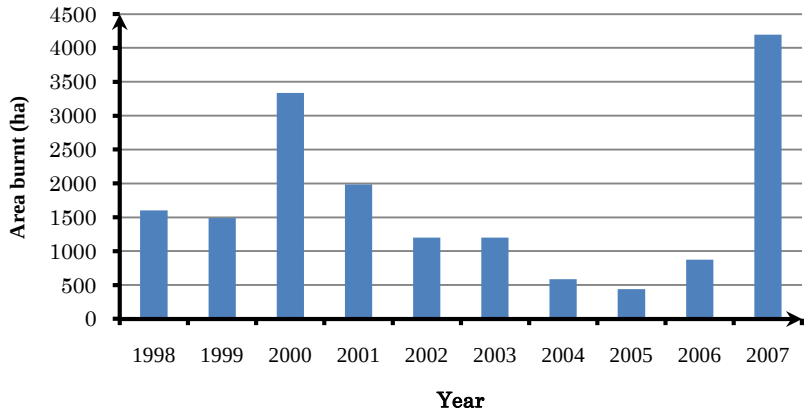
a. Challenges

Main threats to the Lebanese forests include fires, insects and diseases, urban expansion and changes in land use, quarries, overgrazing, overharvesting of selected species, exotic invasive species, soil erosion, felling, pollution, climate change and wars (MoE/GEF/UNDP, 2011). The combination of all these threats, in addition to the natural environmental conditions, is resulting overall forest degradation. All the above mentioned factors present a real threat to forests and contribute indirectly to increased pressure on vegetation. Additionally, hunting represents a serious threat to forest wildlife in Lebanon. The root causes of threats to forest ecosystems have multiple underlying causes or drivers. These can be broadly categorized as political, institutional, economic, external (or global), social and natural causes and are affected by the prevailing socio-political context (Sattout and Abboud, 2007).

a.1. Forest fires

Forest fires are considered as the most influential in the decline of the Lebanese forests. The lack of management of the forests and other wooded lands, mainly in the regions susceptible to fire, increases the risk of occurrence and spread of the fires. Exceptionally, more than 3700 ha of forested lands were burned in the year 2006-2007 (AFDC, 2007). The consequences of forest degradation in Lebanon will be disastrous on the natural environment and ecological systems not to mention the impacts on communities by increasing poverty and lowering the quality of life. The frequency and intensity of these fires are a real threat to the sustainability of the forest ecosystems. They usually occur at the end of summer and are followed a few weeks later by heavy showers of rain, which cause severe soil erosion (MoE/GEF/UNDP, 2011). In some years spring drought conditions caused early forest fires during late April-early May like the case of 2010 where 57% of Lebanon was under the conditions of drought judging by the multitemporal NDVI assessment undertaken at CNRS-CRS.

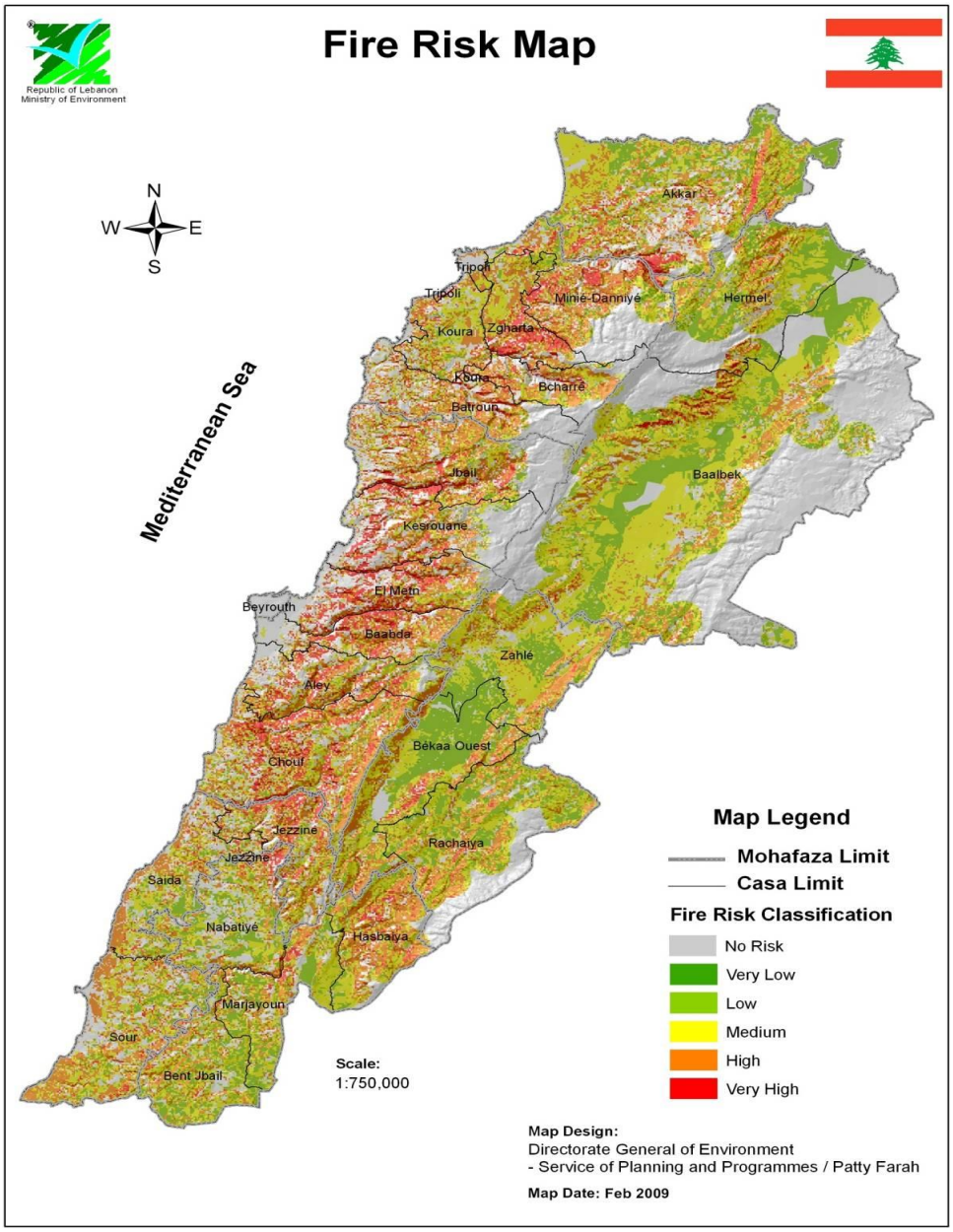
Figure 26. Forest burnt area in hectares per year (Source: MoE/LEDO, 2001; AFDC, 2007; MoE, 2007)



Forest fire prone areas in Lebanon are usually near urban complexes and below an altitude of 1, 200 m. They encompass three main forest types: broadleaved forests (mainly *Quercus spp*.), *P. pinea and P. brutia* pine forests (Masri *et al.*, 2006). Figure 30 shows the burnt forest area for different years between 1998 and 2007 and Figure 31 shows the risk of forest fires in Lebanon. According to the MoE's forest fires database, 129 fires occurred in 2004 resulting in 585 ha of burned forest areas (MoE, 2007).

It has been stated that 5.6% of forests are at high risk of fires, and 25% are at medium risk. The neglect and the lack of management of forests and other wooded lands play the main role in forest fire occurrence. Furthermore, the general public through its lifestyle or livelihood activities represents an important initiator of forest fires, mainly due to the lack of understanding of the importance and value of forests and of the negative impacts of fire (AFDC, 2007).

Figure 27. Forest fires risk map in Lebanon (Source: MoE, 2008)



A case study on Nahr Ibrahim Watershed (NIW) developed a model to assess the natural factors (vegetation, topography, and climate and soil characteristics) and the anthropogenic activities to generate the natural and hazard forest fire risk maps (Assaker, 2011). The results showed that human activities like road construction, housing, agriculture caused an increase of risk areas with very high

and moderate risk from 5% to 38% and from 7 % to 25%, while areas with low risk revealed a significant decrease from 37% to 12% respectively (Figure 32 and 33).

Figure 28. Forest fire risk map for the NIW
(Source: Assaker et al., 2011)

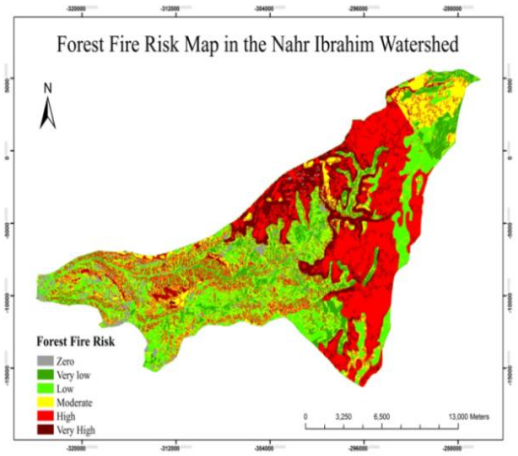
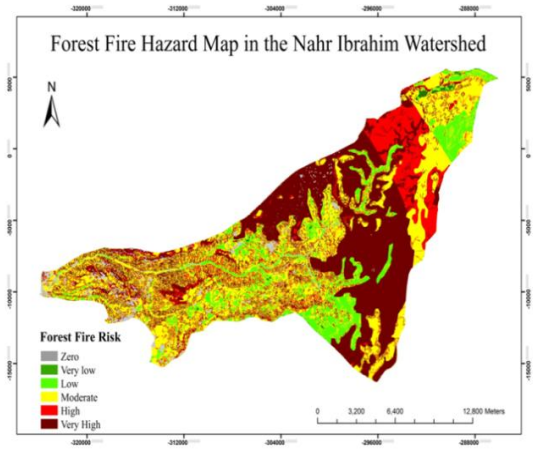


Figure 29. Forest fire hazard map for the NIW
(Source: Assaker et al., 2011)



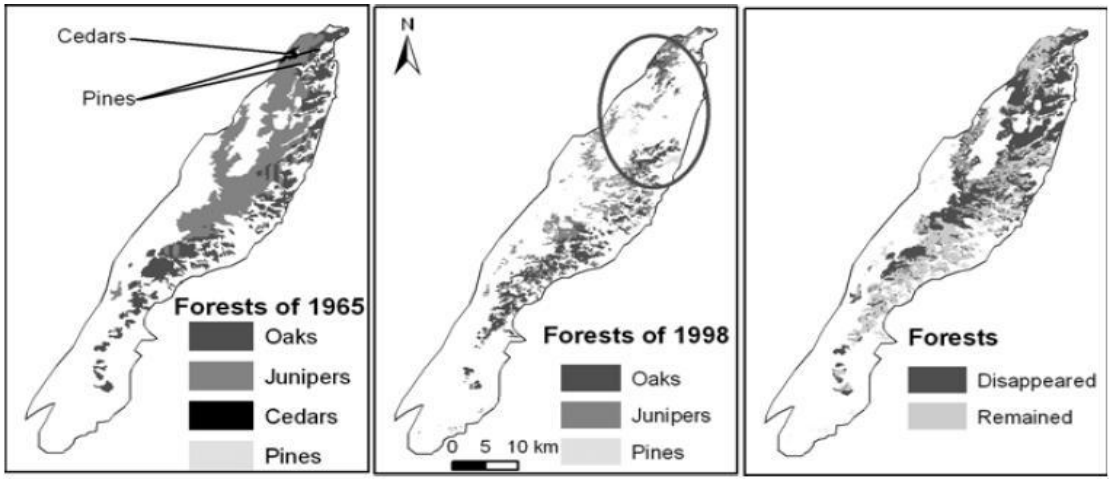
a.2. Ecosystem fragmentation

Urban expansion and road network development, human intervention by logging and overgrazing activities are the serious causes behind biodiversity depletion and ecosystem fragmentation in Lebanon. Forests have been broken into isolated small pieces that are more susceptible to external disturbances than larger ones. The number of forest patches on the eastern flank of Mount Lebanon has increased from 131 to 730 patches between 1965 and 1998. With the disappearance of the forest cover, rock outcrops have appeared within patches due to soil erosion. Almost 50 percent of the total forest cover has been lost in 33 years, mainly affecting juniper stands (Jomaa *et al.*, 2007). Figure 28 shows the severe forest changes between 1965 and 1998.

a.3. Quarries

The majority of quarries in Lebanon followed the rapid urban expansion and were developed with no consideration for their environmental impact, thus causing the destruction of vegetation and important natural habitats, the permanent loss of biodiversity and natural resources, negative impacts on soil stability, and many others (AFDC, 2007). Between 1996 and 2005, the number of quarries increased from 711 to 1,278 with a simultaneous increase of quarried land from 2,875 to 5,283 ha. The interpretation of Satellite imagery confirms that in 2005, 25% of existing quarries developed within forested land (forest and OWL) (Darwish *et al.*, 2008). While 32.5 % of quarries were concentrated in Mount Lebanon before 1989, more and more exploitations were expanding in 2005 towards the North (15.5%) and the South of Lebanon (16 %), and notably towards the Bekaa and the Anti-Lebanon Mountain chain (44 %). Quarrying operations are characterized by significant environmental impacts occurring both during operation and post closure phases (Darwish *et al.*, 2010).

Figure 30. Spatial forest changes on the eastern flank of Mount Lebanon between 1965 and 1998
(Source: Jomaa. et *al.*, 2007).



a.4. Grazing (over and under grazing)

Grazing is one of the most controversial forest uses in Lebanon as it lacks organization and sustainable management. Nevertheless, the decline of grazing activities during the past decades has favored uncontrolled development of forest understory which in turn has resulted in an increased fire risk on forests. The conservative policies (Law 558/1997: Forest code) aggravated the situation as grazing has been prohibited in forested areas, which increased the overgrazing pressure on OWL (MoE/GEF/UNDP, 2011).

a.5. Climate change and pest diseases

Global climate change caused by human activities, mainly the burning of fossil fuels and the production of greenhouse gases, could be described as a threat to biodiversity and forests, or it could be considered a cause of one or more of the direct threats above. Generally speaking, climate change will either affect the composition or location of forests and other natural habitats, or will reduce populations of sensitive species (Table 18), making them more susceptible to overexploitation. Climate change may also exacerbate problems from exotic invasive species and pest outbreaks (Table 19). In fact, Lebanon has witnessed a proliferation of forest pests over the past years that have caused extensive damage to several forests. The most serious and recent infestation was by the pine processionary moth that infested pine forests, and the *Cephalcia tannourinensis*, the Cedar web-spinning sawfly that infested and devastated cedar forests in Tannourine and Hadath El Jebbe (one of the largest cedar forests in Lebanon). Table 19 presents a tentative list of the most harmful pests that have affected several forests in Lebanon (MoE/GEF/UNDP, 2011).

a.6. Illegal Felling

The overexploitation of forests for their wood resources to be used as fuel and charcoal represent another threat to forests. The Juniper and several oak species are preferentially felled for the production of coal. This threat is intensified by the poor implementation of the Lebanese laws and the lack of awareness among the general public (AFDC, 2007).

a.7. Tourism

The development of the tourism sector directly impacted the forests due to the badly planned construction and changes in land use with complete absence of any environmental consideration (AFDC, 2007).

Table 18. Threats to selected forest species based on the degree of severity.

Species	Abusive harvesting	Over-grazing	Urban development	Fires
Kermes oak *(Q. calliprinos)*	3	4	3	3
Haired oak *(Q. cerris)*	4	4	4	-
Aleppo pine *(P. halepensis*)	3	3	4	5
Brutia pine (*P. pinea)*	3	3	3	5
Stone pine *(P. pinea)*	1	2	4	3
Cedar of Lebanon *(Cedrus libani)*	2	2	1	-
Fir *(Abies cilicica)*	3	4	3	-
Juniper *(Juniperus excelsa)*	4	5	2	-
Cypress (*Cupressus sempervirens*)	3	4	2	2

Source: MoA, 1996. Severity scale is from nil (lowest) to 5 (greatest)

b. Responses

b.1. Forestry legislations

Lebanon has two overlapping forest laws:

(1) The Forest Code of 1949
(2) The Law on Forest Protection, Law 85 of 1991 then amended by parliament in 1996.
While the law of 1949 regulates forest activities including pruning, thinning and charcoal making, the laws of 1991 and 1996 imposed severe restrictions on forest activities and a total ban on harvesting resinous trees including pine (Calibrian, Aleppo and Stone pines), Lebanese cedar, juniper, cypress and fir. The law of 1949 recognizes three types of forests based on land ownership (private, municipal and state) and therefore continues to provide the basis for the management of forests by the MoA. The ministry's Directorate of Rural Development and Natural Resources (DRDNR) has sole responsibility for recruiting forest personnel and operating so called "forest stations". The directorate currently has some 20 forest stations and 186 forest personnel (152 forest guards, 13 inspectors and 21 observers). In theory, the forest guards enforce forest legislation (including the Forest Law of 1949 as well as Law 85/1991 and Law 558/1996) and apprehend offenders.

The law of 1949 consists of 151 articles dealing with:

- The general conditions of forests
- Defining forests and types of forests according to ownership
- Management methods
- The function and use of the various types of forests

The Forest Law also laid down various penalties for offenses committed against forests. This law was amended on several occasions since 1949. Since the issue of the "Forest Law", many decrees and decisions have been issued. In the year 2002, the Law of Protection of the Environment (Law No. 444-2002- Protection of the Environment- section 4- article 21and 22) established the general framework for the protection of the environment in Lebanon. The extent to which this law has been applied is restricted by the absence of practical decrees.

Table 19. Most common pests affecting Lebanese forests

Forest Type	Tree Latin name	Pests and insects
Stone pine	*Pinus pinea*	*Emobius gigas, Ernobius sp., Chalcophora detrita, Phytocecia sp., Pitophtorus pubescens, Tomicus destruens, Rhyacionia buoliana*
Aleppo and brutia pine	*Pinus halepensis, Pinus brutia*	*Thaumetopoea pityocampa; Thaumetopoea wilkinsoni, Tomicus destruens*
Cedar of Lebanon	*Cedrus libani*	*Cephalcia tannourinensis, Dichelia cedricola, Cedrobium laportei, Cinara cedri, Thaumetopoea libanotica, Ernobius libanesis, Dasineura cedri, Megastigmus schimitscheki, Phloeosinus cedri*
Oak	*Quercus spp.*	*Lymantria dispar, the processionary moth: Thaumetopoea processionae, Erigaster philipps, Cerambyx cerdo*
Pistacia	*Pistachia palaestinia*	*Thaumetopoea solitaria*

Source: Abdo et al.; 2008; Abou-Jawdah *et al.*, 2008; Personal communication Dr. Nabil Nemer.

b.2. Policy and institutional aspects

The increased role played by MoE and the direct interference of civil society in the different aspects related to natural resources will certainly lead to some positive changes in the forestry sector. MoA is currently revising some aspects of the forest legislation. The ban on the production of charcoal was recently cancelled to allow a controlled exploitation and stop illegal felling. The controlled charcoal production will contribute to the reduction of the highly flammable biomass and will directly contribute to poverty alleviation. It will also prevent acts of arson initiated to contour the ban for charcoal extraction. The consequences of the return to a controlled production of charcoal will be monitored and evaluated by the team of the DRDNR. The protection and conservation of forests and ecosystems naturally implies consequences on the land owners and users. The laws and legislations that govern the protection and conservation measures impose controlled or sometimes limited exploitation. While this legislation contributes to the protection of the ecosystems and is intended for positive effects on the natural resources in Lebanon, it may have direct consequences on the food security and on the income of the owners and users.

Economic alternatives and compensational measures will have to be studied and applied in order to ensure the sustainability and effectiveness of the legislation. On the other hand, and in light of the international discussions on decentralization and its consequences on the forestry sector, the DRDNR is currently studying the possibility of applying decentralization up to a certain level. The effect of this institutional change will lead to a higher involvement of the local community groups, the municipalities and the grass-root organizations in the different areas related to forest management. However, this would only be applied after the implementation of a capacity building and awareness raising campaign.

b.3. Role of public institutions

Several line-ministries and public bodies are contributing to natural conservation and combating land degradation. This is through proposing and implementing the necessary strategies, policies, programs and specific projects within the framework of sustainable development. Of these public bodies the following are mentioned: the Parliamentary Committee on Environment, the MoE, the MoEW, the CDR, the CNRS- CRS, the MoA particularly the DRDNR and its affiliated institutions namely the Green Plan (GP) and LARI, among others. The Lebanese Army and the Ministry of Interior are assisting in some of the aspects related to forestry, mainly reforestation and forest fire fighting, and forest insects and disease control. On the other hand, the private sector, NGOs' and International Organizations are assisting the country by providing technical and financial support to specific projects (Regato and Asmar, 2011).

Until 1981 (creation of MoE), the MoA was the solely responsible of the formation and establishment of laws and legislation for the protection of forests and natural resources in Lebanon (AFDC, 2007). In

the absence of any written forest policy in Lebanon, MoA has been working on developing laws, legislation and projects in a certain framework, aiming at the conservation, promotion and management of the forests and tree resources. Some of the related activities that MoA is undertaking are as follows:

- Issuing of new laws, decrees and legislation: MoA has the jurisdiction to develop forestry related laws that will be subject to approval by cabinet, as well as Ministerial Decrees and decisions (such as the training and deployment of forest guards).
- Forest conservation and development: MoA has the mandate to 1) undertake reforestation/afforestation projects, 2) to protect, supervise and manage the natural resources (forest fires prevention, management and control; illegal wood harvesting; forest pests).

On the other hand, MoE has also the jurisdiction to develop laws that will be subject to cabinet approval as well as issuing Ministerial Decrees and decisions in relation to environmental issues in general which include forest conservation and management.

b.4. Reforestation and fire-fighting

Initiatives to develop and manage the forests of Lebanon are undertaken by many institutions in the country including the different concerned ministries and NGOs. Great efforts are being dispensed across the country to implement reforestation projects mainly by the MoE and international organizations such as UNDP, USAID and the FAO. However, little is known on the rates of survival of the new seedlings. Attempts to improve fire-fighting efforts and efficiency are being made by different actors. Many factors delay the work and efficiency of fire-fighting units in fighting forest fires. These include: lack of coordination among the different involved units, lack in equipment, low number of trained forest fire fighters, and absence of adequate forest road networks, among others. Awareness activities are being conducted by both private and public sectors with a significant role being played by the Lebanese NGOs. In addition, the Italian Cooperation developed a model implemented in cooperation with the civil defense and LARI using a network of real time climatic data and other land factors to identify the area's most vulnerable to fires thus creating a sort of early warning system.

b.4.1. Awareness campaign

MoA has executed several projects to promote public awareness on forestry related issues. In one project, a series of booklets were prepared on "Preparation of Sustainable Management Plan for Forests", "Forest Nurseries" and "Important Forest Species in Lebanon", with the collaboration of the ONF and the EU. These booklets were disseminated to various concerned institutions. MoE conducted numerous and continuous public awareness activities relevant to forests. Through the "Protected Areas Project", MoE has produced and disseminated several awareness materials on protected areas and biodiversity such as brochures, posters, TV documentaries, reports and training manuals. MoE has also been involved in many activities to promote ecotourism in Lebanon such as brochures, posters, TV spots, exhibitions and interviews. Several awareness tools on the importance of biodiversity were produced and disseminated by MoE including a TV spot showing the importance of plants and animals, posters and pamphlets as well as a website.

b.4.2. Forest management

Currently, the DRDNR has 199 forest guards[13] distributed in the different Mohafazas as follows:

- North: 58 guards
- Nabatiyeh: 17 guards
- Bekaa: 77 guards
- Mount-Lebanon: 36 guards
- South: 16 guards
- MoA: 6 guards

Also, the DRDNR manages 31 monitoring stations (25 are located within forested areas) and operated in 2000 four 7,500-liter water trucks and 26 utility cars that can be equipped with 600-liter tanks, used for early intervention.

[13] According to the official and approved organizational structure, the Directorate should have about 240 forest personnel.

c. Critics

Conservation of forest resources is the responsibility of the MoA. While MoA forest personnel monitor and patrol forest areas that are accessible by roads, their ability to apprehend offenders is very limited. On the other hand, a handful of NGOs have been also working very actively to protect forests and landscapes in localized areas, namely Mada association who has been advocating the establishment of a national park in the upper ranges of Akkar and Dannieh in north Lebanon for many years, the Society for the Protection of Nature in Lebanon (SPNL) who has been actively working on the implementation of the Hima conservation system, a traditional approach of community-based management to protect natural resources, AFDC and Arz El Chouf Nature Reserve.

There are a fair number of laws and policies in place that if enforced and properly funded would most likely result in a significant improvement to the status quo of the environmental sector in Lebanon. The enforcement of the regulations related to forest fire management strategy is one case in point. Existing laws also do little to encourage land and environmental stewardship, in fact there are more incentives to clear the land and in the process destroy the habitats than there are to preserve and protect the landscape. Urban growth everywhere is encouraged with very little regard to a sensible and rational zoning (and subsequently, planning) strategy.

c.1. Priority conservation of Lebanon's forests

In Lebanon, there is no central body that plans, coordinates and oversees activities on the Lebanese landscape, even though a national land use master plan exists. No one ministry or departments within ministries are responsible for implementing it. Consequently, opportunities and activities that would greatly promote and enhance forest and biodiversity conservation are not undertaken, or if they are, are done so with no coordination and in a highly ineffective manner. Therefore, it's crucial to address some priority conservation needs and actions necessary to conserve Lebanon's forests.

c.1.1. Political and institutional actions

- Develop an adequate legal and policy framework (e.g., National Forest Program).
- Apply and enforce laws and regulations.
- Improve/clarify access, rights, and tenure over land and natural resources.

c.1.2. Economic actions

- Increase positive incentives.
- Improve capacity of planning for environmentally and socially sustainable development.
- Improve business skills and capacity.

c.1.3. Actions to address external pressures (or global forces)

- Maintain and strengthen national participation in global climate change and biodiversity treaties, negotiations, and mechanisms.
- Develop adequate environmental safeguards for agricultural production for international markets (e.g., medicinal and aromatic plants).

c.1.4. Social actions

- Improve social participation in environmental decision making through access to information, environmental communication, and education.
- Change unsustainable practices and behaviors through public.

d. Conclusion

The sustainable management of the woodlands (forests and OWLs) is a challenge for the future. These woodlands are essential for the protection of soils, water and biodiversity. They are sources of wood, non-wood forest products and rangelands for the rural population. They answer the need for nature of the urban population. They play a very important role in the development of the economy and the tourism sector of Lebanon. Although the future cannot be predicted, with the way future generations will be looking at the woodlands, it is assumed that the conservation of these important ecosystems will contribute to the wellbeing and food security of these future generations.

This integrated management would result in the encouragement of the multiple functionalities of the rural space which would result in:

- The reduction of migration from rural areas.
- The reduction in the abandonment of agricultural land.
- The reduction in the reinvestment of forests on these abandoned lands.
- The encouragement of new initiatives and activities linked to woodlands, like ecotourism and outdoor activities.
- A marked contribution of the forestry sector in poverty alleviation and food security.

Despite mounting pressures on forests and biodiversity, Lebanon has recorded several milestone achievements, namely (in chronological order):

- Lebanese Parliament approved the long-awaited Environment Framework Law (Law 444/2002), although it needs implementation;
- The 440-km Lebanon Mountain Trail (LMT) was launched in April 2008, offering novel opportunities for natural and cultural heritage conservation and rural livelihoods. While the Lebanon Mountain Trail Association was officially registered as an NGO in October 2007, the LMT still needs official government recognition and protection. This will require a concerted effort by dozens of municipalities and government agencies, as well as grassroots support, to protect the trail corridor from unwanted activities and developments over the long-term;
- UNESCO designated Jabal el Rihane and Jabal Moussa as two new Biosphere Reserves in Lebanon (bringing the total number to three);
- CDR prepared the "National Land Use Master Plan" (2002-2005) and the Council of Ministers recently approved the plan (Decree 2366/2009);
- The Council of Ministers approved the long-awaited restructuring of MoE, proposed in 2001 (Decree 2275/2009);
- AFDC in collaboration with the five national agencies produced Lebanon's first National Strategy for Forest Fire Management (May 2009)
- Parliament approved the new Hunting Law (Law No. 580/2009) with opportunities to reconcile game management with wildlife conservation.

Each of these achievements represents giant steps in raising the environmental consciousness of Lebanon and there is a growing awareness among the Lebanese population of the importance of its "green heritage". But forests and biodiversity remain very much at risk in the country. The lack of a clear forest strategy means the actions are not only inefficient, but they may also be in conflict. At the protected area level there are earnest attempts at standardizing management, while an on-going effort to have a national approach and strategy on these landscapes is, for the moment, hindered. These two facts alone put forests in significant jeopardy.

Current laws that are inadequately enforced, the lack of a cohesive and regulated land management policy, and disincentives for landowner stewardship mean that the fires will continue. It is vital that all ministries and concerned government entities improve coordination amongst each other to develop a draft mechanism for the immediate establishment of the National Forest Authority that will monitor and maintain forests in Lebanon.

e. General recommendations

Immediate restoration and conservation measures need to be implemented within the framework of the different subjects treated in the report. Sustainable management of forests in Lebanon (forests and other wooded lands) remains a challenge for the future. These forests are essential for the protection of soils, water and biodiversity. Forests, which are sources of wood, non-wood forest products and rangelands for the rural people, play a major role in the development of the economy and the tourism sector in Lebanon. Accordingly, the conservation and development of Lebanese forests requires numerous recommended activities.

The different actions that should be taken to mitigate threats are:

- Integrated management of forests as ecosystems.
- Stronger law enforcement.
- Prevention and management of forest fires.

- Reforestation/afforestation of non-regenerating fire affected areas and of abandoned lands.
- Proper implementation of land use planning.
- Planning and management of the grazing sector.
- Control and monitoring of insects and pests populations.
- Encouragement of sustainable use of forest resources especially non-wood products.

The risk of forest fires would require the development of pre-fire and post-fire management.

As for hunting, different key measures should be taken to reach a sustainable management of this forest activity in Lebanon. Such key measures are:

- Guidelines for sustainable hunting of birds.
- Promotion of sustainable hunting behavior.
- Development and enforcement of hunting legislation.
- The protection of migratory birds (shared regional responsibility) through strengthening co-operation and compliance with international agreements and organizations.

Protection and Conservation Measures:

- Using integrated land-use planning.
- Maintaining natural forested and wooded ecosystems.
- Implementing a system of representative protected areas.
- Conserving threatened ecosystems, specimen trees and monument forests.

Local community groups, NGOs, grassroots organizations, and other members of civil society should be more involved in the decision making process related to legislation, policies, management options and conflict resolution. This implies capacity building at the local level, and the development of new ties with civil society, through which the local population would become a key partner. Capacity building would entail upgrading the skills of stakeholders within public entities and the local community. Ministries, municipalities, farmers and landowners, women, schools and universities, NGOs, youth groups and volunteers and other local groups should be targeted by the various capacity building activities. At the legislative level, both the amendment and the correct implementation of the Forest Code (Code 558 of the Lebanese Law /96) are suggested. Civil society (NGOs, municipalities, local community groups…) involvement in the preparation of the forest policy will generate stronger interest in its wide adoption and proper implementation. At the technical level, modern techniques for monitoring fire outbreaks such as early warning systems should be introduced and public awareness should be raised.

Few species, like Fir, Juniper, and Oak could be considered for wood production in the future. Wood produced from these species should only serve a niche market of luxury items and handicrafts. Future plantations could play an important role in this respect, if the appropriate species are planted. The valorization of the forests would be achieved through non market values and services offered (landscape, biodiversity, leisure, carbon sequestration…). The planned development of ecotourism and outdoor activities would bring a substantive financial contribution to the local population and would allow for a better conservation of ecosystems.

There is a need to create a Faculty of Forest Sciences at Lebanese universities as a nationally or even internationally renowned research and education center which produces highly competent and responsible professionals with excellent management skills in forestry and other environmental fields. Various reports have indicated the need for taxonomists. In Lebanon, over 9119 species of plants and animals were identified (20% estimate) and a higher number (43500) remains to be identified. Research to identify, study, conserve and exploit reasonably these species is greatly needed. Institutions should be strengthened carry out these activities. Training is significantly required in the fields of Taxonomy, genetic resources, conservation (In- situ, Ex-situ), ecology, resource management, forestry, planning and data processing. An equally important point to development in the forestry sector is the introduction of new technologies that could be used for better management of existing forests and for the improvement of the reforestation and afforestation campaigns.

Overall, there is an urgent need, highlighted more even after the October 2007 forest fires, to create an independent forest authority. This authority is needed to improve the management of the forests by integrating the concerns of all government and non-government stakeholders. This autonomous

authority would be responsible of all the forestry sector and forest related issues and would be the coordination body between all concerned government institutions especially the ministries, and combine the efforts of all involved entities in forestry. This will certainly have a positive impact on the management and conservation of forest resources. The forest strategy for 2020 is discussed in Annex II.A.6.

II.3.4. Protected Areas

a. Challenges

The obstacles and challenges to sustainable PAs in Lebanon can be summarized as follows:

a.1. At policy level

1. The Lebanese MoE had prepared and drafted the needed framework to ensure proper PA management including: a draft framework law for nature reserve; a review of existing categories of PAs and a suggested new category system; a management tool kit for PA staff; a revised set of policies and procedures as well as guidelines for Management planning.
2. Nevertheless, the prevailing unstable socio-economic situation in Lebanon since 2005 has seriously delayed the processing and endorsement of those texts at central government level.
3. No matter how relevant the legislative framework set for PAs protection and effective conservation management, lack of enforcement by local and national government institutions minimizes tremendously its value (Jaradi and Khater, 2005; Matar, 2009). Illegal hunting, urban and agricultural encroachment, entertainment on inside roads (roads inside the protected area) are some of the direct pressures caused by humans on the nature reserves in Lebanon. These activities are infringing internal and national regulations and are not being appropriately penalized (Matar, 2009).
4. Currently, the MoE is revising the suggested categories to align them as well with the "Schéma Directeur d'Aménagement du Territoire Libanais" (SDATL) that was suggested by the CDR in 2004 and approved by Council of Ministers (Feb. 2009).

a.2. At financial level

1. Since 1996, the MoE dedicates within its budget a support fund for nature reserves equivalent to approximately $50.000 per year per nature reserve. In addition to the fact that such small amounts are often non-sufficient to cover management and site expenses, this source of income has been considered as non-sustainable funding. On the other hand, to date, almost all activities occurring within NRs are project dependent and activities are seldom sustained post the project duration. This situation enhances the fragility of the financial situation of PAs.
2. The MoE has consequently drafted a law program aiming to secure recurrent support funds for PAs and has prepared a report on alternative financing mechanism for PAs. Those documents are still considered as internal documentation and were not yet processed for governmental endorsement.

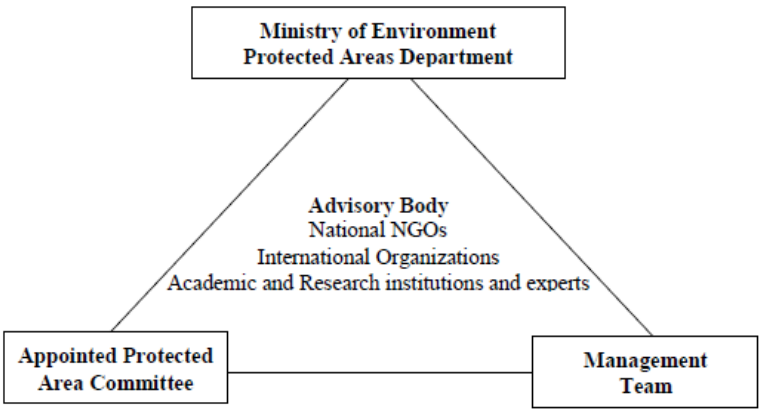
a.3. At socio-economic level

1. A lot of efforts have been invested towards developing business plans for existing Nature Reserves that account for the need to actively involve local communities in the overall management of the sites including benefit sharing. Equally, local NGOs, universities experts and municipalities are represented within the Appointed Protected Areas Committees that are responsible for supervising management of PAs.

b. Responses

At the exception of NRs, most PAs have been excluded from management projects, and consequently suffer from lack of planning and management structures (Jaradi and Khater, 2005). Initially, a vertical management model was adopted, which was later improved as a more flattened triangular structure (Figure 35) involving an advisory body to create an alleviation of technical and managerial responsibilities on the governmental appointed committee GAC (also called appointed protected area committee-APAC) (Bachir, 2005). The new structure also aimed at strengthening the management team by giving it a more formal status and salary structure with full-time skilled personnel.

Figure 31. Triangle management model proposed under SISPAM (Source: Bachir, 2005)



Efforts were thus oriented towards shifting the management structure from Government-Management to Co-Management/Collaborative management. However, many factors decreased the potential effectiveness of decentralizing management of NRs, some of which are: the lack of a legal status for the APAC and the lack of decentralization of decision-making powers. On-ground, the management structure for NRs is still rigid and centralized, which decreases the efficiency of the field management (Khater and Matar, *In press*).

Besides the first three demonstration management plans in Lebanon for Horsh Ehden, Al-Shouf Cedar and Palm Island, only Tannourine Cedar Forest and Tyre Coast have updated their management plans, while the remaining large number of PAs don't have a formal management system and site protection is limited to legislative protection (Khater and Matar, *In press*). This issue is being partially tackled through a new project launched in the summer of 2009 by the MoE and French Agency for Development (AFD-FFEM) partnership. Under the AFD project entitled "Support to Nature Reserves in Lebanon", management plans for five PAs will be updated or created.

On the other hand, the lack of sustainable funding remains the most important problem to effective management of NRs, which also relates to project dependency of PA management in Lebanon where the major funding for management ends with project duration (MoE, 2002; Jaradi and Khater, 2005). Hence, the necessity to secure self funding after the period through attractive activities and interaction with nature.

Moreover, within the framework of the SISPAM Project, MoE prepared a National Action Plan for Protected Areas (MoE, 2006) which outlines purposes, objectives, and tasks that need to be fulfilled in order to successfully manage PAs in Lebanon. The NAPPA is a visionary document that has determined the priority activities and actions for effective management of PAs in Lebanon. It allocates roles and responsibilities and budget estimates for the implementation of the priority activities and actions. In its final form, the NAPPA forms the basis for leveraging and securing funding from the public treasury in the form of a Law Program (قانون برنامج). The allocated funds will then be used to implement the activities and actions outlined in the NAPPA.

Finally, one of the major changes occurring in Lebanon in the field of PAs are several initiatives that are starting in Lebanon aiming to establish Natural parks throughout the territory in line with the suggestions and orientations of the SDATL as the initiative undertaken by Mada Association since 2004, for the unique Natural National Park in the Upper Akkar Region.

c. Critics

c.1. State management

At its current shape, the Protected Areas Department (PAD) at the MoE cannot solely handle PAs management. The department is understaffed, and is centered at the MoE with no regional or local

offices. PAs are mainly in rural areas and under continuous pressures from visitors, grazing and illegal hunting as well as surrounding practices such as agricultural practices and urbanization. The PAD cannot control all these pressures on its own, hence rendering state management of PAs in Lebanon a potentially failing experience.

Being under continuous pressure from human practices, PAs are never isolated from people intervention. People shaped the landscape for millennia in this densely populated country.

While some practices are recreational such as hunting and visits to nature, others such as grazing, fishing and farming define the livelihoods of many living inside or in the vicinity of PAs. Those resource users in specific should be integrated in protected areas management, not only because they have acquired a traditional knowledge of managing those resources, but also because it is ethically incorrect to deprive them from their sources of livelihood. Rural Lebanon faces many economic pressures mainly leading to immigration; hence entering in a cycle of a socio-economic depression both on rural and urban areas. PAs should avoid strengthening those pressures, by paralleling poverty alleviation to its conservation goals.

- Effective state management requires decentralised state institutions with sufficient and stable human and financial resources.
- State management often distances people from PAs leaving socio-economic impacts on communities depending on PAs for livelihood.

c.2. Community Management

- Community's best manage PAs when they foresee the benefit of conservation and acquire responsibility of developing and adapting management rules to their local institutions.
- Communities do require assistance in management, mainly technical assistance. Extension services are among many other tools that state can use to facilitate full community control over areas under protection.

Community-based management of some protected zones is in its early stages in Lebanon. The question is how to fit them within national conservation priorities?

Integrating communities in any PA management initiative is essential as it leaves positive local socio-economic impacts. MoE and NGOs initiatives are working in this direction through the promotion of local income generating activities such as ecotourism and organic farming. While the latter are conceptually attractive, their current low marketing potential and economic return hinder their potential as successful conservation tools.

A couple of programmes in Lebanon are focusing on community based management, such as the current work of Mercy Corps and the Society for Protection of Nature in Lebanon (SPNL) on preserving Ibl Essaqi forest and stimulating community benefit. The initiative is at its early stages. SPNL and Mercy Corps guide the community on the ecological importance of the forest, while the village residents are working on designing the management plans and reviving traditional management practices.

c.3. Private Management

- Private management is not solely the work of corporations or businesses, but also of landowners, and even NGOs solely managing the PA.
- Private interventions for conservation ensure high financial and managerial maneuverability.
- Private protected areas risk distancing their conservation priorities from national conservation agenda.
- Transparent management and local livelihoods are at stake as private managers have the final say in management decisions and may be reluctant to sharing financial information.
- For-profit protected areas risk prioritizing interest of businesses over livelihoods.

Private management of Natural resources has taken various forms in Lebanon:

1) Partnerships between private sector and communities in Al Jord project for example. Al Jord is a private-community partnership for responsible tourism in the mountains of Hermel, Akkar and Donniyeh of North Lebanon. Owned by private investors (63%), local partners (25%) and an NGO

(12%), Al Jord Company promotes activities with social and ecological considerations. Apart from preserving the ecological and scenic importance of the area, the company ensures local benefit from its profits through the local partnership component and employment opportunities. Actual impact of the project on local livelihoods remain however not thoroughly assessed (Al Jord, 2004).

2) Voluntary conservation in the case of Aammiq wetland is a pioneer initiative on private land in Lebanon. Landowners believe they are outweighing in their conservation achievement the work of the public sector namely that of the Ministry of the Environment (Bachir, 2005). Nevertheless, because of Aammiq international importance as a Ramsar site, the question of its integration within national and international priorities surfaces again. MoE attempts to initiate partnerships for conservation with landowners is mainly hampered by the lack of regulatory and economic incentive instruments to ensure collaboration on conservation (Bachir, 2005).

Overall, private management can allocate enough and continuous resources for management. However, the risk of overexploitation and exclusion of local users from their sources of livelihoods always holds, as the private body has the final say in the management and use of the area.

c.4. Collaborative management

- Joint management works well when communities are heterogeneous and stakeholders have various interests.
- Cooperation developed for a dual goal of both providing resource users with decision-making power and ensuring better management and conservation.
- Collaborative management brings state and local stakeholders closer and stimulates dialogue, bridging the gap of lack of communication and collaborative thinking in some societies.
- Collaborative management can be hampered by inadaptability of societies to this new form of participation through existing bureaucracies and stiff regulations.

PAs stakeholders are numerous in the areas under protection, given the various forms of land and resource usage: farmers, herders, hunters, fishermen, tourists, NGOs, municipalities and small businesses. This requires cooperation to foster common vision for management.

The government of Lebanon develops land use regulations and should be brought to the circle of cooperation for the management of PAs to enable face-to-face dialogue on this regard instead of confrontation. Municipalities, ministries and local community can bring their various managerial, regulatory and conflict resolution skills to enable more efficient management. State-stakeholders dialogue needs reviving in Lebanon to reestablish lost trust between the two sides. It enables government to appreciate local management capabilities, and stakeholders to look more positively and with less suspicion at the state intervention in their areas.

c.5. Which management approach for Lebanon?

Beyond the protection of biodiversity and ecological functions, PAs management should aim for equitable distribution of benefits among the groups at stake. The management approach should be acceptable by the concerned communities, and adaptable to the social and ecological changes around it. It should also be economically efficient and financially feasible and sustainable. Apart from state management, all three other management approaches can provide the human and financial as well as technical resources to meet the above principles in the management of PAs in Lebanon, with varying degrees of confidence. Private management through businesses or individuals ensures financial sustainability; however it may ignore local needs and rights of benefit from the resources under protection. The experience of NGOs management in Lebanon has however been overall unsuccessful due to their limited human and financial capital. In order to ensure that conservation objectives are met and falling within national plans, private management imposes monitoring costs on the state or the authorities in charge. Involving communities in monitoring in “community management” can save the authorities a large amount of effort and cost; and ensure local groups benefits from the PA. Communities however can be struggling with availability of funds; and request in Lebanon in general technical assistance for adequate conservation and management.

This raises the need for an integration of various skills and available resources for effective management. Collaborative management can provide the Lebanese setting the right frame to incorporate different ideas into the debate around management of PA from the local managerial and the state regulatory fields. Equitable management is best ensured when communities and local stakeholders have a say in the management of the PA. Bringing the state on board puts local management in line

with national conservation priorities. Apart from its conservation and equitable benefits, collaborative management has a reconciliatory dimension as it bridges the gap of miscommunication and lack of constructive dialogue between the state and communities. It is worth pointing that successful collaborative management is the one that creates the platform for joint decision-making and enables communities to have a say in the management of the resources upon which they depend. Therefore the design of collaborative management in Lebanon should be tailored in this direction rather than towards strengthening state and local elite power over resource management rules.

c.6. Conclusion and Recommendations

PAs creation and management are still at their early age in Lebanon. The first official designation of nature reserves started in 1992, while the MoE was still under construction. In this perspective, major developments and achievements have been observed in the country. Within less than two decades, Lebanon signed the CBD (1992), expanded the creation of protected areas and developed an institutional structure and underlying policy and legislative frameworks for the management of nature reserves in Lebanon.
However, many problems for effective designation and management of PAs in Lebanon still need to be addressed in order to make the process more effective and efficient in reaching conservation goals. Some of the major obstacles reviewed in this report could be addressed through:

1- Aligning PA designation and legislative protection systems between ministries through improved coordination and alignment of PA plans under a systematic conservation national strategy with clearly defined conservation goals.
2- Strengthening the internal management structure by allocating and providing sustainable government funding for on-site management of the PAs.
3- Providing a regular and rigid law enforcement support to management teams on site.
4- Strengthening the management structure, towards effective partial decentralization with more formal participation of qualified local institutions in decision-making and management.
5- Improving monitoring of protected area management.
6- Aligning policies and regulations within ministries mandates to mitigate and better control rising human pressures on conservation and PAs (i.e. urban and commercial developments, roads etc.).
7- Standardizing the categories of PAs in line with the territorial reality of Lebanon and with the suggestions of the SDATL.

II.4. Practices

a. Types of land degradation

a.1. Water degradation

As a result of water degradation, the ecosystem is usually affected by several aspects of water use, which are controlled mainly by the absence of proper management controls and the lack of consumer awareness. Therefore, the impact of wasteful use of water degrades water quality and quantity, and thus it is reflected on the ecosystem.
In Lebanon, there are three major aspects of water degradation as follows:

a.1.1. Surface and groundwater contamination

- Groundwater reservoirs
  - Contamination due to the infiltration of pollutants from surface to groundwater
    Example: Results show high nitrate concentration, exceeding 300 mg/l, in a number of wells, such as in Akkar plain (Halawani *et al.*, 1999), and similarly in the Bekaa (Darwich *et al.*, 2008).
  - Saltwater intrusion
    Example: Salinity in groundwater of the coastal zone has been increased 200 times from the beginning of 1960s (Khair *et al.*, 1994). This influenced soil salinity, and thus the type of crops and their production rate (El Moujabber *et al.*, 2005).
- Water in rivers
  - Direct outfall of liquid and solid wastes in river water
    Example: Total Coliform in Abou Ali River reached 26500 CFU/10ml (Houri and El-Jeblawi, 2007). Also, the phosphorus concentrations in El-Kabir River are extremely high, as well as the ammonia-nitrogen and nitrate-nitrogen concentrations indicating extensive pollution to the river water (Hassan *et al.*, 2005).

- Springs' water
  - Polluting catchment areas of springs by liquid and solid wastes

    Example: The catchment of Chamsine spring is almost unreserved and thus solid and liquids wastes exist; therefore, the investigated Total Coliform reached 3000 col/ml. Also, Nitrate and Phosphate exceeded 90 and 75 mg/l; respectively (CNRS, 2007).
- Wetlands
  - Direct outfall of waste water in wetland areas

  Example: The quality of Aamiq wetland water is affected by the farms in Saalouk and from Qab Elias, as well as by sewage water due to the lack of infrastructure. The presence of such sources of contamination is verified by the microbiological analysis of *Escherichia coli* and intestinal *Enterococci* (El-Khoury, 2007).
- Lakes
  - Direct discharge of waste water in lakes

  Example: The total coliform in the Qaraoun Lake exceeded 5000 Col/ml, and nutrient values reached eight times the acceptable levelsl; in addition, there are sixteen environmental hotspots surrounding the lake (Shaban and Nassif, 2007).

a.1.2. Decline in water volume from different sources

- Over exploitation groundwater reservoirs
  - Increase in the number of water wells:

  Example: Between 30-40% of all the water being furnished for domestic and industrial use and for irrigation are dependent on groundwater from wells (Macksoud, 1998). In the capital Beirut, the distribution density of water wells ranges between 400 and 500 wells/km^2 (Khawlie et al, 2003).
  - Increase in the *per capita*

  Example: The consumption of water in Beirut was 30, 50, 84, 112 and 200 l/day/ capita for the years 1870, 1912, 1944, 1959 and 2007; respectively (Fawaz, 2007). This indicates a yearly increase of about 1.2 l/day/ capita.
- Direct pumping from springs and rivers:

  This is a common phenomenon in many of the Lebanese rivers and spring; thus direct pumping from rivers and springs occurs, notably in the absence of formal controls (Figure 36). The pumped water is mainly used for irrigation.

Figure 32. Direct pumping from rivers is a common phenomenon (Source: A. Shaban, CNRS)

- Exploiting water in Wetlands:

  Example: For Aamiq wetland, the most important in Lebanon, it is largely fed by three springs off the Barouk mountain side. Recently, most of the water from these springs is either diverted to surrounding villages or used directly for irrigation (El-Khoury, 2007).

According to the above discussion, it is obvious that water resources in Lebanon are exhausted and the negative human impact is being exacerbated in the last few centuries. This is well pronounced in the view of the major two challenges, climate change and the population growth.

b. Direct causes

The estimated naturally water availability in Lebanon might be considered as close to regional average despite some optimistic considerations like 1324 m^3/capita/year, which exceeds by six times the water demand (Shaban, 2011). The official estimation of the MoEW is much lower and do not exceed 750 m^3/capita/year. However, water shortage exists and the need for water has become a crucial issue. From the demand-supply point of view, water management is uncertain since there is still a demand for water in sufficient quantity and safe quality. Thus, mismanagement is one of the challenges that water sector in Lebanon is witnessing. However, recently few management implements have been applied and some others are intended to be done. Thus, the status-quo has negative and positive aspects and can be summarized as follows:

c. Indirect causes

- Lack for sufficient data and information due to the lack of measuring instruments.
- Lack for coordination between different water sectors, whether public or private.
- Monitoring systems are rare enough for water volume and quality control.
- No proper implementations to utilize unconventional water resources.
- Lack of maintenance resulting in bad conditions of distribution network
- There is gap in legislations and policies for water exploitation and conservation, notably to cope with the new challenges of climate change and population growth.

d. Main conservation groups

- Applying legislations and laws for water conservation in terms of quantity and quality (e.g. controlling groundwater abstraction, reservation of flood plains, etc.)
- A number of new projects, at different scales, have been done (e.g. dams, water supply systems, new boreholes, etc), and some others are proposed.
- Re-functioning some monitoring systems and measuring instruments (e.g. increasing number of gauge stations, flow-meters, laboratories for quality control, etc).
- Joining international programs and projects in order to achieve financial resources for implementing new projects (e.g. funds from UNDP, GEF, EU, Italian cooperation, etc).
- Shared water resources and related treaties have been recently given concern.

e. Governmental control

- Legislations and water laws should be well applied and respected.
- Cooperation between water sectors must be activated.
- There must be lessons learned from regions under water stress and with similar physical conditions as Lebanon.
- Water policies should be changeable according to demand-supply trending.
- Encouraging and supporting small-scale water harvesting projects by inhabitants.
- Awareness campaign should be carried out within formal programs for better use of water resources, notably in agriculture and domestic uses.
- Unconventional water resources should be considered for further utilizations.

f. Recommendation to address key water management

In order to propose recommendations to improve water situation, the problematic issues and challenges must be primarily determined. In Lebanon, recommending for better water management should be addressed from the view of water conservation, because water as a source is available, but it is not well managed. The optimal water management in Lebanon is actually described within the National Strategic Plan (2000-2010); however, it can be diagnosed on the following basis:

1. Surface water:
- Direct pumping from surface watercourses must be controlled.
- Harvesting approaches are strongly recommended and at different scales (e.g. dams, diverting channels, lakes, etc).
- Catchment areas of springs and snow cover lands should be reserved and formally controlled.
- Quality control and monitoring systems should be widely spread on surface water sources.

2. Groundwater:
- Avoiding drilling boreholes in the coastal plains.

- Artificial recharge should be considered, notably in the coastal zone.
- Recharge zones for the major exploited aquifers must be protected, notably from the landfill, industrial sites and other large-scale implementations.
- Deep aquifers (mostly of the Jurassic) should be utilized within a giant project framework.

a.2. Soil degradation

a.2.1. Loss of arable lands by urban expansion

Urban expansion has been a direct driving force causing the loss of best arable lands in the country. While ancestors preferred settling over hilly and sloppy lands overlooking the plains and depressions, recent Lebanese prefer the construction along the roads and on the account of cultivated lands. According to the map of soil aptitude to agriculture based on multiple factors joining geomorphology, soil characteristics and problems, the best productive lands are spread on the coastal plains and in the intermountain depressions and valleys. The area of highly productive lands consist of 133,700 ha while the moderately productive soils with one major or two slight, manageable problems, like sheet erosion, restricted drainage or infiltration and aeration related problems is 390,800 ha. The area of low productivity lands suffering from severe fertility and management factors is 325,500 ha while the area of non arable lands is 165,000 ha.

Comparing the land cover map with the expansion of urban settlements between 2000 and 2010, showed a total loss of 308 km^2 of land resources (Figure 37, 38). Among lands converted into concrete, a total of 194 km^2 (63%) belong to agricultural lands, 53 km^2 (17.2%) and 50 km^2 (16.2%) occurred at the account of wooded land and grassland respectively. Less than 11 km^2 (3.7%) of recent urban development has expanded on unproductive land leaving a large question mark about the implementation and sustainability of agro ecological and urban zoning in the country.

Figure 33. Land capability and historical urban agglomeration on fertile lands
(Source: CNRS)

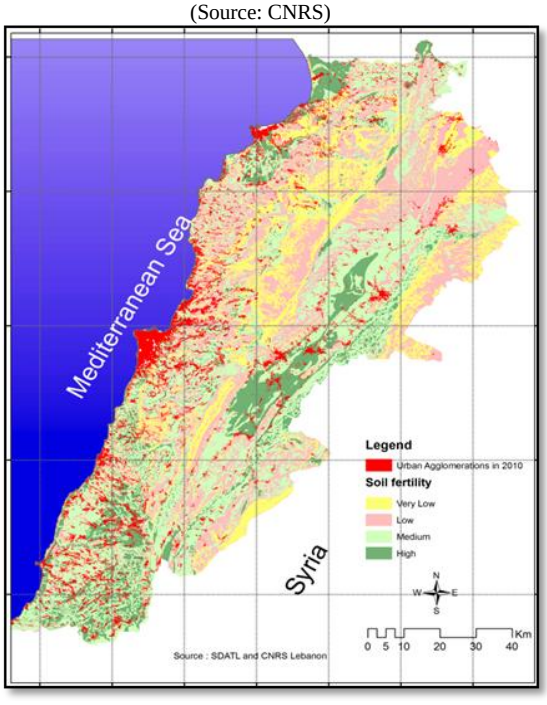
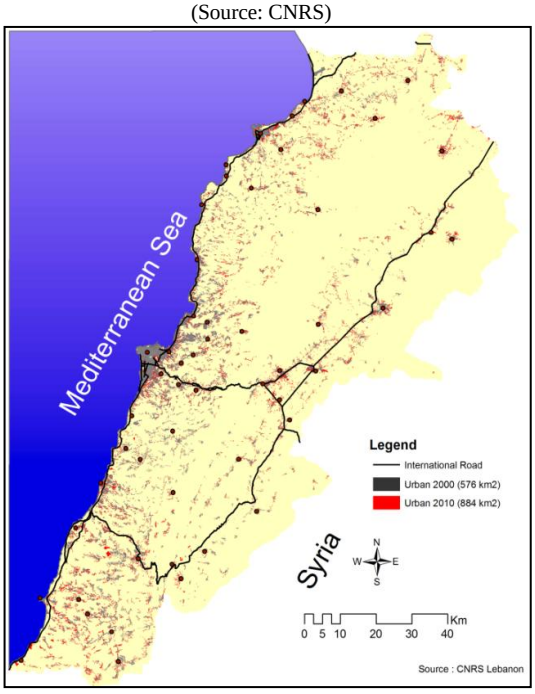
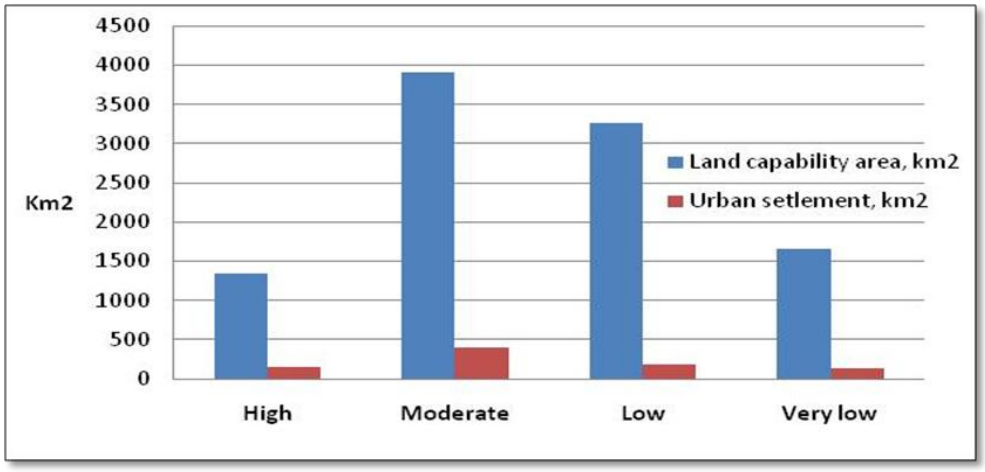


Figure 34. Urban expansion in Lebanon between 2000 and 2010
(Source: CNRS)



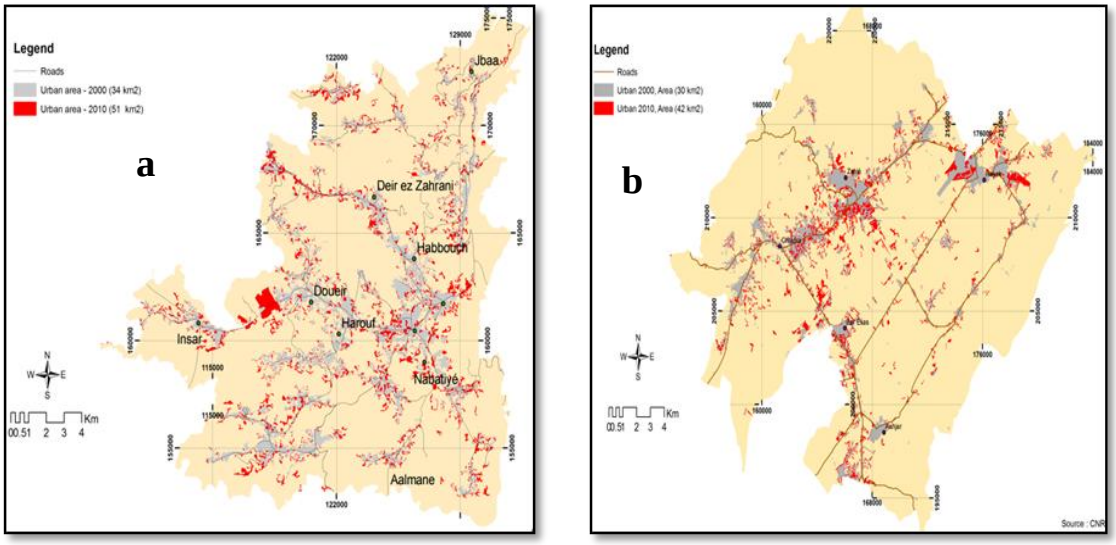
The most affected area by urban sprawl is the coastal strip between 0 and 400 meters above sea level representing 19.3 % of the country area. Previous assessment using multi temporal image analysis of land use change in Tripoli and surrounding, located in coastal north Lebanon, between 1964 and 2000 revealed large expansion of urban areas consuming 60% of prime lands (Darwish *et al.*, 1999). Indeed, the most important urban agglomerations are concentrated on the coastal Lebanese zone, which comprised 47% of the total urbanized area (Dar-Iaurif, 2002).

Figure 39. Cumulative land sealing of productive lands by urban expansion between 2000 and 2010



Downscaling to traditional agricultural areas located in Caza Zahlé, Central Bekaa and Caza Nabatiye showed a respective loss of 12 km^2 and 17 km^2 of arable lands by chaotic urban expansion (Table 20), which expanded from 30 to 42 km^2 and from 34 to 51 km^2 between 2000 and 2010 respectively (Figure 40a, b).

Figure 35. Chaotic urban sprawl in Nabatiye (a) and Central Bekaa (b) (Source: CNRS, 2010)



The major recent loss of cultivated lands in the selected Cazas is noticed in the area allocated to field crops traditionally manageable under mechanized agriculture. A significant loss of olive orchard was observed in Nabatiyeh while in both Cazas unproductive lands were conserved.

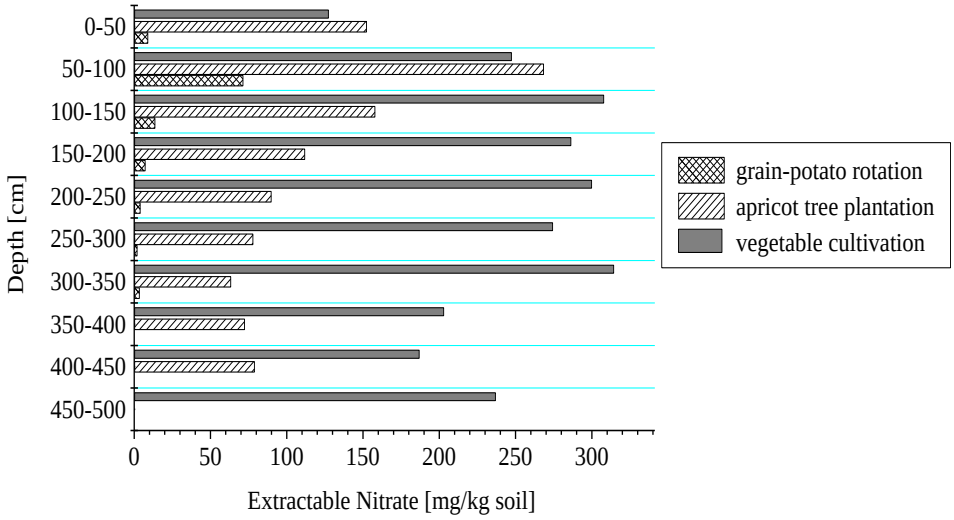
Table 20. Loss of arable lands by urban sprawl in two representative Cazas of Lebanon between 2000 and 2010 (km^2).

Caza	Land use class						Total area
	Olive	Grape/fruit trees	Field crops	Woodland	Grassland	Unproductive land	
Zahlé	-	1	10	0.5	0.4	0.1	12
Nabatiyeh	6	-	6.8	0.6	3.6	0.0	17

a.2.2. Land contamination

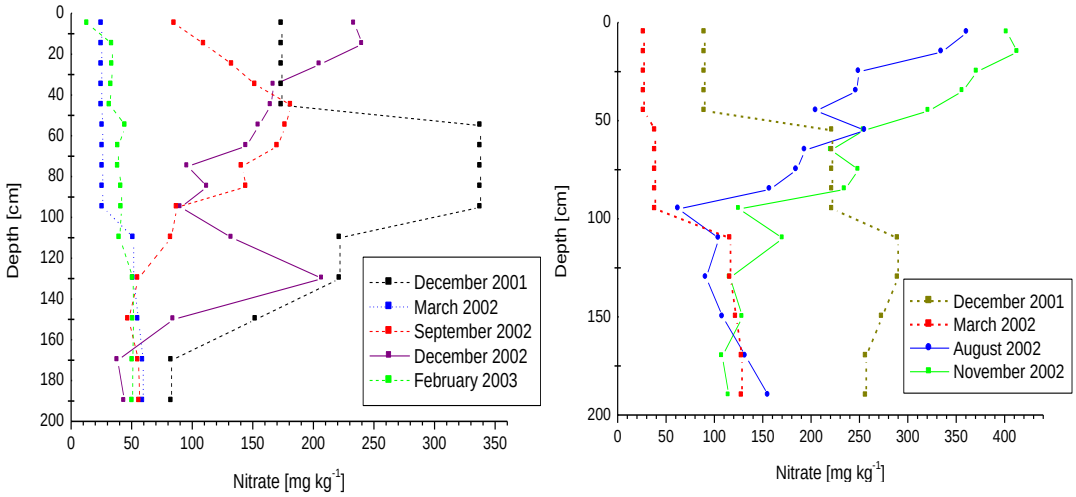
A slight accumulation of some heavy metals in the soil with possible contamination of high water table with Ni, Cr and nitrates was observed (Darwish *et al.,* 1999). Poor rotation, low water and fertilizer use efficiency resulted in increased nitrate content in the soil and groundwater (Darwish *et al.,* 2008a). Human activities, industry, manufacturing and agriculture are the main causes of chemical soil deterioration. The Arab-German cooperation project between CNRS-CRS, ACSAD and BGR on soil-groundwater protection from pollution in Central Bekaa plain proved the geogenic origin and excess fertilizers input and irrigation using low quality water are behind heavy metal input to the soil-groundwater system (Mueller *et al.,* 2002). Fortunately, soil protection effectiveness is still significant regarding the possible heavy metal transfer to deep groundwater. But, indications for a higher leaching potential of soluble pollutants within the soil can be derived from the high concentrations of nitrate down to 5 m depth found at the vegetable monoculture and fruit trees cultivation in Central Bekaa (Figure 41).

Figure 41. Depth distribution of soil nitrate (Nmin) as a function of different land use
(Source: Mueller et al., 2002)



Soil contamination can pose problems not only to the soil-groundwater system but also to public health. Given over irrigation practices and the pattern of rainfall in the country, a clear positive water balance is created during winter causing the leaching of accumulated nitrates at the end of agricultural season to groundwater (Figure 42). On the other hand, excess pumping from wells caused the deterioration of groundwater quality on the coastal area by seawater intrusion (El Moujabber *et al.,* 2006).

Figure 36. Accumulation of soil nitrate in different land use in fall and leaching by spring
(Source: Mueller *et al.*, 2002)



Peach tree **Vegetable monoculture**

a.2.3. Soil salinity

More than two thirds of the soil resources in Lebanon are facing other significant stresses like alkalinity, moisture deficit and salinity (Darwish, 2002a). In greenhouses, a steady increase in the soil electrical conductivity (ECe) from 0.4 dS/m to 15 dS/m was observed (Solh *et al.*, 1987) and explained by poor soil leveling. However, soil salinity rose up to tenfold inside the greenhouse compared to outside soil. This was associated with excess input of fertilizers (Atallah *et al.*, 2000) and use of saline water in irrigation. In Hermel-Qaa area, north east Lebanon, more than 52% of monitored sites at open field, showed an ECe in the range of slightly saline and saline soils (El Khatib *et al.*, 1998; Darwish *et al.*, 2002a). Recent revisiting and monitoring of ECe of the saturated-paste extract of 75 samples in Qaa indicated an increasing proportion of salt-affected soils in comparison with the previous field sampling undertaken in 1997 for the same area (Table 21).

Table 21. Evolution of soil salinity in a semi arid Lebanese region between 1997 and 2000

Level of salinity dS/m	Normal <2		Very slightly saline 2-4		Slightly saline 4-8		Saline 8-16		Number of samples
Year of observation	1997	2000	1997	2000	1997	2000	1997	2000	75
Proportion %	35.3	15.9	23.5	30.1	31.4	39.3	9.8	14.7	

Source: El Khatib *et al.*, 1998.

But, the statistical analysis showed no direct correlation between secondary soil sanitization and the amount of added manure. It is rather the combination of high evaporation rate and the use of manure with high salinity index mineral fertilizers coupled with mismanaged irrigation and restricted drainage that possibly enhanced the salinity buildup in the soil. Improving fertilizer use and the efficiency of water application was possible through using fertigation of protected and open field crops based on soil conditions and crop demands (Atallah *et al.*, 2002; Darwish *et al.*, 2005). Promoting modern irrigation systems, training of farmers and supporting dood practices and farming activities can substantially contribute to reducing salt buildup in the soil and groundwater.

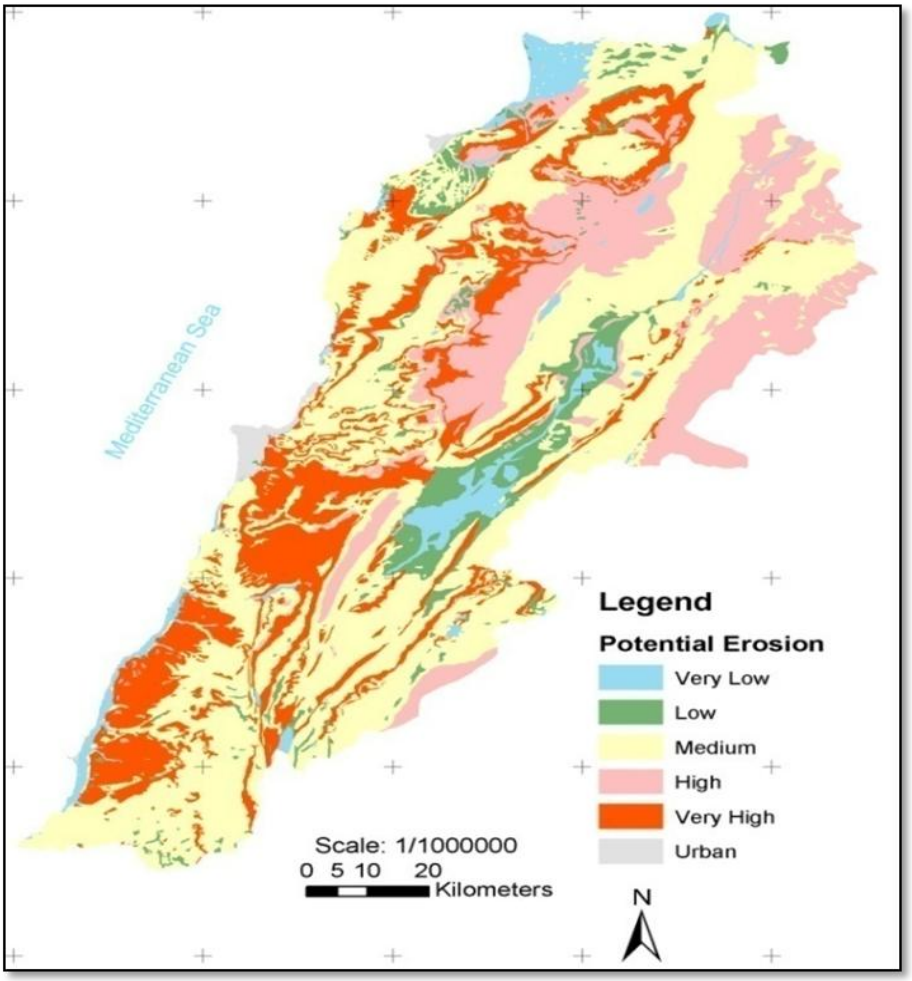
a.2.4. Soil erosion

a.2.4.1. Mapping of potential erosion

Erosion is accelerated by the abundance of steep slopes and barren lands notably in the mountain areas. However, one of the essential dynamic factors in this concern is related to human impact on soil development and sedimentation. Excavation processes such as quarrying, construction practices, bad

agricultural operations and deforestation represent the main driving forces of soil erosion. Several studies have been executed in the CNRS-CRS combining remotely sensed data and GIS technique to produce soil erosion vulnerability maps (Figure 43). For example, the assessment of erosion in the central Lebanese mountains showed more than 90% of the area to have moderate and high erosion rates (Faour *et al.*, 1999; Bou kheir *et al.*, 2001).

Figure 37. Erosion risks in Lebanon as a function of geomorphology, soil properties and climate



(Source: Darwish *et al.*, 2002b)

a.2.4.2. Descriptive erosion mapping

Because Lebanon lacks systematic quantitative studies on the rate of soil erosion, implementing descriptive soil erosion mapping can represent a semi-quantitative approach to assess soil erosion in reasonable time with limited resources. The analysis of potential erosion was supplemented by a semi-quantitative approach describing soil erosion in two Lebanese watersheds (Annex II.A.7).

b. Direct causes of land degradation

b.1. Mismanagement of fertilization and irrigation

Bad practices, excess fertilization and water input, discharge into open streams and wadis, use of low quality waters for irrigation, beside the geogenic origin are behind heavy metals and nitrate accumulation in the soil and groundwater systems.

b.2. Range land deterioration

Soil erosion is enhanced by the deterioration of range lands caused by the recession of the vegetative cover, land cover/land use change and steep slopes. Two mountainous pilot areas with contrasting

climatic conditions were chosen to analyze rangeland degradation (Darwish and Faour, 2008). Results showed the significant impact of changing landuse and overgrazing on the degradation of rangelands (Annex II.A.8).

b.3. Overgrazing

Livestock production is an integral part of dryland management in Lebanon with an increased number of local breeds of sheep and goats adapted to scarce vegetation (Awassi and Baladi) from 500,000 in the 70s to 700,000 in the 90s (Hamadeh, 2005). The expansion of cultivated lands and reduction of rangeland, associated with the low productivity of rangelands, lead to overstocking and overgrazing of fragile lands. 75% of annual diet is provided through permanent or seasonal migratory from rangeland grazing and partial lease of agricultural lands in Bekaa. Up to 40% of this grazing pattern focuses on common lands which provide 30% of animal diet year round. Overgrazing is obvious from the mismatching of outdoor feeding pattern with the stage of vegetation cover (Figure 44).

Managing the carrying capacity of Lebanese rangelands for small ruminants, which was estimated to be below 2 head/ha, showed that the carrying capacity is exceeded by 30% on both Mount Lebanon and Anti-Lebanon slopes (Hamadeh, 2005). This and other landuse constraints in Arsaal like expanding the cultivated area to the rangelands and the absence of protected zones for biodiversity conservation resulted in the fragmentation of pastoral lands, loss of natural habitat and possible erosion of wild crop relatives.

Arsaal is identified as a transfer point for the winter migration of more than 30,000 heads towards the semi-arid Lebanese or Syrian areas. Meanwhile, Kfarselouane and its surrounding is the transfer point for less than 5000 heads which in semi-nomadic way cross the area for wintering on the coastal area (Figure 45). But, in summer a large undetermined number of flocks visit Sannine and Cedars mountains for uncontrolled grazing, which might damage the recharge zone and pollute groundwater (Figure 46).

Figure 38. Seasonal vegetation index of Kfarselouane and Arsaal subwatersheds versus the practiced feeding calendar.

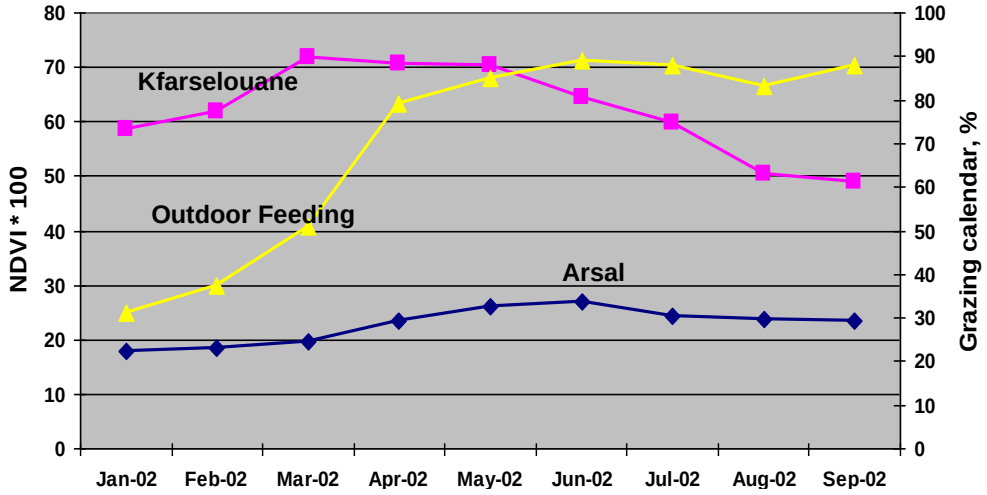
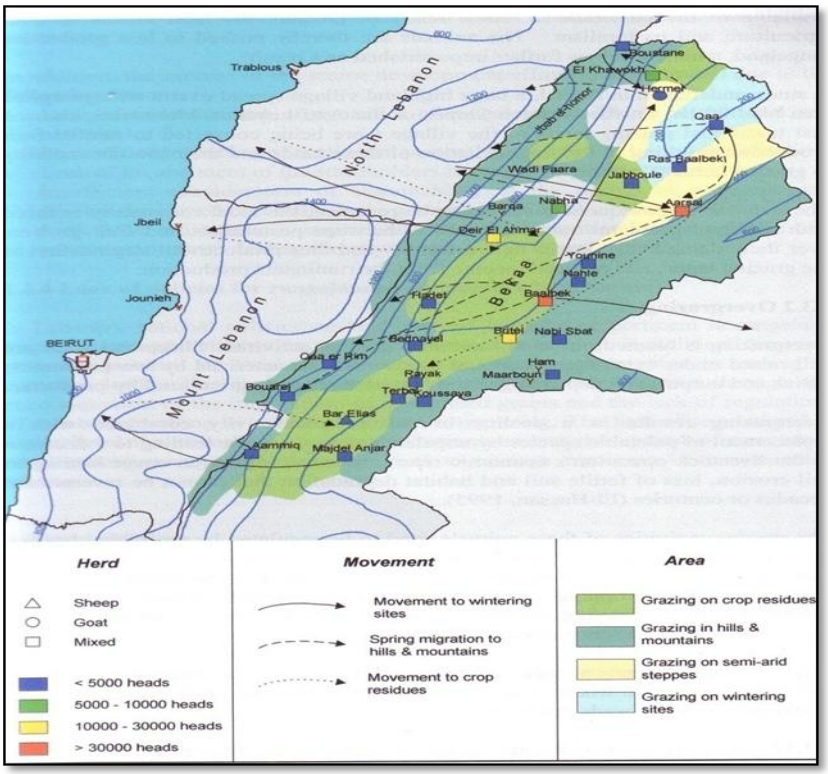


Figure 39. Small ruminants flock movement and grazing pattern in Lebanon
(Source: Hamadeh, 2005)



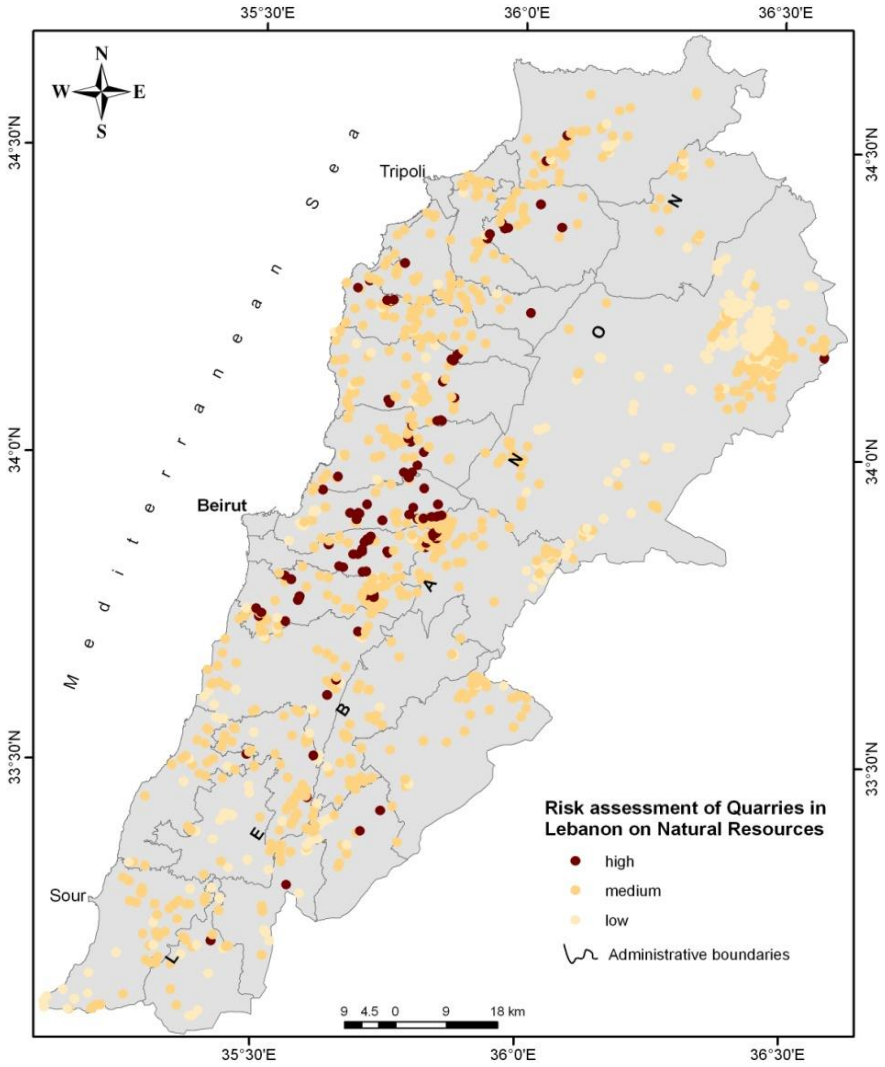
Arsaal in general suffers from higher rate of rangeland degradation due to overgrazing, quarrying activities, wood cutting, and land reclamation for "extensive agriculture" because land is not used according to its capability and suitability. The latest factor is related to low farmers skills and the absence of soil conservation measures, like the construction of terraces, traditionally found on the western mountain slopes.
Anti-Lebanon had been traditionally used for grazing. Recently, cultivating rainfed fruit trees became the major source of income in Arsaal. On the contrary, in Kfarselouane the privately owned lands is 47% and the communal land is leased to the stakeholders. Kfarselouane land has a protected forest area where animals are not allowed to graze within the 8 years after controlled wood cutting. Dry herbs and plant residues which can multiply the risks of forest fires are grazed in summer.

Figure 40. A new, animal factor is added to multiple climatic and human factors affecting snow quality and melting rate. (Source: original picture of the author)

b.3. Quarrying practices

Abandoned and degraded quarries exert large impact on land resources in Lebanon causing soil erosion, the deterioration of forest cover and increased risks of land contamination. The multi temporal analyses of landsat images and Ikonos revealed that between 1996 and 2005 the number of quarries increased from 711 to 1278 and the quarried land area increased from 2875 to 5283 ha (Darwish *et al.*, 2011). Modeling the risk of abandoned quarries on land resources in Lebanon using parameters like slope, climate, previous vegetation cover, land use, soil and rock types revealed large number of quarries (65.9% and 8.2%) having moderate and high impact respectively (Figure 47). From 1278 existing quarries, only 25.9% had low negative effect on surrounding natural resources. The negative impact was equally observed on the Mount Lebanon and Anti Lebanon mountain range indicating the vulnerability of forest areas and bare lands. The current practice of quarries management policy in Lebanon needs reconsideration.

Figure 47. Impact of quarries on natural resources in Lebanon (Source: Darwish et al., 2009)



c. Institutional approach

It is possible to implement more efficient use of nitrogen fertilizers and water by fertigation using drip irrigation. A recent study funded by the Joint FAO/IAEA Division on the use of isotope technique in agriculture and CNRS Lebanon in which also participated AUB, the Lebanese University and LARI proved this issue. Good practice provided water and money saving and prevented the contamination of the soil-groundwater systems. Recently, the MoA appointed additional technical staff for the activation of extension service to promote more sustainable chemical inputs to prevent land contamination.

Internal migration did not play any important role in rangeland degradation in the country. But a progressing loss of interest to agriculture among young population was observed in Kfarselouane and considered as responsible for the breakdown of traditional land conservation practices (Zurayk and El Moubayed, 1994). This can lead to the collapse of terraces in the upper Kfarselouane subwatershed and can negatively affect the natural balance of grassland ecosystem. The grassland area, however, was more affected by the expansion of forest area and related mismanagement.

To enhance the protection of fire prone areas, the ministerial decision 181/98 introduced a five years ban on grazing on public land after fires to enhance land cover recovery and protect soil against erosion. However, the law 558/96 protected the forests and allowed just the pruning of fruiting pine. But, the rural community pressure and studies showed increased fire hazards under prevailing protection system and proved the advantage of forest conservation by sustainable management and interaction of local community with the forest, which is a part of their livelihood (Masri *et al.,* 2006). Forests provide the local stakeholders an additional income by exploiting the medicinal and aromatic plants, honey charcoal production and controlled grazing.

Reduced Farmers' income from irrigated fruit trees production pushed local stakeholders to lease their open grasslands for grazing to those herders who pay more money regardless of the number of grazing animals. Water harvesting practices contributed so far to prevent flush flood in Kfarselouane, while this practice is absent in Arsaal. Inundation of low lands is frequently observed in Arsaal subwatershed due to the absence of real water harvesting and soil conservation measures. This increases the risks of desertification resulting in deteriorated springs, soil erosion, mass movements, ecological imbalances, deforestation and reduced nutrients to plants (Khawlie, 1999).

Analysis of NDVI in the Bekaa Valley showed a 40% decrease in the natural vegetation cover between 1987 and 2000 within a small area (Jomaa and Khawlie, 2002). Rangeland in the Bekaa dropped from 142000 ha to 50000 ha with a substantial increase of irrigated lands from 26000 ha to 55000 ha (Lebanese Statistics, 1973; MoA/FAO, 2000). Similar trend was noticed in Mount Lebanon and other Lebanese Cazas. Our observations showed that the abandonment of rainfed wheat cultivation on mountainous slopes which used to be covered by primitive terraces deprived the small ruminant flocks from a valuable source of grazing on crop residue in summer time. For this reason more pressure was put on forestland rangeland for grazing beside other existing natural and manmade hazards. However, besides plowing in, two opposing practices prevail regarding the management of crop residues on level plains: grazing like the case of Central Bekaa (Figure 48) and burning crop residue like the case of Akkar plain (Figure 49) which damage the soil biota and organic matter beside the risk to surrounding orchards.

The national action plan to combat desertification (NAP, 2003) defined the causes and impacts of land degradation in Lebanon and laid the basic outlines for a national action program to mitigate and reverse land degradation. However, this action program needs further development and support to draw and implement the detailed rehabilitation projects involving the local communities in income generating activities.

Figure 41. Animal grazing of wheat residue in Central Bekaa is more sustainable
(Source: original picture of the author)

Figure 42. Burning of wheat residue in Akkar plain harms the soil fauna and destroys the soil OM (Source: original picture of the author)

d. Recent intervention

d.1. Development of silvo-pastural system in the Jourds of Arsaal

The population of Arsaal expands the cultivation of rainfed fruit trees without terracing, appropriate agricultural practices or effective water harvesting. Recent changes in land cover/use led to the expansion of fruit trees in Arsaal at the expense of grasslands. Comparing the trend lines of the vegetation index with the grazing pattern revealed an overgrazing of mountain rangelands. A controlled grazing within silvo-pastural and silvi-horticultural systems can sustain the interest of new generation to implement and sustain land conservation measures. Improving the income of local population from agriculture, rainwater harvesting and the production of export fruits can enhance population involvement in rangeland management as a part of the ecosystem.

To contribute to reducing grazing pressure, a UNDP supported small grant project implemented in 2009-2011 in Arsaal by the Development Studies Association in cooperation with the Cooperative of Herders in Arsaal. It aimed at promoting the agro pastoral system consisting of planting fodder crops between largely spaced fruit trees in order to provide additional sources of fodder crop and increase soil OM content. The project consisted of planting winter cover crop (*Vicia ervilia*, *Vicia sativa*, *Lathyrus cicera* and barley) between the fruit trees as income generating activity that protects land functions and promotes soil fertility, associated with the multiplication of certified seed crops (Figure 50, 51).

While irrigated seed cropping was successful, in dry year the yield of fodder crop under cherry trees was modest due to low density. However, the herders-farmers learned on how to secure continuous flow of seeds and water harvesting for supplemental irrigation of fodder crop. Therefore, agro pastoral system has been implemented as spring crop on supplemental irrigated lands. Results indicate the possibility to improve yields of fodder crops with the possibility of onsite grazing to reduce energy related to harvest with direct "life manuring" by grazing ships depending on irrigation facilities (Table 22).

Figure 43. Low density cover crop in orchards spread over the Jourds of Arsaal (original picture of the author)

Figure 44. High density irrigated seed crop in Arsaal depressions (original picture of the author)

Table 22. Implementation of agro pastoral system in North Bekaa, Lebanon

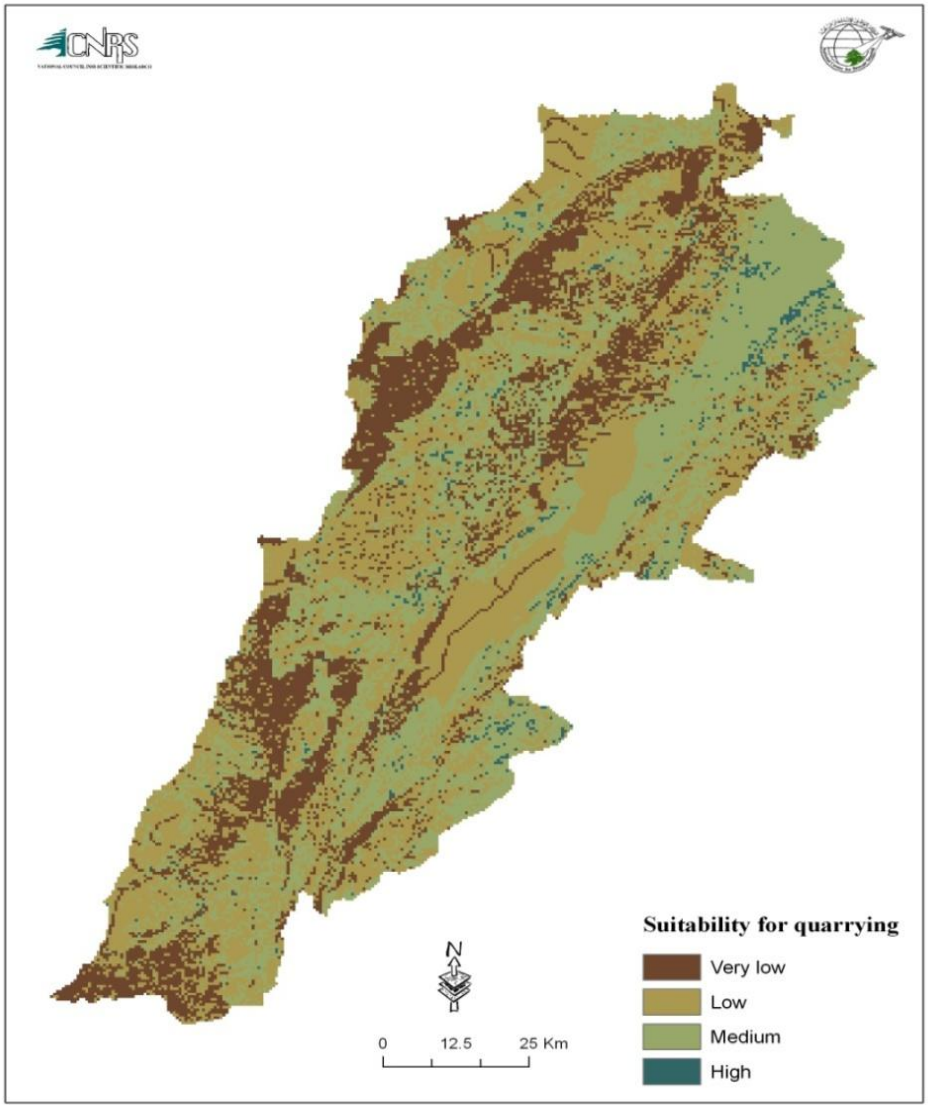
Farmer/ Herder	Area Du	Fodder crop	Density kg/du	Productivity	Suppl. irrigation	Grazing ruminants	days	Manure left, kg/du
Atrash Houssein	15	Gelbane	10	high	3	300	15	1000
Atrash Ahmed	12.5	Bakia	12.5	Very high	4	450	15	1500
Atrash Abdallah	15	Kersanna + bakia	10	moderate	3	300	12	800
Atrash Haidar	15		10	low	2	350	12	1000

Source: Herders Cooperative of Arsaal 2011.

d.2. Suitability for quarrying activities

Assessing land suitability to quarries based on the concept of less damage and more chance for successful rehabilitation to initial land cover revealed large areas suitable for quarries notably in central mountains, eastern mountain chain and south Lebanon (Figure 52).

Figure 45. Land suitability for quarrying activities



Source: (Darwish et al., 2011)

II.5. General Challenges

1. The first challenge facing Lebanon is the fragmentation of responsibilities in the water sector amongst several institutions limiting the sustainability of management of the water sector. Recent promulgated laws (Law No. 221/2000 and Law No. 241/2000 regrouped the 22 Offices and 210 Committees of water in 5 regional Establishments and decreased the number of Water Establishments to four for more efficient management. The MoEW has developed a 10-year water strategy designed to promote integrated water resources management, including the construction of dams, wastewater treatment, controlling unlicensed wells, updating antiquated distribution mechanisms and securing good quality potable and irrigation water.

2. The second challemge facing the country is the sustainable agriculture. Despite the fcat that agriculture secures 7% of national income, 20% -30% of employment and represents about 17% of the value of exports up to 20% of national debt is due to imported agricultural products. The challenge consists of achieving product competitiveness in view of globalization and securing food security and covering the gap between import and export of agricultural materials. The structural crisis affecting the agricultural sector in Lebanon restricts its organization including reforms on the role of the state to better achieve the economical, environmental and social dimensions of agriculture. The MoA is convinced that there must be a new vision in relation to the agricultural sector to identify the appropriate reforms and to integrate various official and private actors and stakeholders to overcome the low budget, overlapping of responsibilities, weakness of agricultural policy and outdated regulations, fragmented plots, low investments, outdated production and irrigation techniques.

3. The third challenge facing the country is the sustainable management of the woodlands (forests and OWLs) and protected areas. Woodlands are essential for the protection of soils, water and biodiversity. They are sources of wood and non-wood forest products playing important role in the development of the economy and tourism sector of Lebanon and contributing to the wellbeing and food security of future generations. The milestone achievements done by the approval of environment laws (Law 444/2002), active efforts of NGOs and municipalities to expose new generations to natural and cultural heritage including rural livelihoods, the announcement by UNESCO of Jabal el Rihane and Jabal Moussa as two new Biosphere Reserves in Lebanon, the approval by the CoM (Decree 2366/ 2009) of the "National Land Use Master Plan" (2002-2005), restructuring of MoE (Decree 2275/2009), the announcement of Lebanon's first National Strategy for Forest Fire Management (May 2009) and the approval of the new Hunting Law (Law No. 580/2009) represent giant steps in raising the environmental consciousness and awareness of Lebanese population. But forests and biodiversity remain very much at risk in the country. The lack of a clear forest strategy means the actions are not only inefficient, but they may also be in conflict. At the protected area level there are earnest attempts at standardizing management, while an on-going effort to have a national approach and strategy on these landscapes is, for the moment, hindered. These two facts alone put forests in significant jeopardy.

4. The fourth challenge is mitigating land degradation and desertification risks. Land degradation in Lebanon can be resumed in the following aspects"

4.1. Reduction of water volume and decrease of water quality. The main causes are climate change, increased demands and human mismanagement though the dumping of wastes and sewage waters in open wadis and water streams, overuse of fertilizers and chemicals in agriculture, excess irrigation and the use of old irrigation techniques with low efficiency. To face these challenges, applying water conservation legislations and laws, supporting new water harvesting projects and monitoring systems, manage water supply and water demand, control water abstraction from surface and groundwater and raise awareness.

4.2. Loss of productive soils by chaotic urban expansion, soil erosion, soil salinity and contamination. Between 2000 and 2010, Lebanon lost 30800 ha of fertile soil resources. Only 3.7% of recent urban development expanded on unproductive land. The most affected area by urban sprawl is the coastal strip between 0 and 400 meters above sea level representing 19.3 % of the country area. Soil erosion and rangeland degradation are linked to deforestation and overgrazing beside the impact of current quarrying practices. Available studies showed slight accumulation of some heavy metals in the soil of some Lebanese agricultural areas with possible contamination of high water table with Ni and Cr. Recent reports pointed to high level of nitrates in the soil leading to possible environmental and public health hazards. The reason is much related to the use of polluted waters, uncontrolled chemical inputs

to the soil and weak implementation of landuse planning based on land quality. There is a need to capacity building on the level of farmer to increase awareness and skills on use of chemical and water in agriculture, agglomeration of segmented lands, developing of agro-sylvicultural practices, suitability assessment for quarrying with improved exploitation and rehabilitation practices.

II.6. General Conclusion

The Republic of Lebanon is located on the eastern coast of the Mediterranean Sea with a total area of 10,452 km², consisting mainly of rugged mountainous regions with slopping and steep lands. Lebanon has a typical Mediterranean climate with long, dry, summer and mild winter with torrential rain. The Lebanon's climatic conditions vary from typical Mediterranean climate along the coastal plain to sub humid in the middle mountain range and sub-alpine on the highest slopes. The population of Lebanon, estimated at 4.0 million, is unevenly distributed across the country with more than 90% living in urban areas; notably on the narrow coastal zone. This implicates competing land use, high pressure for land and water resources and for land environmental functions. Climate changes for the past 40 years affected the useful rainfall and temperatures, thus affected crop water demands and interfered with adopted agricultural cycles.

Land tenure problems are a key factor in land degradation in Lebanon. Land over-exploitation by grazing, quarrying and agricultural activities is observed associated with vague stakeholders' roles and responsibilities for managing common lands. 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.

Some Lebanese laws and regulations related to land tenure are old and refer to the Medjelle and Ottomans laws. Other laws exist in the civil code, and some are very recent as the law for the protection of the environment (law 444/2002). The concept of sustainable land management includes water, soil, biodiversity, natural resources and so on which are not found in the Lebanese regulations. This law has imposed the need to subjugate projects to the initial environmental screening studies and environmental impact assessment which applies to the zoning and land-use. However, the extent of this law's enforcement stays actually limited due to the absence of applied decrees.

A large number of laws covering land tenure and management are old and are no longer consistent with the sustainable land management and new approaches to environmental protection. Today mismanagement and land use shows that these laws do not protect the land and there is an urgent need to strengthen legislation to protect the land.

The text of the Lebanese legislation on land use planning and zoning contain overlap in the powers and responsibilities between the Directorate General of Urban Planning and a number of various public administrations, including the Council for Development and Reconstruction, the Ministry of Environment, the Ministry of Industry and the Ministry of Energy and Water and the Ministry of Interior and Municipalities. Legislation did not link planning and investment operations of public water or the extraction of sand and gravel.

There is a need to clarify and specify the meaning of land and correct the gaps in the Lebanese legislation (law 444/2002) regarding the implementation of environmental policies for land management, occupation and land use options. 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. Also, there is a need to develop and implement regulations oriented to protect agricultural land.

Moreover, there is no political decision for urban planning which is the major problem despite the fact that SDATL has been voted. It still considered as a guiding document only.

The physiography of Lebanon characterizes its hydrologic setting with distinguished figure including the existence of tremendous water resources distributed over the entire country. An inventory on water resources in Lebanon and aspect of degradation occurring on these resources were introduced in this report. The existing management approaches including previous and recent implements were analyzed. The legal framework and proposed strategies were also analyzed to end-up with possible recommendation to address key point towards sustainable water resources management in Lebanon.

Agriculture concerns a large number of Lebanese families as people living solely or partly from farming accounts for 28% of the country's population. According to recent Agricultural Survey carried out by the MoA and FAO in 2006-2007, the total cultivated land area in Lebanon in 2007 was 277 000 ha (27 percent of the total land area), of which about 50 percent was irrigated. For the period spanning between 2000 and 2010 land use witnessed large changes in the area of annual and perennial crops both at the country and local levels. Only between 2000 and 2010 a total of 30.800 ha of productive lands were lost to urban expansion. Agriculture also suffers from land fragmentation, fluctuating subsidies, restricted access to loan and export possibilities. This is due to excessive input of chemicals and low quality of produce. The newly activated extension service within the new policy of the MoA is supposed to bridge science and practice to disseminate good agricultural practices.

Being a highly mountainous country with extreme variability in climatic conditions, soils and socio-economic status, Lebanon hosts very particular forests in their variation and characteristics thus representing a unique feature in the arid environment of the Eastern Mediterranean. The forest cover in Lebanon is broadly divided into three main classes: Mixed Forests, Broadleaves and Coniferous. The main forests widespread in Lebanon are *Quercus calliprinos*, *Quercus infectoria*, *Quercus cerris* (mostly referred to as *Quercus spp*), *Juniperus excelsa*, *Cedrus libani*, *Abies cilicica*, *Pinus pinea*, *Pinus halepensis*, *Pinus brutia* and *Cupressus sempervirens*. In addition, Lebanese forests contain a wide range of aromatic, wild and medicinal plants. Based on the FAO Forest Resources Assessment (2005), forests in Lebanon cover 13.2% of the country's territory, while other wooded lands add an additional 11.3% of the territory, yielding a total of 24.5%. However, Lebanese forests are threatened by fires, insects and diseases, urban expansion and changes in land use, quarries, overgrazing, overharvesting of selected species, exotic invasive species, soil erosion, felling, pollution, climate change and wars. The combination of all these threats, in addition to the natural environmental conditions, is resulting overall forest degradation. The forest ownership in Lebanon is almost equally distributed between the private sector, the public sector and the religious communities under several tenure systems.

Lebanon has two overlapping forest laws: The Forest Code of 1949 and the Law on Forest Protection, Law 85 of 1991 then amended by parliament in 1996. While the law of 1949 regulates forest activities including pruning, thinning and charcoal making, the laws of 1991 and 1996 imposed severe restrictions on forest activities and a total ban on harvesting resinous trees including pine (Calibrian, Aleppo and Stone pines), Lebanese cedar, juniper, cypress and fir. In Lebanon, there is no central body that plans, coordinates and oversees activities on the Lebanese landscape, even though a national land use master plan exists.

Existing classification of PAs in Lebanon includes 16 Protected Forests, 10 Nature Reserves, 24 Natural sites/Natural Monuments, 5 Himas (Ancient Arab system of ecosystem's community-based Management), 14 touristic sites, and a multitude of sites that are worth protection. At present, 10 nature reserves are declared in Lebanon: 8 terrestrial forest nature reserves, 1 marine and 1 coastal. At the exception of the latter, most PAs have been excluded from management projects, and consequently suffer from lack of planning and management structures. Equitable management is best ensured when communities and local stakeholders have a say in the management of the PA. Hence, collaborative management can provide the Lebanese setting with the right frame to incorporate different ideas into the debate around management of PAs from the local managerial and the state regulatory fields. PAs creation and management are still at their early stage in Lebanon.

In 2000 the area of rangeland in Lebanon was 4066 km^2 consisting of grassland (400 km^2), shrubland land and land with little or no vegetation (3825 km^2). The area of non arable lands exceeded 165000 ha. The changes were caused by land use change, urban expansion, rehabilitation into terraces and quarrying. Rangeland development in Lebanon is faced with two main problems: erosion and uncontrolled grazing. Several studies have been executed in the CNRS-National Centre for Remote Sensing combining remotely sensed data and GIS technique to produce soil erosion vulnerability maps at the national and local levels. The potential erosion risk map based on soil characteristics, geomorphology and climatic conditions showed the frequent occurrence of high and very high erosion risk on the escarpment of Lebanese mountain chains. Erosion is accelerated by human activities, abundance of steep slopes, excavation processes, wrong agricultural operations and deforestation and results in the loss of fertile lands, agro biodiversity and contamination of low lands and streams.

The land use planning project (SDATL, 2002) delineated the areas with special interest for agriculture. However, the implementation shows large urban expansion on prime lands. Organizing full cadastre

and land use and controlling urban sprawl beside the implementation of new agricultural policy based on land use matching land capability, quality and functions can lay solid basis for sound and sustainable agriculture.

Detailed measurements of the quantity and monitoring of the quality of surface and groundwater resources would contribute to better resource management in Lebanon enable planning and sustainable water withdrawal and share between different sectors. The agricultural sector needs an effective extension service and governmental support to increase water and fertilizer use efficiency. By these means, the risk of nitrates accumulation and leaching is reduced to the maximum, which enhances the agricultural production and improves the quality of land resources and reflects on the farmer's income and sustainability of natural resources for the coming generations. However, such progress will be possible if land use planning is implemented. In fact, the management of factors affecting water resources, soil cover, forest, rangeland, quarry and protected areas is allocated to several institutions at the national and local levels.

The prevailing legislation must define, in a clear way, the roles of different partners involved in the management and protection of soil and water resources. Setting standards for the exploitation and protection of soil and groundwater resources in the spirit of coordination between the public and the private sectors will ensure preventing the deterioration of soil and groundwater quality. The modernization of laws and implementation of international conventions together with the enforcement of laws in the context of enhancing public awareness and control on import and reasonable use of chemicals are key elements for the successful policy in land resources management and protection.

At the agricultural level, even though bad agricultural practices are frequently observed, Lebanese farmers are becoming familiar with several types of sustainable land management and conservation agriculture. Organic farming, integrated pest management, no-tillage practices, the development of agro-pastoral system and the use of vetch are good examples of these good practices. However, increasing farmer's literacy and creating conditions for permanent agricultural jobs at the farm's level would enhance farmer's skills for good agricultural practices.

II.7. Recommendations

1. There is a need to clearly define the meaning of "land" and correct the gaps in the Lebanese legislation (law 444/2002) regarding the implementation of environmental policies for land management, occupation and land use options. In this regard, after the recent adoption of the laws on the creation of Environmental Prosecutor, SEIA and EIA, it is crucial to get parliamentary approval of the laws to convert the practical sides of land use planning into legal requirement and protect the natural resources.
2. 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.
3. Address the weakness found in the Lebanese legislations in order to link the planning and study of the public and private state-owned properties processes to the subject of protection and safety of the environment.
4. Develop and implement regulations oriented to protect agricultural land use, restrict foreign ownership of land addressing real estate business instead of agricultural, touristic or industrial activities, and properly impose sanctions in case of destruction of cultivated and forest lands.
5. Clarify the quintessence of the coordination between different governmental entities and the procedures to be performed for the determination of clear environmental criteria and conditions that should be taken into consideration when preparing guidelines charts governing the integrated management of land resources.
6. Undertake national assessment of land degradation and desertification based on updated and detailed soil, land cover and land use maps.
7. Assess on the local and regional levels soil erosion, soil and water salinity, contamination and promote land use planning and notably agricultural use based on soil and water quality.
8. Promote participatory approach, interactive management, exploitation and protection of forests and conservation of protected areas.
9. Support the role of women in agriculture and cooperative traditional food processing.

10. Promote agro tourism and eco tourism and sustain high quality production meeting the international standards and support innovation approaches to facilitate export of agricultural products which can stop and reverse land degradation and streghten the links between youngsters and land through income generating activities.

Annex I.A.1. Categories of real estate

Article 1: There are three categories of real estate:

a. Property Immovable by its Nature (Immeubles par nature).
b. Property Deemed Immovable (Immeubles par destination).
c. Incorporeal Property (Immeubles incorporels).

Article 2: Property Immovable by its nature are material things that have, given its essential nature, an immovable fixed location such as land, mines, plants rooted in the ground (as long as they adhere to it) and buildings.
It is not meant but the word "building" constructions only as "residential houses, stores, factories, wards and barn, etc ...", but technical structures of all types too (such as bridges, wells, furnaces, dams, reservoirs and tunnels, etc. ...) and, more generally, all the gathered materials bound together in an affixed way, whether they are visible on the ground or within it. All equipment and parts, etc. ... adhering to the building and meant for completing it (as balconies, gutters, lightning spears and drawing water pipes) are considered Property Immovable by its Nature.

Article 3: Property Deemed Immovable, are things considered by themselves to be movables, but are supplements to the Property Immovable by its Nature, provided that:

- They are along with the Property Immovable by its Nature for the same owner.
- They are dedicated to the exploitation of the building, or more generally, to serving the property of which these things are supplements.

Some of these things are:

1. Concerning agricultural exploitation: Animals intended for farming, agricultural machinery, squeezers, alembics, large barrels to contain grapes in wineries, ponds fish, hives, cocoons, fertilizer and straw intended to fertilize crops, and vines calipers.
2. Concerning industrial exploitation: Stored up supplies and all machines (including camions and small wagons etc ... and horses) on the condition that the building containing these machines is equipped especially to accommodate the machines and installations that are in it. Some of the things also considered Property are: Movables fixed permanently in the ground.

Article 4: Incorporeal Property is rights, insurances and servitudes in-kind, as well as lawsuits dealing with a corporeal property.

Annex I.A.2. Types of real estate

Article 5: Properties (possessions) are the properties located within the regions of built areas as these regions are specified administratively and on which the absolute right of property is applied, except properties located in the former, independent territory of the Mount Lebanon Government, (that is, the properties that are excluded), which remain subject to the provisions of the local customs.

Article 6: Amiri (princely) are properties of which the usufruct goes to the state and where the right for disposal can take place.

Article 7: (Amended by Law No. 47/71 on 24/06/71, with the addition of paragraph 3 in virtue of Article 36 of Law No. 173 - 14/2/2000 - budget 2000).

a. Abandoned Annexed Property is property belonging to the state that some groups have the right to use. This right's specifications and extent are defined by local customs and administrative regulations.
b. Property referred to in the preceding paragraph is considered the private property of the municipality if they are within its scope. Municipal authorities have the right to cancel or modify the right of use to certain sections of the said property while preserving the rights of others.
c. Municipalities are banned from selling or disposing of property referred to in the second paragraph except after the approval of the Council of Ministers upon the proposal of the Minister of Finance and the Municipal and Rural Affairs.

Article 8: (Abandoned and Protected) Property is a property belonging to the state or municipalities and that is part of the Public Property.

Article 9: (Public Barren) Property or Barren Land are Amiri lands belonging Barren Land are Amiri lands belonging to the state but that have not been identified or determined so that whoever occupies them first, under a license from the state, has the right of priority on them within the conditions specified in the regulations of state property. This constitutes a serious problem since land occupancy is rather chaotic and out of the control of the Lebanese government.

Annex I.A.3 Complete definition of real rights

Table I.A.1: Definition of real rights in the Property Code

Real rights	Article of the property code	Definitions
Real property	Article 11 to 13	Real property is the right to use a property, benefit from it and dispose of it within the limits of the laws, resolutions and regulations. This right is only applicable on owned property (Article 11). The ownership of a property entitles the owner to the right in all what the property produces and what is joined to it incidentally, whether this unity or production is natural or artificial (Article 12). Land ownership includes the possession of above the surface of the ground and beneath it, therefore the owner of the land has the right to plant in it any vegetations he wants, construct any buildings he wants, dig it to any depth he wants, extract from these excavations all that they can produce within the restrictions stated by laws, decrees and regulations (Article 13).
Tessarouf (disposition exerted only at Amiri Property).	Article 14 to 19	Disposal is the right to use a property, benefit from it and dispose of it within the conditions stipulated in this resolution and within the limits of laws, decrees and regulations. This right applies only on Amiri (Princely) Property (Article 14). The disposal of a property gives its bearer the right in everything produced by this property and what is joined to it incidentally, whether this unity or production is natural or artificial (Article 15). The bearer of the right to dispose of the land is authorized to construct and to plant any vegetation he desires (Article 16).
Land's surface	Article 28 and 31	Is the ownership of buildings, structures or plantations based on a fund belonging to others made before November 12, 1939 date of enactment of the Property Code.
Usufruct	Article 32 to 55	Is a real right of use and enjoyment for individuals, not corporations, of others' properties that necessarily goes with the death of the usufructuary (Article 32). The usufruct can be established on the property, disposition, area, and both rentals and long lease (Article 34).
Easements	Article 56-90	Are "an obligation imposed on a specific property for the benefit of a determined building belonging to another owner". They result from the natural situation places or obligations imposed by law or agreements between owners (Article 57).
The liens (pledge and anticheris)	Article 91	The pledge by the transfer of property under article 91 is the sale of real property under the condition that at any time or on expiry of the stipulated period, the seller may take the thing sold against restitution of the price, and the buyer demand repayment of the price by returning the thing sold. The antichresis (Rahn) whose validity depends on the existence of a debt duly noted is a contract whereby the debtor is a building in the possession of its creditors or third agreed between the parties, and that gives the creditor the right to retain the property until full payment, and failing, to transfer ownership.

Privileges and assumptions	Article 117-118	Privileges in real estate are the quality of the debt gives the creditor to be preferred to other creditor's even mortgage (Article 117). These privileges as listed in Article 118 are legal costs arising from the sale of the land and the distribution price, inheritance taxes and fines for false statement and the perception of the exchange value of the land to Article 44 of Decree 186/26.The mortgage is an interest indivisible and transmissible buildings assigned to the security of an obligation. Article 121 has determined the rights that can be mortgaged as follows: land built or not, the usufruct of the lands, the right to areas, and the idjaratein moukataa.
Endowment (Wakf)	Article 178-179	The Wakf khairi in the pure state with religious or charitable destination. The former wakfs "zuri" or "ahli" - or so the family wakfs whose beneficiaries are private individuals who can even be rich, but belonging to the family of the settler.
The Idajaratein (double rent)	Article 180	Idjaratein consists of a contract previously authorized by the judge being acquired by a person, in perpetuity the use and enjoyment of real property subject to a means of the Wakf payment of a price calculated in two parts, one being a sum money representing a specific accelerated rent equal to the value of assigned right and the other the creation of a perpetual annuity whose rate is set at 3 per thousand of the value of the property.
The Idajara Tawil (long lease) or mokataa	Article 193-194	The idajara Tawil is a contract that must be previously authorized by the judge, by acquiring a licensee against payment the price, the right to build any buildings and to any plantations in real property Wakf (Article 193). Only the contract idajara Tawil through mokataa (Fixed annual fee) is authorized to the exclusion of any other (Article 194).
Emphyteusis	Article 34	Emphyteusis was the subject of the order of 12 January 16, 1934 is a real right of enjoyment of a property for a period of fifteen years minimum and 99 maximum. Its usefulness comes from what it allows owners of large tracts of land of little value that do not have the means to occupy, to lease against a small fee to someone who undertakes to do work to improve them and returns them after this to their owners with greater value.
Joint ownership in real rights	Articles 20 to 23	Administration of undivided property: Article 20 of the Code of Property has specified that no co-owner may not without the consent of all other exercise its rights on all or on a specific part of the building. The co-owners set by mutual agreement the mode of use of the common building and, unless otherwise stated, the sharing of the fruits is in proportion undivided interest (Article 21).

Annex I.A.4.Articles of Resolution No.37

Article 1: Annexation of property is a process that has the purpose of replacing a bad parceling in the villages lands, generating from the partition of plots and their large dispersion from each other or by their form in a new partition in accordance with the needs of agriculture that would secure the exploitation of the land in most favorable terms. This process includes otherwise the modification of roads and the exploitation ways in "ungraveled" roads or their leveling and when necessary, the fixing of irrigation canals and water drains or their establishment.

Article 2: The annexation of property is carried out in the real estate regions, area by area. The administration or construction is carried out at the request of a majority of landowners or by persons who own at least half the area of land in the agricultural region or when the real property is in a way that prevents it from being duly exploited, especially if the plots are very narrow and very long.

Article 3: The processes stipulated in articles 1 and 2 set forth hereinbefore do not include the following:

a. Built lands and related annexes.
b. Lands adjacent to residential built places and lands that could be kept for the extension of these places.
c. Places fenced with walls.
d. Places exploited industrially or in mining.
e. Orchards and gardens of fruitful trees.
f. Lands comprising trees and forests.
g. Ruins of old villages and areas of archeological excavations, cemeteries, edifices, prayer places and sanctuaries.
h. Lands which the committee mentioned in article 17 considers as excluded from the process of plots annexation or amendment.

Article 4: The processes mentioned in article 1 and 2 hereinabove include Abandoned Annexed Property if they are necessary for the establishment of common pastures or threshing floors.

Article 5: The exchanges that take place as a result of processes of annexation or amendment of plots should be obligatorily fair, so as each owner is given one or several plots of which value is equal to the plot that he used to own in the region of the annexation.

Article 6: The roads network and the new ungraveled roads prepared for transportation in the new plots of lands are established in a way that makes each of these plots have a direct access. This network should be planned in a way that ensures easy and direct transportation with the neighboring villages and the existing roads network on the one hand, and ensures finding easy transportation with the inside of the village on the other hand. This network, water channels and drains are established by landlords jointly. These landlords have to provide the labor force necessary for these works during the annexation process.

The width of roads and routes is determined as follows. This width differs according to the type of the roads and their importance:

a. The width of roads and routes which link villages to each other shall be from 10 to 14 meters.
b. The width of roads and routes that link the surrounding lands of the villages shall be from 8 to 10 meters.

The law 37/1934 has helped with protection and restructuring of rural and this law is the one that is still applicable since there was no reassessment of this law since 1934.

Annex I.A.5. Relevant laws and decrees

Land Exploitation: Rural Property Leases

Heading 4 of Book IV of Code of Obligations and Contracts (COC) has established provisions for rural property leases by specifying in its Article 602 that "rural property leases are subject to the general rules hereinafter (being the provisions of COC) and the specific rules established by the following provisions "(being those established by book IV heading 4 aforementioned). In addition, Article 623 of COC stated that Medjelle Code would remain in force for al-Mouzaraa and al- Moussakat contracts.

Rural Leases in Code of Obligations and Contracts

Lease Term: Article 603 of the COC stipulates that "leases of rural property may be made for forty years maximum". Considering the content of this article and the long term of the lease, it is natural to assume that the same article has also stated that if the leases "are for higher terms, either party may terminate the contract at the end of forty years".

Content of the lease: Articles 604 and 605/ COC have stated that the lease shall include (a) the type of crops or products, object of the exploitation, failing this, the contractor is authorized to all crops therein that can be produced in the land, and (b) the delivery by each party of an accurate inventory signed thereby and consent to make a common assessment when the lease comprises utensils, livestock or supplies (hay, straw, manure, ...). It should be noted herein that Article 609 of COC states that if we give, in a farm lease, land which capacity is higher or lower than the one they have in reality, it is necessary to either supplement or decrease prices or terminate the contract as per the cases and rules stipulated in the book of the said COC. The prescription of this action is one year as of the date of the contract, unless the appropriation has been set at a later date on which the prescription delay starts from that date.

Benefit of the land: Article 606 of COC has enacted certain provisions related to farm leases. The main concern of the owner is to allow the lessee to enjoy the leased land under the conditions determined by the contract. But the lessee shall use the land in a non-harming way and may not make any changes to the exploitation, which would have a detrimental effect even after the expiration of the lease, unless they are expressly permitted.

Liability of the lessee: Article 608 of COC has stated that in case of a lack of stipulation or otherwise use, the lessee has to bear all the work necessary for the usage of the land such as opening and maintenance of drains, cleaning of canals, maintenance of roads, paths and hedges, rental repair of farm buildings and silos. These works shall be done at their own expense and without compensation and the lessee is liable for damages resulting from breach of the obligations thereof.

Liability of the lessor: paragraph 2 of Article 608 of COC made the lessor to bear the costs of constructions or building renovations or other farm outbuildings; in addition to the repair of wells, canals, pipes and reservoirs.

Force Majeure: Article 610 of COC states that if, in case of force majeure, the contractor is unable to plow or sow his land, and he is entitled to obtain either a discount or a refund of the advance payment.

Loss of crop: the legislator has noted two cases in this situation, either that the loss occurs before the separation of the fruits from the soil, i.e., harvest (a) or after the separation thereof (b).

a. Case of crop loss before the separation of the fruits from the soil: Article 611 of COC has stipulated the following:

- In the event of a total crop loss made by the lessee after sowing, and following a force majeure not related to a mistake committed by the lessee, the latter is entitled to a discount or a refund.
- In the event of a partial loss, a proportional discount or refund may only be made if the loss is more than half. The paragraph in fine of the same Article 611 has stated as well that a discount or a reduction may not be made if the farmer has been compensated for the damage by either the person causing this damage or by insurance thereof.

b. Case of the crop loss after the separation from the soil: In this case, Article 612 of COC states that the lessee or the farmer - the code uses the two terms interchangeably herein - is not entitled to a discount when the fruit loss is made after being separated from the soil unless the lease grants the owner a quantity of the harvest in kind. In this case, the owner must bear their share of the loss; provided that the lessee would not be in default to deliver thereto its part of the fruit. In addition, the paragraph in fine of the same Article 612 stated that the farmer can apply for a refund when the cause of the damage existed and known at the time the lease was signed.

c. Exemption: Article 613 of COC has stipulated that an express stipulation in the contract may designate the recipient of the fortuitous events that may occur. However, and to better balance this clause, the paragraph in fine of the same article stipulates that this provision can be made for incidental ordinary cases such as hail, fire or frost. It is null if this stipulation is made for incidental extraordinary cases such as the ravages of war to which the country is not ordinarily subject.

Termination in favor of the lessor: Article 614 of COC has stated that such termination occurs for any of the following reasons:

- If the tenant abandons the farming of the leased land or does not use it like a good father should.
- If he does not store the harvest in the places determined by the lease.
- If he uses the rented property differently than the usage intended as per its nature or according to the contract.
- And generally, if he does not execute the clauses of the lease in a way that would cause damage to the lessor.

Lease Expiration: Articles 615 to 622 disposed the situation of the lessor and the lessee at the expiration of the lease.

a. Terms and specific terms of the lease expiration

Article 615 of COC has stated that the lease of rural property would automatically cease upon the expiry of time for which it was made. In case no term has been agreed upon, the lease is deemed made for the period required for the contractor to collect all the fruits of leased land. As for arable land, when they are divided into soles or seasons, the lease expires at the end of the last sole. Leave must be served to the tenant at least six months before the expiry of the current year. However, Article 616 of COC states that if, upon the expiry of the term agreed upon, the lessee stays and the leased land remains in his possession, the contract is deemed renewed for the same period - if it is concluded for a given period - or not, it is renewed until the collection of the next harvest. In addition, Article 617 of COC states that the lessee whose harvest has not been collected at the end of the lease as a result of circumstances resulting neither from his fraud nor his fault, is entitled to remain at the occupier by paying to the lessor the rental which is equal to that determined in the contract, if he has carefully noted at the end of the lease, the state of the crop.

b. Delivery conditions imposed on the lessee

Articles 618-621 of COC imposed various obligations on the farmer for which he is responsible at the end of the lease. Therefore, the farmer is required to take into consideration the following:

- Do nothing that reduces or delays the usage of his successor of the rural land (Article 618 of COC).
- Leave to his successor some time before taking possession, adequate housing and other facilities necessary for the works of the following year (Article 619). In this context, paragraph 2 of the said article states that consequently the first mover would have to leave the person coming the appropriate housing and other facilities for the consumption of forage and remaining crops. The paragraph in fine provided that in both cases, the use of the premises must be followed and respected.
- Leave the hay, straw and manure of the year if received during the appropriation thereof in quantities equal to the ones he received. He cannot be released from this duty by claiming the necessity.

- Restore at the end of the lease the things delivered in inventories except in cases of force majeure, not attributable to his fault, and providing that the harm results from the ordinary and normal use of these things.

c. Delivery conditions imposed on the lessor

Articles 612 and 622 of COC stated that the lessor is to consider the following obligations when the lease expires.

- Pay to the farmer the expenses incurred during the lease to replace or repair what would be missed or deteriorate things delivered to him on inventory unless he is responsible therefore Article 621 in fine).
- Pay the value according to experts or return to the farmer in the state where they are the tools for exploitation against other objects not included in the inventory which the farmer has completed at his own expense.

The provisions of Medjelle Code

Article 623 of Code of Obligations and Contracts stipulates that agricultural contracts such "al Mouzaraa" (colonage partiaire) and "Moussakat" remain subject to the provisions of Ottoman Medjelle Code and local customs and traditions. For this purpose it is necessary to bring the provisions of Medjelle in this field.

Al Mouzaraa (colonage partiaire)

a. Nature of Mouzaraa

Article 1431 of Medjelle has defined Mouzaraa as "a category of society in which one of the partners put in a land and the other his work, in other words, the land is planted and products of the land are shared between the two partners". The Mouzaraa is a planting contract, which is why Article 1432 of Medjelle stated that "Mouzaraa is formed by offer and acceptance. So if the owner tells the settler", I give you this land, plant it and you will get such a quantity "and the settler responds "I agree" "or utters other words implying his consent or if the settler tells the land lord" give me your land through Mouzaraa and the owner accepts, the Mouzaraa would be formed. For the formation of the contract, Article 1433 of Medjelle stated that the parties of the Mouzaraa shall be of sound and capable of discernment. Being pubescent is not required: thus the minor emancipated can enter into Mouzaraa contract.

b. Nature of Mouzaraa and the distribution of shares

Article 1434 of Medjelle stated that Mouzaraa can determine the types intended to grow - just as it may stipulate that the settler may be engaged in any kind of culture of their choice. However, Article 1435 of Medjelle has stipulated that "the agreement must determine the fruit share of the settler. This share should be proportional to the entire crop representing half or third the fruits". Article 1435 has carefully specify that "Mouzaraa is not valid if (i) the share of the settler is not determined, (ii) when this share, while being determined, consists in a fixed part of so many bushels of harvest and (iii) or when it is stipulated that the settler shall receive a remuneration that is not consisted wholly of fruits".

c. Making the land available

Article 1436 of Medjelle required for the validity of Mouzaraa that "the land must be capable of being cultivated and must be delivered to the settler" - failing which, the Mouzaraa contract is canceled and vitiated (Article 1437).

d. Problems arising from distribution of fruits

Article 1439 of Medjelle stated that if "Mouzaraa is voidable; all the fruits belong to the seed owner and the land lord". As for the rent of his land, being the owner or the farmer, the value thereof is the same.

e. Continuity of Mouzaraa

Article 1440 of Medjelle stated that in case of death of the owner before the crop is being mature, the settler may remain in possession until they can pick the fruits; the heirs of the owner can not oppose

thereto. In case of death of the settler, his heirs may remain in possession of the ground until the crop will become mature and the owner may not object.

Al Moussakat

a. Nature

The Moussakat was defined in article 1441 of Medjelle as "a category of society in which one of the partners delivers to the other trees which the latter will grow and cultivate; provided that the fruits shall be divided between them".

b. Formation of the contract

Article 1442 of the Medjelle stated that Moussakat is formed by supply and approval. If the owner of the trees says to the settler, "I'll deliver these trees to form with you a Moussakat company, you will have this fruit share and if the settler accepts this proposal, the Moussakat is formed". In addition, Article 1443 stated that for the contract to be valid, contractors shall enjoy a sound mind and be capable of discernment. Being pubescent is not required.

c. Distribution of shares

The shares of members should be determined in proportion to the total quantity of fruits (Article 1444) and divided among the partners according to the agreement of the parties stated in a valid contract (Article 1446).

d. Making the land available

The trees must be available and this condition is imperative for the validity of Moussakat (Article 1445). If the contract is vitiated, the fruits would belong to the owner of the trees and the settler would be entitled to the fees of his services only (Article 1447).

e. Continuity of Moussakat

Article 1448 stated that in case of the death of the tree owner before the fruit maturity, the settler remains the possessor of the trees until the fruits become mature; the heirs of the owner may not oppose thereto. In case of death of the settler, his heirs may continue working in the company and the owner may not oppose thereto.

Land and Soil

Land and soil relevant laws

a. Some articles of the Ottoman Medjelle are still applied such as article 1234, which provides that herbs in a common land are for all.
b. Decision 34/LR dated on 5/2/1934 related to land grouping in rural regions.
c. Law November 9, 1951 defines the authority of MoA for the protection of forests and pastures from grazing.
d. Green Plan established by decree 13335 dated on 12/7/1963, the main roles are: construction of agricultural roads, management of agricultural lands and participation in reforestation campaigns. Article N. 2 Decree 13785 dated on 9/9/1963 links the Green Plan to the authorities' of MoA.
e. Decree No10659, September 21, 1970: Defines the mechanism for the control of the import, production and sale of chemical fertilizers.
f. Articles 7 and 8 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.
g. Decision 181 dated on 6/11/1998 prevent grazing in land exposed to forest fires.
h. Decision 1/77, August 1998 gives guidelines for the exploitation and conservation of medicinal and aromatic plants.

Protection of natural sites and monuments

a. Decision, July 8, 1939 defines measures to conserve and manage natural views and sites.

b. 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 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.
c. Law 121 dated 9/3/1992 introduced the concept of protected areas in Horch Ehden and Palm Island.
d. Several adopted laws declared reserve sites in some 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),
- 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:

1. State-owned forests.
2. State-owned which give villages the right of utilization.
3. Municipality and village-owned forests.
4. Forests owned by individuals.

The function and use of the various types of forests have been defined by 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.

a. Law 85, September 17, 1991 bans and defines penalties for cutting, exploitation and manufacturing of resinous trees
b. Law 558 dated 24/7/1996 provides a legal framework for the protection of forests.

Reserves

Starting from early nineties, several laws declared reserve sites like:

a. Law 121 dated on March 9, 1992 Horsh Ehden Nature Reserve and Palm islands Nature reserve.
b. Decision 1/71 dated on May 13, 1992 nature reserves in Kafarzabad Caza Zahle.
c. Decision 1/127 dated on October 1991Establishment of Moasr el Chouf reserve.
d. Law 532 dated on July 24, 1996 Al- Shouf Cedar Nature Reserve.
e. Law 718 dated on November 5, 1998 Tyr Coast Nature Reserve.
f. Law 9 dated on February 20, 1999 Forest Cedar of Tannourine Nature Reserve.
g. Law 11 dated on February 20, 1999 Bintael Nature Reserve.

Laws and decrees prevent fire, hunting campaigns, cutting of trees, entrance of goats, exploitation of stones, sand and minerals and permit to take water, soil, flowers and herbs only for scientific research reasons.

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 Adlya2, 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:

a. Law No. 320 of May 26, 1926 permits the creation of water associations.
b. Decree 14438 of May 2, 1970 concerning the use of groundwater.
c. Decree 10276 of 7/8/1962 relates to the delimitation of the perimeter of protection of sources.
d. Legislative Decree No. 112 of December 16, 1983 whose purpose is to define the norms of water related industry.
e. Decree 5616, September 6, 1994 outlines the legal framework for water use and conservation in Lebanon.
f. Decision 8/1, March 1, 2001 sets maximum permissible limits for the concentration of pollutants in discharges from classified establishments.
g. Decision 24, October 18, 2001 establishes a special ministerial committee responsible for the revision of decree 5616.

These articles have not been repealed by subsequent legislation

a. Decree No. 680 of September 5, 1990.
b. Law No. 241 of August 7, 2000.
c. Law 221/2000 of 29 May amended by law 337/2001 (organization of water sector)
d. 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".

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, the 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. The 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. Consequently, the Decision 2, adopted on the 77th session of the Council of Ministers made the following amendments:

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

Annex I.A.6 Main environmental related clauses

Clause 1: Environment related general conditions in the guidelines charts

In general, the general conditions of the design guidelines contain the following environment related texts (whether directly or indirectly).

- Concerning the partition and annexation and partition: The license for partition or annexation and partition is subject to specific conditions related to the implementation of specific beautification arrangements like finding open spaces or the partition of the parcels and their shape etc…

- In the spaces dedicated for roads and playgrounds within the project of partition and annexation and partition: Each project, partition or partition and annexation, of an area exceeding ten thousand square meters has to have a total area for roads, parks and playgrounds belonging to the project that is not less than twenty five per cent of the total area. However, in case of the real estate partition to five plots or less and the area of each plot, resulting from the partition, is not less than four times the minimum area imposed for the partition in the region, the administration can find that the minimum necessary to ensure roads for the project is sufficient and not adhere to the twenty five per cent above imposed, provided that they register on the cadastre of each plot, the obligation to implement the twenty five per cent in case of partition of the plots resulting from this partition one more time.

- Concerning the exceptions: Taking into account the preservation of the landscapes and the special servitudes (Aviation safety, radio, radar, etc. ...) it is possible to exclude the constructions of schools, hospitals and sanctuaries in all regions from the limitation of the number of floors and the maximum height only and that is only after the prior approval of the DGUP, provided that the number of floors does not exceed twice what is specified in the regulation.

- Concerning the cemeteries: Taking into account the provisions related to cemeteries, the lands dedicated to cemeteries should take into consideration the nature of the land and the surrounding areas and its impact on the groundwater, the necessary areas and the roads for transportation.

Clause 2 : Environment related special conditions in the guidelines charts

We cannot generalize when talking about special conditions as they vary in different regions and lands for which guidelines charts are set. But overall, the environment related following texts were noted in the special conditions concerning the exploitation of the land and the determination of its use and classification:

- It is allowed (in general) within the residential/commercial areas to build and invest in commercial shops, galleries, cafes, nightclubs, restaurants and cinemas and to invest in establishments ranked as third category only and fuel distributors classified as first category. The establishments classified as first and second category are not allowed to do so.

- It is allowed in the areas allocated for housing to construct residential buildings. Any other activity or use is prohibited.

- It is allowed to establish and invest in establishments classified as first and second category within the industrial areas only, where it is prohibited to build houses and residential buildings.

- The investment in quarries, rock breakers, sand quarries and plants for casting concrete stones are allowed within the areas dedicated for those purposes only.

- Logging and land reclamation are prohibited in the forest areas and constructions allocated for public facilities are allowed while maintaining the woodland feature of the area.

- It is allowed, within the agricultural areas away from housing, to build livestock and poultry farms and to exploit them and to establish some agro-industries provided that they do not cause disturbance or damage.

- Within archeological areas, the permitted uses are identified in coordination with the Directorate General of Antiquities, but any building (if allowed) must be consistent with the ancient archaeological landscape of the area.

- Areas designated for each activity and their use are stated through detailed maps accompanied by guidelines charts.

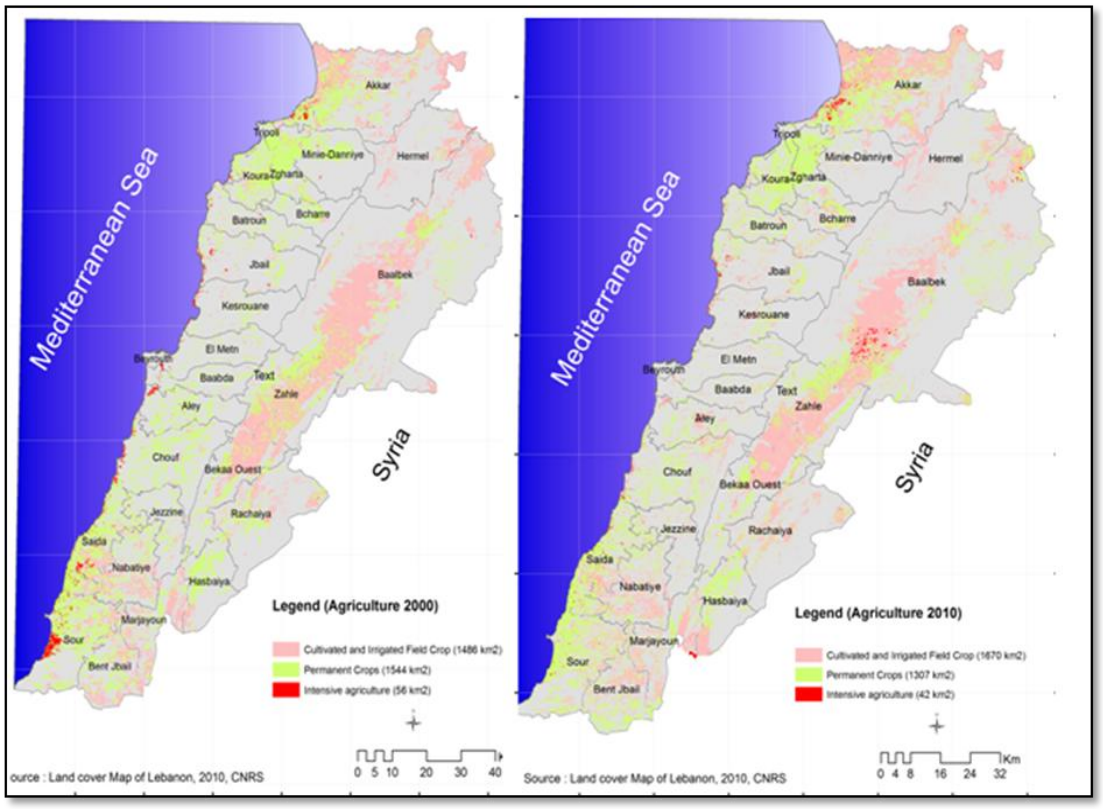
- It must be recalled here once again that the above points cannot be generalized on guidelines charts, as these conditions vary depending on the characteristics of the region under study. However, these points were mentioned in general, based on the review of a number of charts guidelines, only to illustrate the relationship in the special conditions between land use and the environment.

It should be noted that the conditions book related to the design, guideline and detailed, general regulation of the regions, established by the DGUP, mentions several environmental aspects, such as the inclusion of the first phase of investigations about the quality of soil, geological studies and population studies showing the number of population and its development, the population density and the daily and seasonal transitional population movement and the transportation, in addition to the infrastructure (water, sanitation, storm water, drainage and methods of collection and disposal of wastes) and other environmental elements (forests, riverbeds etc…). However, these conditions are actually not applied with their whole content and it is very important to study and to give priority to these aspects especially for the planning process.

Annex II.A.1. Recent landuse change using remote sensing

For the period span between 2000 and 2010 land use witnessed large changes in the area of annual and perennial crops both at the country and local levels (Figure II.A.1.1, Table II.A.1.1). Affected by the governmental subsidy policy on wheat, the national area of cultivated and irrigated field crops showed an increase from 1486 km^2 in 2000 to 1670 km^2 in 2010, i.e., corresponding to 184 km^2 (>12%).

Figure II.A.1.1. Land use change in cultivated lands between 2000 and 2010 (Source: CNRS, 2010)



In general, the area of national arable land or land under cultivation derived from remote sensing was 308,600 ha in 2000 which decreased in 2010 until 301,900 ha. In any case, this area is larger than that announced by the national statistics of 1999, 2007 and 2010. This indicates the necessity to unify the statistical methods integrally using both remote sensing and land based methods. Downscaling to Zahlé and Nabatiyeh Cazas, the area of cultivated land changed from 148 km^2 to 155 km^2 and from 66.6. km^2 to 70.7 km^2 corresponding to an increase of 7 and 4.1. km^2 respectively (Figures, II.A.1.2, Figure II.A.1.3 and Table II.A.1.1.). At the national level, both the permanent crops and intensive areas decreased from 1544 km^2 to 1307 km^2 (by 237 km^2) and from 56 km^2 to 42 km^2 (by 14 km^2) respectively.

A large decrease in the permanent crops was observed in Zahlé area where the area declined from 99 km^2 to 65 km^2 due to the concentration of the cities at the account of backyards gardens and orchards and shift from fruit trees to other land uses. The area of intensive agriculture remained almost constant in the studied Cazas.

Figure II.A.1.2. Land use change in cultivated lands in Zahlé Caza between 2000 (left) and 2010 (right)
(Source: CNRS, 2010)

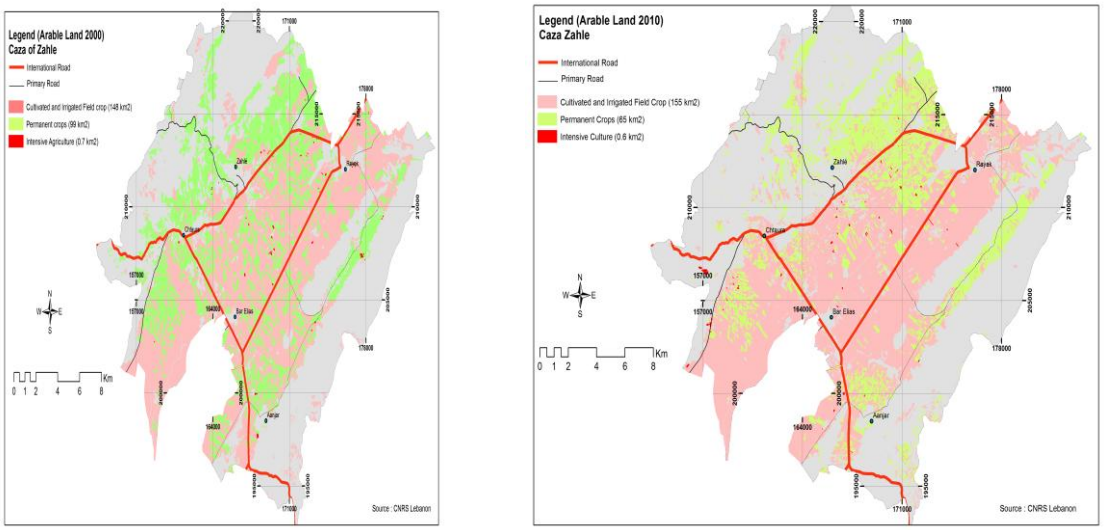
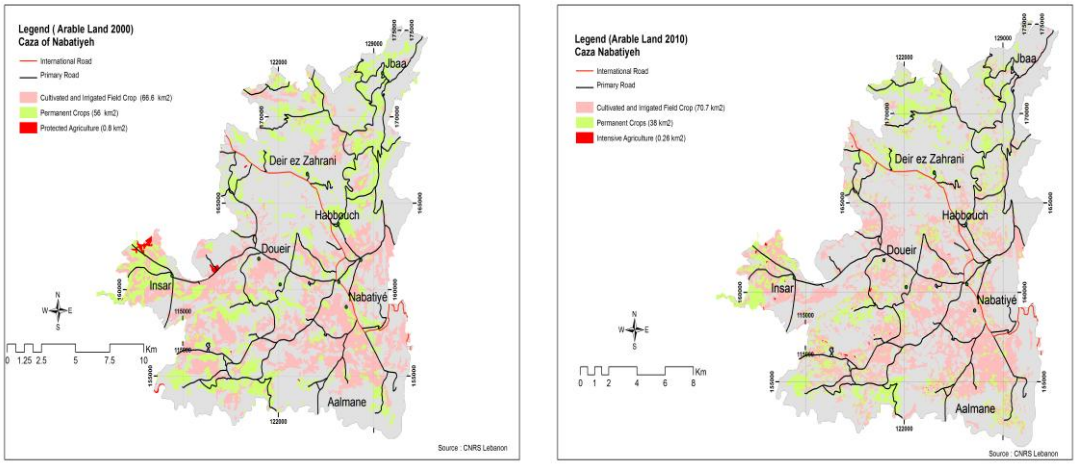


Table II.A.1.1. Recent land use change in Lebanon (km^2).

Crop	Lebanon			Zahlé			Nabatiyeh		
	2000	2010	+ -	2000	2010	+ -	2000	2010	+ -
Cultivated and irrigated field crops	1486	1670	+184	148	155	+7	66.6	70.7	+4.1
Permanent crops	1544	1307	-237	99	65	-34	56	38.0	-18.0
Intensive agriculture	56	42	-14	0.7	0.6	-0.1	0.8	0.26	-0.54
Total	3086	3019	-67	247.7	220.6	-27.1	123.4	108.9	-14.4

Figure II.A.1.3. Land use change in cultivated lands in Nabatiyeh Caza between 2000 (left) and 2010 (right)
(Source: CNRS, 2010)



Annex II.A.2. Forest bioclimatic zones in Lebanon

According to altitude, the Lebanese mountains are divided into bioclimatic zones, namely the Thermo-Mediterranean, Eu-Mediterranean, Supra-Mediterranean, Mountainous Mediterranean and Oro-Mediterranean zones (Table II.A.2.1 and Figure II.A.2.1). A belt of evergreen maquis and garrigue characterizes the former, while the latter are respectively covered by summer-green forests and dwarf thorny vegetation characterizing the alpine and subalpine zones (AFDC, 2007).

Figure II.A.2.1. Phyto-association zones in Lebanon (Source: Abi Saleh and Safi, 1988)

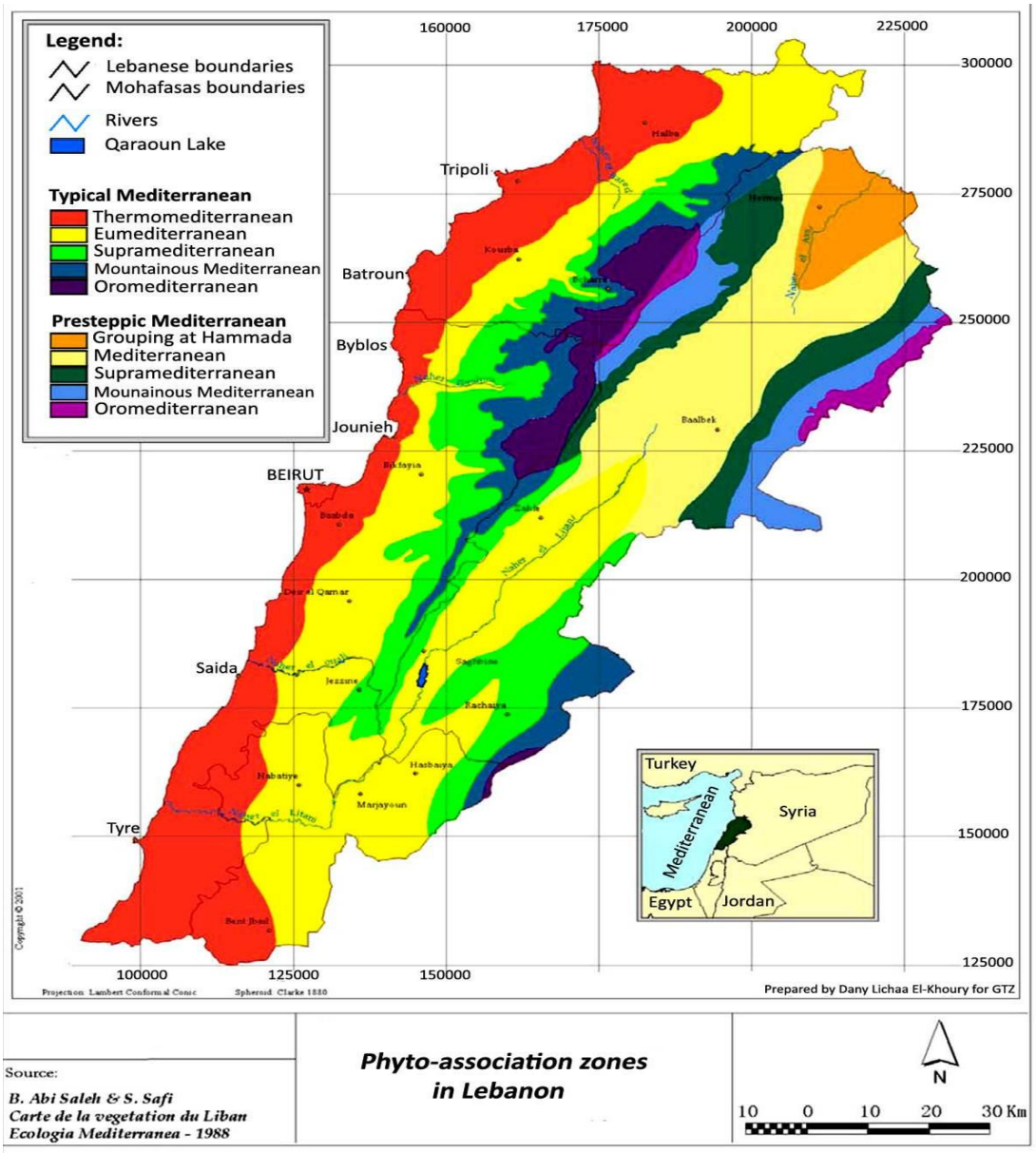


Table II.A.2. 1. Distribution of vegetation in Lebanon on the different vegetation levels.

Floristic ensemble	Vegetation level	Mother-rock		
		Limestone	**Marl and Marly limestone**	**Sandstone**
Mediterranean	Thermo mediterranean (0-500 m)	*Ceratonia siliqua* and *Pistacia lentiscus* series Thermophilic series of *Quercus calliprinos*	Thermomediterranean series of *Pinus brutia* and *Cupressus sempervirens*	Thermomediterranean series of *Pinus pinea*
	Eumediterranean (500m – 1000 m)	Mediterranean series of *Quercus calliprinos* Mediterranean series of *Quercus infectoria*	Mediterranean series of *Pinus brutia* and *Cupressus sempervirens*	Mediterranean series of *Pinus pinea*
	Supra mediterranean (1000 m – 1500 m)	Supramediterranean series of *Quercus Calliprinos*, normal series of *Quercus Calliprinos*, Series of *Ostrya carpinifolia* and *Fraxinus ornus*, Series of *Quercus cerris*	-	Supramediterranean series of *Pinus pinea*, Series of *Quercus infectoria* sandstone variety, Series of *Quercus cerris* sandstone variety
	Mountainous Mediterranean (1500 m – 2000 m)	Series of *Cedrus libani* and *Abies cilicica* Mountainous Mediterranean series of *Quercus cedrorum* and *Quercus brantii* ssp. *Look* Mountainous series of *Juniperus excelsa*	-	-
	Oromediterranean (> 2000 m)	Oromediterranean series of *Juniperus excelsa*	-	-
Mediterranean presteppic		Formation of Hammada eigii	-	-
	Mediterranean presteppic (1000m-1500 m)	Presteppic series of *Quercus calliprinos*	-	-
	Presteppic supra Mediterranean (1400m-1800m)	Mixed presteppic series of *Quercus calliprinos* and *Quercus infectoria*	-	-
	Presteppic mountainous Mediterranean (1800 m – 2400m)	Mountainous presteppic series of *Juniperus excelsa*	-	-
	Presteppic oromediterranean (>2400 m)	Presteppic oromediterranean series of *J. excelsa*	-	-

Source: Abi Saleh and Safi, 1988.

The main forests types of Lebanon are:

Cedar, fir and juniper forests

Cedar, fir and juniper are found together as mixed evergreen forests in some parts of the country, but pure, or nearly pure, stands of each are also found. Both cedar (*Cedrus libani*) and fir (*Abies cilicica)* are generally found between 1,300 and 2,000 meters above sea level (Awad, 2009; Hajar *et al.*, 2010).

Junipers (*Juniperus excelsa* and *Juniperus oxycedrus*) are found growing with fir and cedar starting at about 1,500 meters. Occasionally, between 2,000 meters and the timberline (about 2400 meters), pure stands of junipers are found becoming increasingly scrubby as altitude increases (ECODIT, 2009).

The remaining cedar forests, which once covered the mountainous Oro-mediterranean zone are now found only as mosaic patches, occupying approximately 2,200 ha on the western slopes of the Mount Lebanon chain. These forests are located on the western slopes of the Mount Lebanon range, in the following localities from north to south: Qamou'a, Dinnieh, Bsharre, Ehden, Sweisse, Hadeth-tannourine, Jaj, Bmohray, Ain-Zhalta, Barouk and Maasser al-Shouf (Chouchani *et al.*, 1974).

Mixed forests of fir and cedar are found in Qamou'a, and in Ehden, its southernmost limit, where it grows at a lower density mixed with cedar and other tree species. Sparse Grecian Juniper forests, covering an area of 9,000 ha (Baltaxe, 1965) grow in patches on the eastern slopes of the Mount Lebanon chain and in the Caza of Hermel. All these forests have suffered from deforestation and severely eroded soils since biblical times leading to severe deterioration in their natural habitats and invasion by degraded guarrigue (METAP, 1995).

Pine forests

Stone pine (*Pinus pinea*) forests occupy an area of 17,000 ha with nearly half of this managed for the production of pine nuts. These forests are found at altitudes ranging from 800 m. to 1500 m. above sea level, on the sandy soils of Metn and Jezzine on the western slopes of the Mountain Lebanon chain. The area covered by these forests has decreased primarily as a result of war, forest fires, and urban development. The other pine forests types - Calabrian pine (*Pinus brutia*) and Allepo pine (*Pinus halepensis*) - grow between 500 m. and 1,300/1,500 m. on the western slopes of the Mount Lebanon chain (Masri *et al.*, 2006).

Calabrian pine forests occupy a large area in the North, while Aleppo pines cover an area of 400-500 ha in the southern part of the country in the Cazas of Marjaoun and Hasbaya (MoA/UNEP, 1996).

Oak forests

The kermes oak (*Quercus calliprinos*) forests cover 10% (40,000 ha) of the forest area, and their dominance in the lower altitude of the western slopes of the Mount Lebanon range is an indicator of habitat degradation (ECODIT, 2009). The oak coppices found on the eastern slopes of Mount Lebanon extend in a very discontinuous manner in the low elevation zone between Yammouneh and Hermel and on the slopes of Jabal Barouk/Niha. On the western slopes of the Anti-Lebanon chain, only a few diminutive oak stands persist, mainly east of Baalbeck, Masnaa and around Rachaya (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 cutting for charcoal production and to overgrazing, which has led to their deterioration and their replacement by highly degraded garrigue. Additionally, sporadic trees of Turkey oak (*Q. cerris)* are found in Qamou'a and Ehden, Cedar Oak (Q. *cedrorum*) and Lebanon oak (Q. *libani*) in Ehden, pennatifid oak (Q. *pinnatifida*) in Ehden, Hadeth-Tannourine and Bsharre, and brant's oak (*Q. brantii* ssp. l*ook*) in Ain Zhalta and Barouk. Cyprus oak (Q. *infectoria*) is found in cedar and fir forests.

Evergreen Cypress

The only remaining forest patch of cypress (*Cupressus sempervirens*) is found in Akkar on hard limestone. Other species in this patch include Mediterranean buckhorn, Kermes oak (*Q. infectoria* var. *boissieri)*, and the oriental strawberry tree (*Arbutus andrachne*). The mesic nature of this patch is indicated by the presence in this association of Maple (*Acer* spp.*)*, whitethorn (*Crataegus monogyna*), false senna (*Coronilla emeroides*), hop-hornbeam (*Ostrya carpinifolia*) and others (Zohary, 1973) In the Northern part of the Mount Lebanon chain, sporadic cypress tree populations are found in Calabrian pine forests, in Karm-Sadet and Aito villages (Chouchani *et al.*, 1974).

Annex II.A.3. General considerations of land use planning in Lebanon

Land is an essential resource for the most fundamental human activities. Land provides the basis for agriculture and forest production, water catchments, recreation, and settlement. The East Mediterranean region and notably Lebanon has limited productive land and the available land is subject to old human pressure resulting in land degradation. The abundance of bare and deteriorated lands with shallow soils points to processes of severe erosion and land deterioration (Eswaran and Reich, 1999). The increasing population with expansion of construction areas and rapid urban growth has been a principal cause of desertification in the Mediterranean countries. The degradation of agricultural and marginal lands in the region is partly due to natural agents but mainly caused by manmade factors. Pressures on the resource base due to high population growth rates, rapid urbanization, and lack of land use planning further aggravate the agro ecological situation in the region (Darwish *et al.,* 2004). Chaotic urban expansion, unsustainable agricultural practices, over-cultivation and over grazing of marginal lands, overexploitation and contamination of water resources and the absence of integrated management of land and water resources are also adversely affecting the sustainability of agricultural sector and food security in the country (Darwish and Faour, 2008).

Despite the progress made by the project "Schéma Directeur d'Aménagement des Territoires-SDATL", the weak implementation of proactive policies for encouraging the efficient and sustainable use of land resources aggravate the degradation of natural resources both at regional and local levels. The restricted lands resources are often mismanaged and irreversibly lost that threaten the livelihoods of increasing population and leave little hope for future generations. Land resources are being increasingly degraded and over-exploited. Thus, land resources in the region are becoming increasingly scarce, and the quality of such resources is decreasing, mostly as a result of poor management and weak conservation. Given the fact that lands cultivated today are limited, these lands must be protected for future generations. Based on the dimensions and rates of land degradation we merely can imagine a secured future, notably in the agricultural sector, unless the remaining lands are increasingly overexploited. However, our lands are characterized by low resilience caused by low organic matter content (Darwish and Zurayk, 1997), weak and moderate grade of structure and vulnerable structural stability (Darwish *et al.,* 2006). Therefore, Lebanese soils are not enough tolerant to extreme pressures that make them highly vulnerable to erosion, secondary salinization, contamination and irreversible loss by any mismanagement practices.

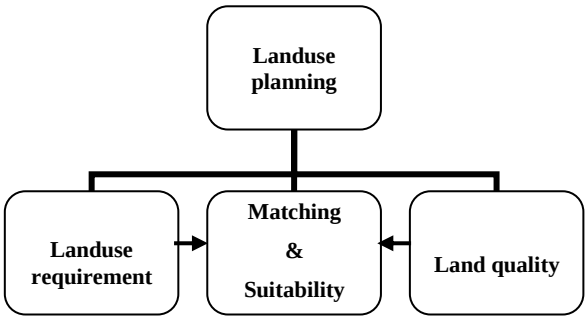
Appropriate landuse based on land capability and Land suitability assessment for given functions and services are primordial for sustainable development. Land use is determined by the interaction in space and time of biophysical factors (constraints) such as soils, climate, topography, and human factors like population, technology and economic conditions (Veldkamp and Fresco, 1996). Landuse options are limited by environmental factors: climate, topography and soil characteristics, demographic, socioeconomic, cultural, and political factors, such as population density, land tenure, markets, institutions, and agricultural policies and the comparison of agricultural land use to other uses. In developing countries, the needs and demands of rapidly increasing populations have been the principal driving force in the allocation of land resources to various kinds of uses, with food production as the primary land use. Population pressure in poor Lebanese regions with low satisfaction factor and increased competition among different land users emphasized the need for more effective land-use planning and policies.

FAO with the collaboration of the International Institute for Applied Systems Analysis (IIASA) has developed the Agro-ecological Zones (AEZ) methodology. This methodology enables rational land use planning based on land resources appraisal and estimate of biophysical limitations and potentials. The AEZ utilizes land resources inventory to assess, for specified management conditions and levels of inputs, all feasible agricultural land-use options, to quantify expected production of cropping activities relevant in the specific agro-ecological context.

Landuse planning starts from land evaluation which is the assessment of land performance when used for a specified purpose, considering land characteristics to identify and compare the best land use. Land quality depends on geology (rock infiltration and stability), landform (relief and slope gradient), soil type and characteristics (soil fertility, productivity and erosion risks) vegetation type, use and value, climatic conditions and constraints, market conditions and social attitude and preference. The Assessment of land suitability is based on the requirements of specific land use and matching between land quality and landuse requirements (Figure II.A.3.1). A comparative analysis of inputs versus

benefits from a certain landuse within the physical, economic and social context and assessment of potential environmental impacts and sustainability is implemented.

Figure II.A.3.1. Matching landuse requirements with land qualities and suitability is the prerequisite for successful landuse planning leading to policies and action plans.



Every year about twenty million hectares of agricultural land is converted to spreading urban centers and industrial developments, transforming the farmers into city dwellers or putting more pressure on highly prone to degradation marginal lands. The uncontrolled expansion of human settlements constitutes a challenge for sustainable land planning and management. Particularly the concentration of people and cities in coastal areas increases the demand for limited land resources. Coastal areas are among the most crowded regions in the world. In Lebanon more than 80% of the coastal area is built and densely populated (Huybrechts, 1997). The increasing human population in Lebanon and other developing countries besides the climatic variability and weak preparedness multiply pressure on limited land resources and cause over-exploitation from one side and land degradation from the other.

The disintegrated and single objective approaches used to alleviate land abandonment problems have often resulted in weak results. For instance it is not clear until now what was the national benefit from subsidizing some crops like sugar beet and wheat instead of supporting the whole agricultural sector through promoting efficient extension service, capable water harvesting practices, competent water distribution canals and efficient modern water and fertilizer application techniques? Increasing the return from irrigated lands by more efficient water use and balanced fertilization and cropping pattern (more yield, better quality and less cost) will put the Lebanese agriculture at the place it deserves in a country where up to 28% of people are directly involved in this production sector (Hamzé *et al.,* 2010). Thus, an integrated approach is required involving all stakeholders, accommodating the qualities and limitations of each land unit, and generating feasible and sustainable land use options.

However, landuse planning is not a simple land valuation; neither is it a land capability classification. It is rather a landuse policy with integrated production and conservation components. Landuse policy is essentially an expression of the government's perception of the direction to be taken on major issues related to landuse and the proposed allocation of national land resources over a fixed period of time[14]. Landuse planning based on sustainable land development models is considered as necessary tool to provide optimal ways for progress (Yeh and Li, 1998). Landuse planning covers all potential uses of land and proposes workable and attractive landuse options for the population with minimal impact on environmental resources.

An integrated landuse planning is, therefore, a "systematic and iterative procedure carried out in order to create an enabling environment for sustainable development of land resources which meet people's needs and demands". In this regard, information on the spatial distribution of lands with different potentials and constraints is required. Alternative land uses are compared and analyzed if they are physically possible and socially relevant and accepted. The adverse physical, social and economic impacts associated with each landuse are assessed and the necessary and relevant inputs or management changes to reach the production targets and minimise the adverse impacts are elaborated.

[14] http://www.fao.org/nr/land/land-policy-and-planning/en/

Annex II.A.4. Achievements of institutions in the organic farming field (Based on personal communication of Haddad, 2011)

LIbancert

Until the moment, Lebanon does not have its own organic farming law; Libancert operators are applying the regulations of the EU commission for organic farming no. 834/2007 and 889/2008. The operator should abide to these two regulations to get certified "Organic". LibanCert is also issuing certificate according to the Lebanese Norms NL 724-1:2003. LibanCert has till date about 120 certified farmers, processors, wild collectors and animal producers. Some are organic and others are in the 1st, 2nd or 3rd year of the conversion period. Operators are distributed all over the Lebanese regions but mainly in the South, Mount Lebanon and the North.

- Area of Land under conversion is about 157.7 ha.
- Area of Organic land is about 57 ha.
- Total certified area is about 354.7 ha including grazing and wild collection areas.

Certified products

Major certified crops:

- Stone and pome fruits, olive, grapes, vegetables (mainly tomato, cucumber, leafy vegetables, squash, eggplant, lettuce, cabbage, broccoli, cauliflower) and banana. Mainly processed products: Jams, pickles, raisin, bakery, Olives and olive oils, produced as home products or produced by women's coops.
- Animals and animal bi-products: Chicken eggs, milk, Laban, Labneh, white Cheese, Goat and Chicken meat.

Certified agro-tourism projects

- El Rancho is located in the Ghodras Hills in Keserwan, Lebanon near Beirut. It offers authentic place for vacations and holidays. El Rancho also offers numerous activities ranging from horseback riding, paintball, archery, children playground and educational activities, animal feeding, vegetable picking, campfires, mountain hiking and camping[15].
- Arnaoun Village is a 300-plus year old Lebanese village that existed during the Ottoman days and its name stood strong throughout the years keeping its geography rising on a hill-top over the historic Msaylha Fortress along the Batroun Highway, North of Lebanon.
- Arnaoon cherish this heritage by reviving the old houses' ruins, beautifying the scattered landscapes and educating generations on respecting Mother Nature. Arnaoon village offers a bouquet of locations and services fully hosting memorable celebrations and quality moments ranging from private occasions and weddings to corporate events as well as lodging in its old houses or enjoying the generous Lebanese cuisine in its exquisite old style restaurant[16].

Mediterranean Institute of Certification (MIC)

MIC is a private company that has public authorizations and international accreditations for the certifications activities development. According to the global organic survey carried out by the FiBL and IFOAM (FiBL and IFOAM, 2009), the total fully converted organic land (or land under conversion) is 1260 ha, while the total organic producers and smallholders does not exceed 193. The majority of the registered operators with MIC are producers with significant number of bee keepers and processors and limited number of importers (Table II.A.4.1). Livestock bearer and manufactured productions occupy a significant part in the registered producers, mainly live animal production of bovine, goats and poultry (Table II.A.4.2).

[15] http://www.elrancholebanon.com/
[16] http://www.arnaoon.com

Table II.A.4.1. Registered operators with MIC.

Registered operators	
Total producers	154
Total processors	35
Total importers	5
Total exporters	5
Total trades/ wholesalers	3
Total Bee keepers	39
Total registered operators	**189**

Source: FiBL and IFOAM, 2009.

Table II.A.4.2. Livestock Production.

Livestock	Production volume (numbers)	Production volume (t)
Live animals (average annual stock)	-	662.5
Bovine animals	111.0	562.5
Pigs, sheep	0.0	0.0
Goats	965.0	100.0
Poultry	1,875.0	0.0

The different categories and repartition of lands under conversion and fully converted agricultural lands is presented in (Table II.A.4.3). The area of totally converted land exceeds 3300 ha with 82% under annual field crops, mainly cereals and vegetables. About 18% of lands are exploited under permanent crops, mainly olive and grapes. The area of grazing land, medicinal and aromatic plants and other exotic plants are steady increasing. The amount of organically manufactured products is almost 3000 tons with 95% allocated to dairy and egg products (Table II.A.4.4). A total of 1125 tons belongs to the raw milk with 300 tons and 262 tons for cow milk and goat milk respectively.

MOA

The four selected crop for Organic production are:

- Tomato, a mesothermic, annual and renewal crop.
- Olive one of the most diffusive crops in Lebanon (22% of agricultural land are planted with olive trees). It is specie with a high hardiness and resistance to dry periods.
- Origanum syriacum, a spontaneous and perennial plant that belongs to the Laminaceae family. It is well adapted to the local conditions and not susceptible to the most common pests and diseases.

Table II.A.4.3. Different crops of organic production (Source: FiBL and IFOAM, 2009)

Crops/Land use	In conversion [ha]	Fully converted [ha]	Total [ha]
Agricultural land and crops	976.5	2,326.3	3,302.8
Arable crops	449.3	903.5	1,352.8
Cereals for grain production	165.7	328.2	493.9
Fresh vegetables and melons	206.3	361.3	567.6
Plants harvested green	77.3	213.0	290.3
Seeds and seedlings	0.0	1.0	1.0
Permanent crops	114.4	472.1	586.5
Fruit of subtropical and tropical climate zones	0.0	14.9	14.9
Grapes	71.0	195.5	266.5
Nuts	8.0	8.0	16.0
Berries	1.2	1.2	2.4
Olives	34.2	250.0	284.2
Permanent medicinal and aromatic plants	0.0	2.5	2.5
Permanent grassland/grazing	0.0	125.0	125.0
Wild collection	0.0	27.5	27.5
Berries, wild	0.0	12.5	12.5
Medicinal and aromatic plants, wild	0.0	10.0	10.0
Nuts, wild	0.0	5.0	5.0
Chestnuts	-	2.5	2.5
Pine nuts	-	2.5	2.5

- Potato, a very important crop occupying about 15.000 ha in Lebanon. It is cultivated as both fresh table and a processing product (MOA, 2008).

According to these guidelines, instructions to follow in order to obtain organic production are:

- The choice of the variety depends on its pedoclimatic altitude, resistance to the principal pests, rusticity, precocity of maturation, elevated flavor of the fruits and the markets.
- Propagation material (rootstock and grafted plants) must be organically certified.
- Soil analyses are mandatory before any fertilization plan.
- Soil requires rotation, tillage, water management and mulching.

Table II.A.4.4. Manufactured Organic Products

Manufactured products (including products from live animals)	Production Volume [t]
Manufactured products	2,977.5
Vegetables, prepared and preserved	5.0
Fruit, berries and nuts, prepared and preserved	6.3
Oils and fats	75.0
Dairy and egg products	2,841.2
Raw milk	1,125.0
Cows' milk (hectolitres)	300.0
Goat's milk (hectolitres)	262.5
Eggs	28.7
Beverages	50.0

Source: FiBL and IFOAM, 2009.

Appropriate fertilization and common pest and weeds control and corresponding management for these four cultivations can be summarized as shown in Table II.A.4.5.

Table II.A.4.5. Instructions for Organic Production

Crop	Fertilization	Weeds	Management	Pest	Management
Tomato	-Animal/ chiken manure	- Portulaca, o. - Amaranthus, r. - Solanum, m.	- direct control - prevention measures	- Nematodes - aphids - Mites	- green manure - Nitrogen nutrition
Olive	- Legume - green /animal/ chiken manure		- Shallow tillage - periodical mowing - sheep introduction	- pest: Silverleaf - bacteria: Olive Knot	copper compounds
				insects: - Olive moth	- BT[17]
Oregano	- organic fertilizers - manure	- superficial ploughing - harrowing			- Phytosanitary products - Natural enemies(BT)
Potato	- Solid/ liquid/green manure - compost			Bacteria: - Ralstonia Fungi: - Fusariumsp	- suppressed by a maximum frequency of 1:4

Source: MoA, 2008.

[17] BT: Bacillus Turengencis

Annex II.A.5. Recent Interventions in agricultural sector

Technical cooperation project

The project "Management, Protection and Sustainable Use of Groundwater and Soil Resources" funded by the German Federal Ministry of Economic Cooperation and Development (BMZ). Location: Lebanon (Central Bekaa), duration: 1997-2003.
Implementing agencies: 1. Federal Institute of Geosciences and Natural Resources (BGR); 2. The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD); 3. CNRS-CRS.

Project details

Objectives: To support national institutions, local communities and planning authorities to improve the environmental situation in the Arab region.
Specific Objectives:

- To enhance ACSAD's competence in counseling national institutions responsible for issuing and enforcing guidelines in the field of soil and groundwater protection.
- To investigate the vulnerability of the soil groundwater system in the Bekaa valley and assess their contamination by heavy metals and nitrate using the Groundwater Modelling System (GMS 3.1).
- To train local staff on how to assess the soil protection effectiveness using the German Concept, to designate suitable land use based on soil quality using the Eikmen Cloke concept.

Main results

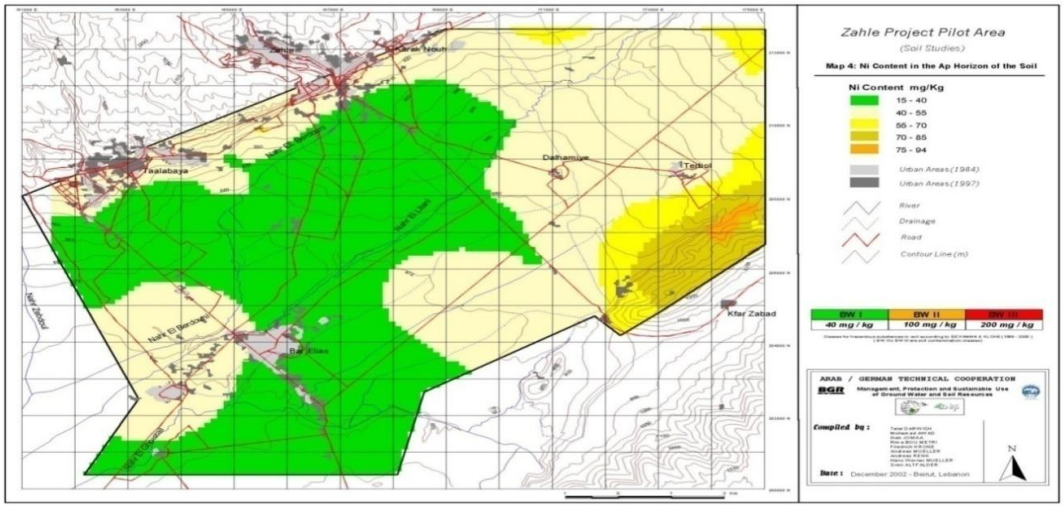
Status of heavy metal contamination of the soil-groundwater system

The content of heavy metals in the Ap horizon of the soils represents quite similar trends of higher Ni and Cr content in comparison with other trace elements, notably in the eastern part of Central Bekaa area. This could implement higher background values (natural content) for these metals in general beside the possible geogenic nature of these elements near Terbol. This could be supported by the fact that the content of Co, Cd, Zn, and Cu revealed to be also higher in the surrounding of Terbol. This means that the content of Pb, As, Hg, in general, represent no hazards yet. Consequently, for these metals, the soil in the project pilot area could be considered as multifunctional. Nevertheless, Pb and As represent relatively higher content near the most populated Zahlé city with heavy traffic and old tanneries. As to Ni and Cr (Figure II.A.5.1), the content has reached the tolerance level 2, i.e., the soil must not be utilized for leaf succulant cropping systems.

Nevertheless, taking into account the whole picture and heavy metals content with a penalty system of one element determining the soil vulnerability and land use class, the most vulnerable soil resources are located in the area of Delhamiye-Terbol, Elmarj and Taalabaya. These areas are classed according to Eickmann and Kloke (1999) in the Tolerance Level II. This implies some limitations on the appropriate agricultural land use towards growing technical crops and fruit trees instead of vegetables.

Based on the organic and chemical sources of contamination of the soil-groundwater-food chain it is important to pay attention to the quality of mineral fertilizers and composted materials which might contain heavy metals as by product. In Lebanon the concentration of nutrient elements is controlled in the imported fertilizers but little attention is paid to other contamination risks. Also, there is no clear rule and final regulation for the quality of imported and locally produced composted materials except the recently developed by the MoE through its Management Support Consultants (MSC) program draft document entitled, Compost Ordinance Assurance and Utilization of Compost in Agriculture, Horticulture and Landscaping (CO). The CO defines the standard quality for compost, types and sources of compost material and its corresponding rate of use (MEEA, 2005).

Figure II.A.5.1. Nickel spatial distribution in the plough layer of the soils of Central Bekaa Plain, Lebanon (Source: Darwish, CNRS, 2000)



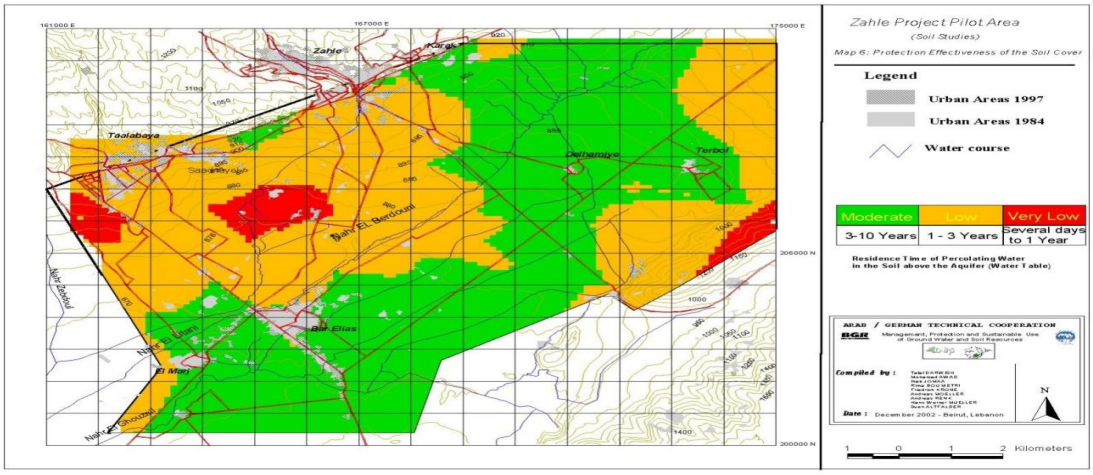
It is important to raise these issues because of public health hazards related to heavy metals dietary intake, which was assessed for average Lebanese population (Nasreddine *et al.,* 2003). In 2004, Bashour et al. confirmed that soil of Mount Lebanon, Bekaa valley and coastal plain, were free or contained very low concentrations of DDE. The levels of residual DDT in all of the analyzed soil samples were within the permissible limits for agricultural soils (Bashour *et al.,* 2004).

The status of contamination by lead and cadmium in fruit and vegetables from different regions of Lebanon was also studied (Nohra and Esseily, 2004). The study revealed that the Chiah region was the most contaminated by lead (0,6 ppm ± 0.02), while Zook region was the most contaminated by cadmium (0,18 ppm ± 0.02). The concentration of pesticides in water, honey and dairy products was also detected (Hilan *et al.,* 1998). Results showed that the total amount of pesticides in water has reached the maximum admissible rate, while honey contained low amounts and 67% of dairy products contained pesticides.

Assessment of soil protection effectiveness

The analysis of the protection secured by the soil cover based on soil types, depth, texture, percolation rate (Darwish *et al.,* 2008 b) using the German concept showed different degree of groundwater protection with significant part having moderate and low protection effectiveness (Figure II.A.5.2.).

Figure II.A.5.2. Soil Protection effectiveness in Central Bekaa as affected by soil depth, texture, lithology, percolation rate and other soil properties (Source: Darwish, CNRS, 2003)



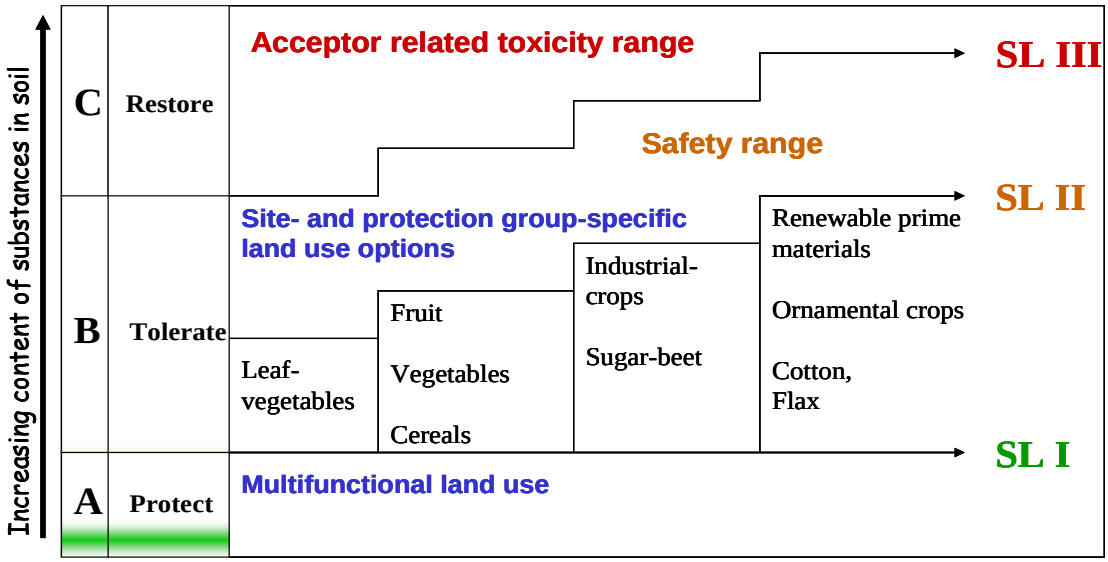
Land use based on land quality

The Eckman Klocke concept on soil contamination with heavy metals and corresponding land use based on land quality indicated three levels of heavy metal content in the soil. The lowest level, close to the background tolerable values corresponds to multifunctional land use where even leaf succulent "accumulator" plants can be grown without any public health concerns (Figure II.A.5.3. With heavy metal increase, land use must shift to other cropping system like seed crops and trees, sugar beet and when exceeding the tolerance level to industrial; crops. When the level of heavy metals in the soil exceeds level II and safety range, restoration of the contaminated site is a must.

Nitrate dynamics and heavy metals transfer to the aquifer

The analysis of water resources in Central Bekaa done by Darwish *et al.*, (1999) showed some accumulation of Cr in shallow water table, Ni and Cr in the Litani River, Pb in the Berdawni River, reaching the value of intervention (Table II.A.5.1). Deeper groundwater showed high vulnerability to nitrate build up and good protection from heavy metal contamination. The level of O_2 (0.15 mg/l) was low in the downstream of Bardawni river indicating wastewater input. The value of O2 increased until 1.47-2.9 mg/l in the deep water well and reached normal values by ISO standards in the open reservoir, whose water is obtained from drainage water accumulating in shallow groundwater table at 2-3 m. depth, and eventually pumped and reused for irrigation. In general in the absence of natural sources of soil and water salinization, the EC values of water sources slightly exceeded those of the FAO standards for optimal irrigation water quality.

Figure II.A.5.3. The EIKMANN-KLOKE "three sector system" model for possible uses of contaminated agricultural soil.



SL: Soil level

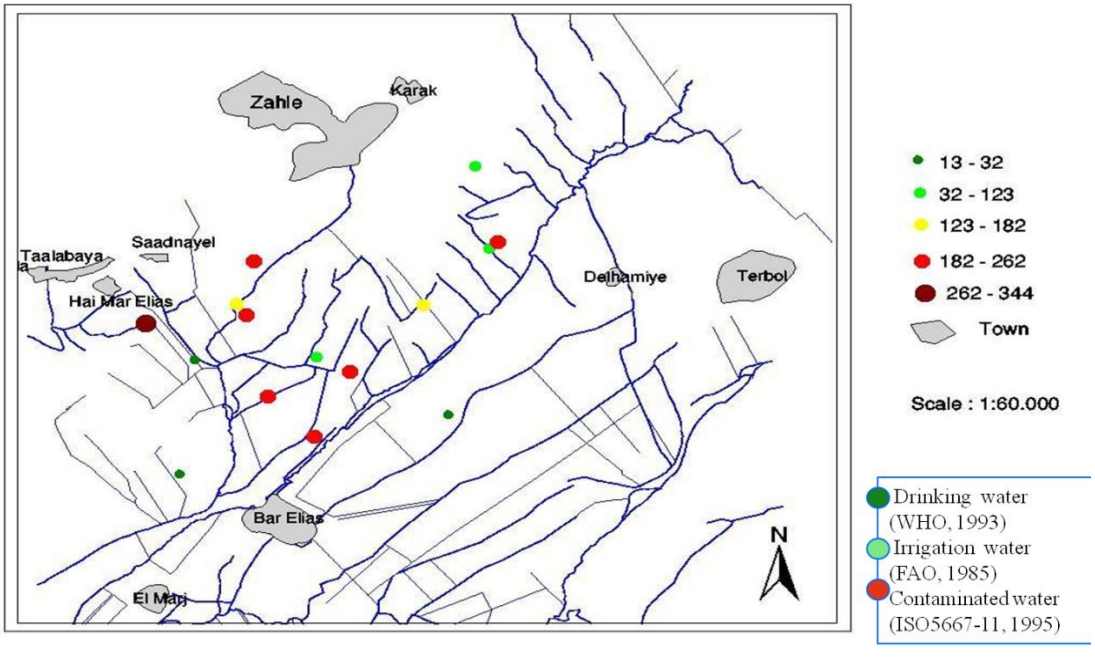
The nitrate content in near surface groundwater (< 5 m) of the uppermost aquifer as well as its water table depth was assessed in spring 2002 (Darwish *et al.*, 2002a). Nitrate content of the shallow groundwater table showed that only three of fifteen water samples were below the international and national threshold value (40 mg/l) for drinking water Figure II.A.5.4.

Table II.A.5.1. Preliminary analysis of water resources from the Bekaa Valley.

Source	pH	TC°	EC ds/m	NO_3 ppm	O_2 Mg/l	Ni µg/l	Cr µg/l	Cd µg/l	Pb µg/l
Deep well 70 m	7.21	16.6	0.84	270	2.9	5	4	0.02	0.4
Surficial well El-Marj 8 m	7.00	17.4	1.13	-	1.47	12.5	5	0.03	0.95
Shallow open water reservoir 2 m	7.64	13.7	0.87	-	7.03	13.9	6.4	0.06	0.86
Berdawni River	7.43	13.3	0.88	-	0.15	6.8	3.8	0.16	14.7
Litani River	-	-	-	-		15.3	10	0.2	6.3
Level of Intervention	7.0	-	0.75	40	-	15-37	1-26	1.5-6	15-not determined

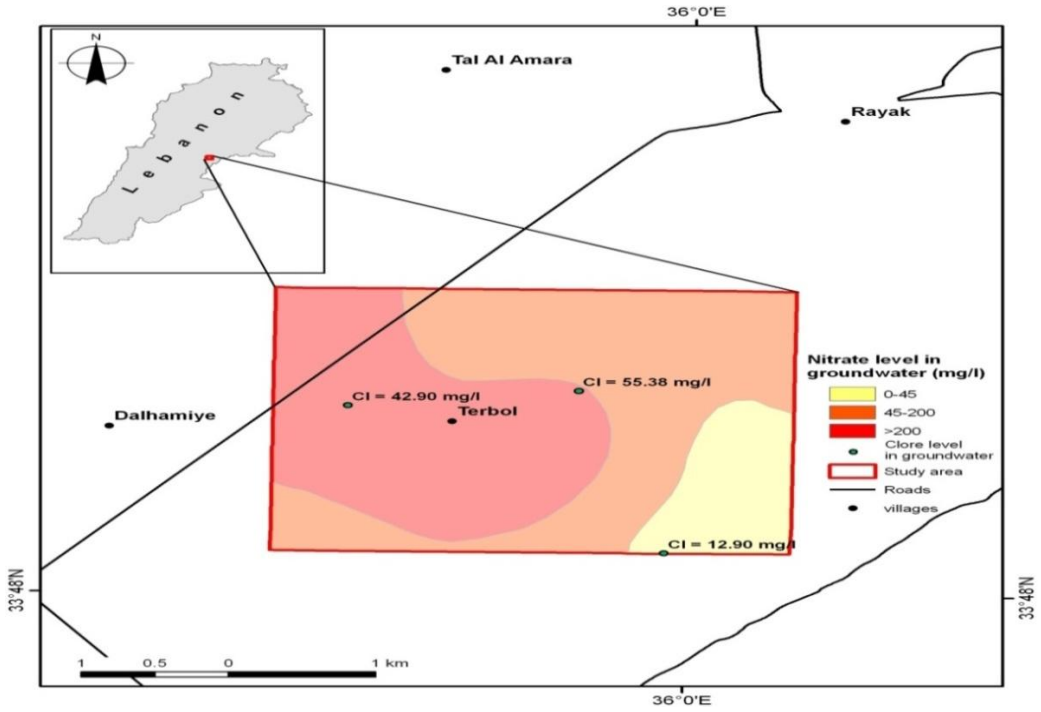
Some wells were even contaminated with nitrates to a range exceeding the values for irrigation water quality. The same picture applies to deeper groundwater whose depth varies between 50 m and 125 m (Figure II.A.5.5) and which is largely used for irrigation in Bekaa. The fertilization policy does not consider the available soil and water nitrogen pools, which multiplies the health and environmental risks of nitrates accumulation in the soil-ground water- food chain (Darwish *et al.*, 2009).

Figure II.A.5.4. Nitrate concentration in Central Bekaa shallow groundwater table in Spring 2002
(Source: Darwish, CNRS, 2010).



The available data does not allow judging the continuity in the soil mass to properly assess the protection effectiveness of the unsaturated zon (Darwish *et al.*, 2008a). For this reason, it is necessary to distinguish between a soil and a surface deposit. The fractured system (karstic limestone, faults) of the surrounding mountain area implies the necessity to undertake geophysical studies on the depth of ground water, water table and nature of deposits overlying the aquifer in the Bekaa valley.

Figure II.A.5.5. Nitrate concentration in well water used for irrigation in Central Bekaa Plain, Lebanon
(Source: Darwish, CNRS, 2010)



Based on the current cropping pattern and irrigation practices, an annual load of nitrates and heavy metals to the soil can exceed the tolerance level. Depending on its concentration, an amount of irrigation water equivalent to 10.000 m^3/ha/year applied in two consecutive seasons, like the case of Central Bekaa, bring along 125-153 g/ha of Ni and 1152 -2195 g/ha of Zn, which exceed the permissible level (100 and 1200 g/ha respectively). Meanwhile for a concentration of nitrate in irrigation water equivalent to 200 NO_3 mg/l, the crop would receive about 400 kg N/ha/year which is more than enough for a high edible yield beside the risk of contamination and depression of the economic yield.

Projects of the MoA

Rural Livelihood Recovery in Southern Lebanon through Reforestation and Sustainable Use of Carob, Pine and Laurel Trees

This project was identified as part of the German Government support to Lebanon following the July 2006 war from the Project of the Environmental Fund for Lebanon. The German identification mission concluded that environmental damages of the war are closely linked to the economic development of small and medium enterprises (SME) in Lebanon. The project was therefore developed to respond to environmental damages and economic development of SMEs.

The donor agency:Deutsche Gesellschaft fur Technische Zusammenarebeit(GTZ)

The project aims at livelihood recovery of local communities in Southern Lebanon through improving the capacity of the ministry to increase production of carob, pine and laurel trees in order to meet the growing forestation demands by the rural communities with these endemic and income-generating trees. In addition, the project aims at the conservation of the three tree species in southern Lebanon through promoting sustainable mechanisms for using and benefiting from their products.

Recovery and Rehabilitation of Dairy Sector in Bekâa Valley and Hermel-Akkar Uplands OSRO/LEB/901/UNJ

The donors are FAO and UNDP.

The aim of this project is to enable recovery-rehabilitation and assistance to the livelihoods of 300 vulnerable livestock keepers in Central Bekâa Valley, North Akkar and Hermel-Akkar Highlands who are resource poor, with little or no assistance and currently unable to keep up with the highly competitive animal production sub-sector. An additional 300 farmers will draw indirect benefits from the project through veterinary and artificial insemination services as well as training sessions.

Flood risk management in Qaa region

The donors are GTZ and ACSAD.

The aim of this project is to establish water harvesting structures to reduce the runoff velocity, thus increasing the time for water to infiltrate to the soil. It also focuses on specific structure types, carefully allocated to serve the purpose, which is capturing soil and water with minimal configuration requirements.

Mainstreaming Biodiversity Management into Medicinal and Aromatic Plants Production Processes

Lebanon lies within an important centre of flowering plant biodiversity, with approximately 2,600 species and an endemism rate of 12%. Around 365 medicinal and aromatic plants (MAPs) are found and utilised in Lebanon. The MAP and herb domestic markets are worth approximately US$35 million per year and wild stocks supply approximately 98% of the MAP markets. The collection of wild stocks now threatens the conservation of globally significant MAP biodiversity.

The project idea is that non-destructive harvests, together with income generated by MAP business opportunities for local people, will maintain the wild stocks of at least 6 globally significant MAP species that are commercially traded and threatened by current harvesting practices. The project will create incentives for local communities to sustainably manage the wild stocks by ensuring the increased financial returns flow to the guardians of wild MAP stocks and are directly linked to sustainable harvest and management practices. The project will introduce a sustainable management regime for 800 tons annually of the target species. For this purpose, the project will support both the establishment of 7-10 community-based MAP-MSEs, and value-added production systems. At the end of the project, over 8 value-added products made from sustainably harvested MAPs will be available, using at least 300 tons of raw materials.

Conservation agriculture

The donors are GTZ and ACSAD.

The project aimed at sustaining conservation agriculture on the coastal area and Bekaa by planting wheat, alfalfa, barley, vetch, and Barley-Vetch mixture between the fruit trees and olive to reduce evaporation, increase soil fertility by N fixation and reduce the risk of water erosion.

Annex II.A.6. Forest priorities and strategies for 2020

The following priority goals are proposed for the development of the forestry sector to the year 2020:

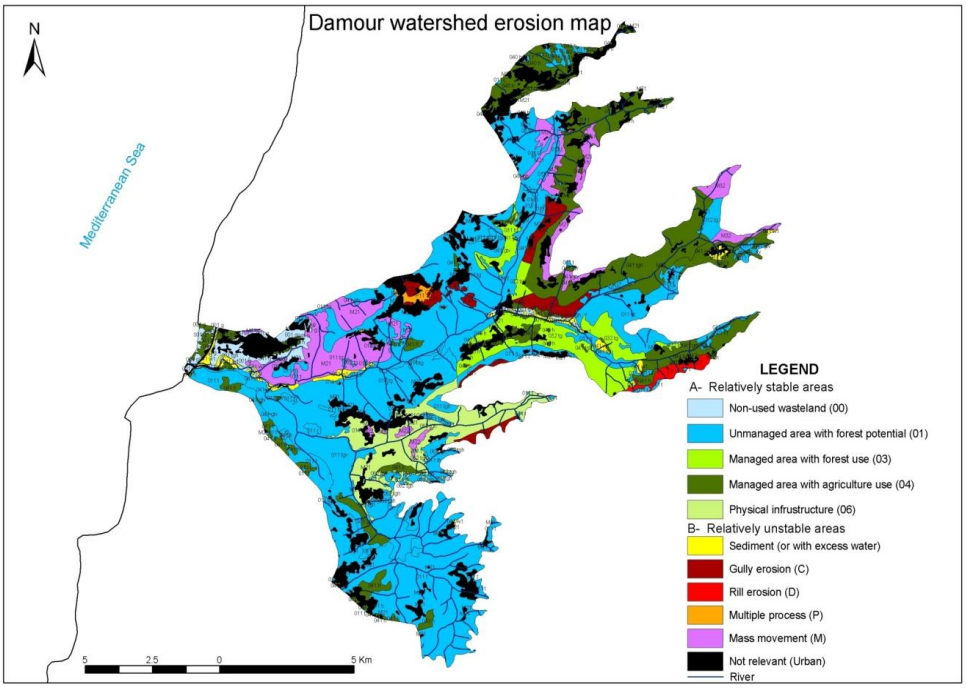
1. Adopt an ecosystem-based approach that maintains forest health, structure, functions, composition and biodiversity through integrated land-use planning, the implementation of a system of representative protected areas and the establishment of mechanisms to advance the conservation, management, planning and maintenance of urban and peri-urban forests.
2. Foster the participation and involvement of rural populations in particular the most marginalized ones, in forest management and conservation, improving access to natural resources and enhancing the equitable sharing of multiple benefits thereof, improving therefore rural livelihoods and contributing to poverty alleviation.
3. Support private forests and OWL owner's investments in small and medium-sized viable forests and woodlots businesses through the right mix of extension services and incentives.
4. Stimulate the diversification of markets for forest products and services promoting value added and best end-use through expanded research and design as well as markets for environmental services.
5. Create an independent Government Agency (Forest Office) or strengthen and develop the existing institutions for a better management of the forests and other wooded lands and a better integration of the concerns of all government and non-government stakeholders.
6. Review, amend, harmonize and update the forest legislation with forest-related and environmental legislation to rationalize taxation, make provisions for incentives and payments for environmental services, recognize intellectual property rights and include emerging new issues and relevant international commitments.
7. Establish a comprehensive national forest reporting system that consolidates data, information and knowledge for all features of the forest, both urban and rural, other wooded lands, trees outside forests and land use change.
8. Maintain and enhance the skills and knowledge of forest and natural resources practitioners at all levels (engineers, forest guards, NGO's, private sector, municipalities…) by creating a training centre and a research institute.

Finally, sustainable management of forests in Lebanon (forests and OWLs) remains a challenge for the future. These forests are essential for the protection of soils, water and biodiversity. Forests, which are sources of wood, non-wood forest products and rangelands for the rural people, play a major role in the development of the economy and the tourism sector in Lebanon.

Annex II.A.7. Descriptive soil erosion mapping

The reported study is part of the EC-funded Life project: "Improving Coastal Land Degradation Monitoring in Lebanon and Syria- "abbreviated CoLD" N°: LIFE TCY/00/INT/00069/MED (Khawlie and Darwish, 2005). The project focused on assessing coastal soil erosion in Lebanon and Syria. The detailed analysis depended on the methodology developed by PAP/RAC and FAO published as "UNEP/PAP/MAP: Guideline for erosion and desertification control management with particular reference to Mediterranean coastal areas". The outcomes and findings from the field work done in two watersheds of Lebanon: Damour (Figure II.A.7.1) and Zahrani and the detailed analysis of biological and socio economic factors of soil erosion would serve as an input to elaborate draft management plan for arriving at a soil conservation strategy based on specific recommendations. The significance of public participation was always given due consideration in the process, especially in view of the requirements of integrated coastal zone management. Lately, this methodology was applied to a pilot area in Nahr Ibrahim watershed (Darwish *et al.*, 2011).

Figure II.A.7.1. Descriptive erosion mapping of Damour subwatershed until 800 m of elevation
(Source: CNRS, 2006)



According to the methodology recommended in the above guidelines, the mapping for the detailed analysis was based on the combined analysis of physical and biological factors with the socio-economic factors to identify and map the erosion affected areas, degree and extend, factors and trends of erosion. The methodology distinguishes the stable areas. i.e. areas with no evidence of any active erosion processes, due to the predominant stabilizing effect of one or several landscape components thus generating a state of morphodynamic equilibrium. Within these categories managed and unmanaged areas were distinguished. The unmanaged stable areas are the forest lands, wastelands where no or very limited human intervention is observed. The managed areas belong to lands with agricultural activities where protection or conservation measures have been applied.

The methodology describes the unstable, affected areas, i.e. areas where one or several active erosion processes occur. Based on this description, a prioritization map for the community and government intervention associated with a draft management plan were elaborated, describing the preventive and curative measures and the role of stakeholders in their implementation, together with a set of indicators to assess the successful involvement[18].

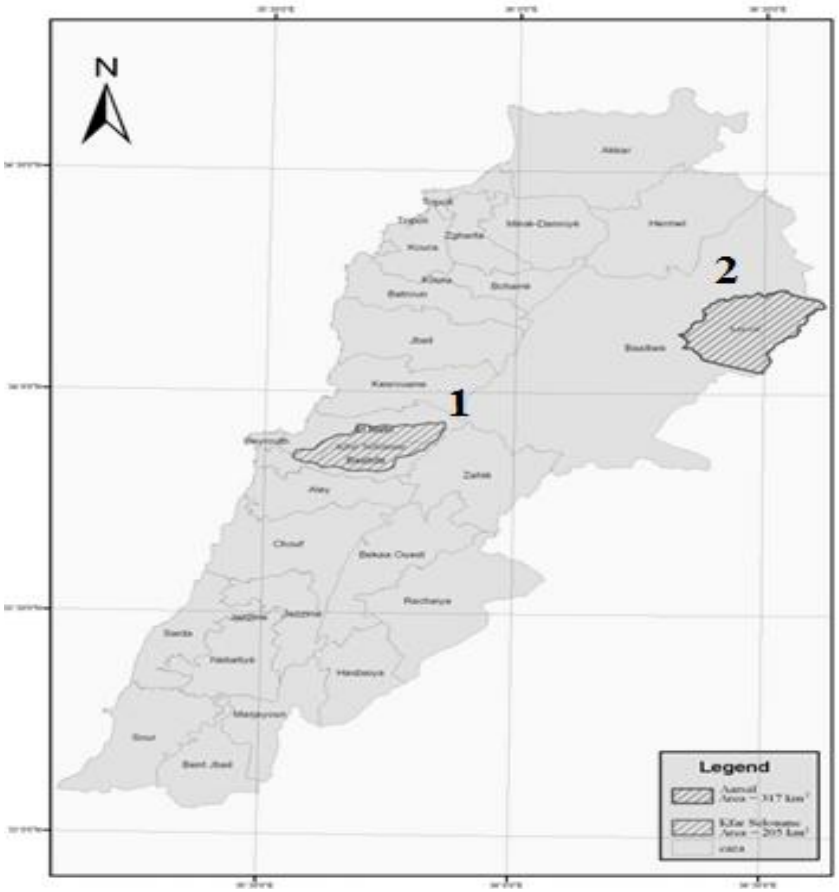
[18] http://www.pap-thecoastcentre.org/pdfs/CoLD%20LEBANON%20-%20Country%20Report.pdf

Annex II.A.8. Rangeland degradation (Case study)

The first case is Kfarselouane subwatershed with an area of 205 km^2 located on the Western mountain chain and the second is Arsaal subwatershed with an area of 316.7 km^2 spread on the Anti-Lebanon mountain chain in Northeast Bekaa (Figure II.A.8.1).

The work used the NDVI as a tool to monitor trend lines and landcover/use change as indicators to elaborate draft plans for combating desertification in the semi-arid Arsaal and the subhumid Kfarselouane representing two different agro-ecological zones. Kfarselouane is characterized by an average annual precipitation between 800 and 1400 mm through the subwatershed transect. Arsaal subwatershed is distinguished by an average annual rainfall between 300 mm at the level of Arsaal village and 600 mm in the elevated area. In both areas a long dry season (up to seven months) with no rainfall is common.

Figure II.A.8.1. Location of the Kfarselouane (1) and Arsaal Subwatersheds (2)
(Source: Darwish et al., 2008)

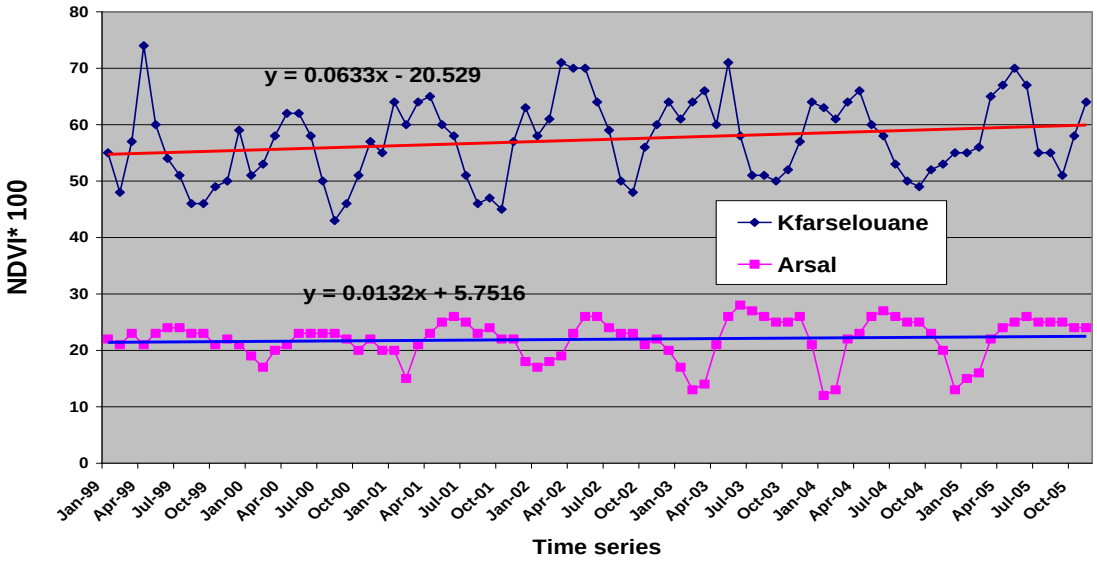


Land cover map of 1962 were derived from topographic maps of Lebanon scale 1:20.000 and aerial photos using visual interpretation method. Landcover map 2000 was derived from pan-sharpen satellite image (5m resolution) using Landsat and IRS-1C (Indian Satellite), adopting Corrine nomenclature, using visual interpretation. Both legends were adapted for comparison.
NDVI was produced using Spot multitemporal (10 day sequence) and I km x 1km spatial resolution from January 1999 until September 2005. Time series NDVI model is separated into linear trends with the equation: $NDVI_{(t)} = \alpha + ßt + \varepsilon$.

Where t is time; α, ß are constant of the linear model and ε is noise. ß represent strength and direction of the trend line fitting. The model was implemented into ERDAS software.

The multi temporal 7-year analysis of NDVI over the study areas from 1999 until 2005 revealed a general trend of amelioration in the green cover in Kfarselouane with a steady state in Arsaal (Figure II.A.8.2). However, the poor vegetation cover in Arsaal was observed despite the decreased amplitude and increased frequency of the NDVI index over the alternation of dry and wet seasons, indicating the probable impact of seasonal drought in dry Lebanese Mediterranean areas.

Figure II.A.8.2. Long term time series analysis of NDVI in Kfarseloua and Arsaal Watersheds.



With the change of Kfarselouane's people occupation from forest-mulberry cultivation to wheat cultivation during the 1920s, large areas for grazing on crop residues were available for animal production (Zurayk and El Mouybayed, 1994). However, after the WORLD WAR II, landuse changed from wheat to grape and apple cultivation. The breakdown of traditional grazing practices and reliance on fruit trees as alternative source of income caused the disappearance of large grasslands and vine cultivation areas.

Comparing land cover/use change in Arsaal area between 1962 and 2000 using aerial photos and large resolution satellite images from the IRS showed a change in the spatial distribution of woodlands, fragmentation and slight increase of the degenerated forest cover from 1108 ha to 1168 ha (Table II.A.8.1), with a simultaneous increase of cultivated lands (mostly fruit trees) from 932 ha to 4878 ha respectively. Quarries expanded over 463 ha of mountainous lands. Consequently, grasslands decreased from 29581 ha to 25000 ha. For the same period, the area of grassland in Kfarselouane was invaded by forestland where rangeland decreased from 8073 ha to 3568 ha and woodland increased from 5766 ha to 11800 ha respectively. The forest expansion occurred even at the account of unproductive land which decreased from 2668 ha to 248 ha, while cultivated lands did not reveal any substantial change.

Table II.A.8.1. Detailed land cover/use change in Kfarselouane and Arsaal (ha).

TYPE	Kfarselouane		Arsaal	
	1962	2000	1962	2000
Agriculture land	2592.64	2568.53	932.68	4878.82
Grassland	8073.51	3568.10	Not identif.	18062.15
Unproductive land	2667.87	248.46	29581.74	6949.34
Wood land	5765.95	11799.79	1108.30	1168.38
Artificial land	1405.04	2099.12	44.96	144.91
Quarries	0.00	182.54	0.00	463.61
Artificial hill lakes	0.00	38.48	0.00	0.47
Total	20505.02	20505.02	31667.67	31667.67

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