National Circumstances

1. National Circumstances

1.1 Geographic Profile

Lebanon is located on the eastern basin of the Mediterranean Sea (Figure 1-1) with a surface area of 10,452 km^2, characterized by mostly mountainous areas constituted of the following parts (Walley, 2001):

- A narrow coastal plain composed of 2 plains, one in the north (Aakar) and one in the south (Tyre) and a succession of little narrow plains separated by rocky headlands in the center.
- The Mount Lebanon chain with an average elevation of about 2,200 m. Cut by deep canyons, and composed essentially of Jurassic thick carbonate sediments, the northern part of the chain is the higher region.
- The Anti Lebanon chain - subdivided into two massives: Talaat Moussa (2,629 m) in the north and Jabal el Sheikh or the Mount Hermon (2,814 m) in the south.
- The Beqaa valley - a flat basin with a length of about 120 km, located between the Mount Lebanon and the Anti Lebanon chains. Its elevation averages at 900 m, peaking at 1,000 m at its center.

Figure 1-1 Geographical location of Lebanon

1.2 Government Structure

Lebanon is a republic, with the official language being Arabic, while French and English are the two locally used languages. The country's institutional authorities consist of:

1. The Legislative authority: represented by the General Assembly of the Parliament (whose role is to issue and update legislations);
2. The Executive authority: represented by the Council of Ministers (CoM) and its support institutions;
3. The Judiciary authority: represented by the Higher Council of Justice (whose role is to apply the legislations).

The Head of the State is the president of the Republic, who is elected by the Parliament and supervises the functions of each of the individual authorities. With the consultation of the members of the Parliament, the President appoints the Prime Minister which in turn forms a government. The appointment of cabinet ministers is ratified by the Parliament.

Administratively, Lebanon is divided into 8 mohafazat, divided into 25 Caza (Figure 1-2). The administrative center of each Caza is principally located in the most important town of the region. Each Mouhafaza is headed by a Mouhafez, who represents the national government administration and each Caza is headed by a Qaimmacam.

The Municipalities and the Councils of Elders make up the local government in Lebanon. The Mayor heads the municipality enjoying a vast authority over local affairs, while the Moukhtar heads the Council of Elders and provides services related to civic personal certifications.

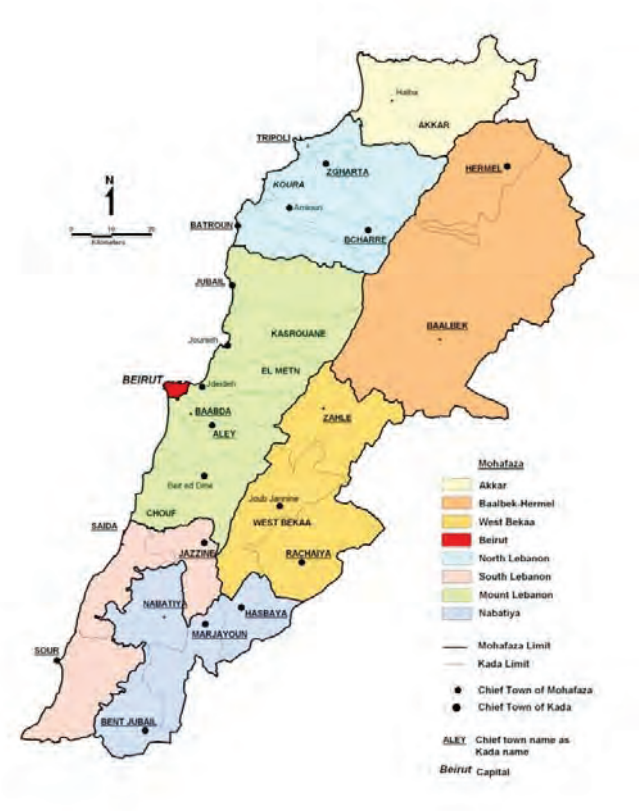

Figure 1-2 Administrative boundaries of Lebanon

The Ministry of Environment (MoE) is the main governmental body concerned with environmental issues in the country. It was established in 1993 under Law 216/93 to meet Lebanon's environmental challenges, and articulate environmental policy principles and strategy objectives. MoE and other government agencies (the Ministry of Water and Energy (MoEW), Ministry of Public Works and Transport (MoPWT), Ministry of Agriculture (MoA), Council for Development and Reconstruction (CDR), the Directorate General for Urban Planning (DGUP), etc.) dispose of a growing arsenal of legal and regulatory instruments to protect the environment. Policies are addressed by the highest Executive level (through the Minister of Environment at the Council of Ministers) as well as by the Legislative Branch (through the Environmental Committee of the Parliament). Lebanon has passed as many as 750 texts related to environmental issues, including in order of increasing importance: circulars, ministerial decisions, decrees, laws and international treaties.

Lebanon has signed the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992 and has ratified the convention on August 11th 1994 by virtue of Law 359, and acceded to the Kyoto Protocol on November 13th 2006 by virtue of Law 738.

1.3 Demographic Profile

The only population census ever conducted in Lebanon dates back to the year 1932, where the total number was estimated to 793,000. Since then, demographical data are obtained from estimations which differ from one source to another. In addition, massive emigration and the presence of Palestinian refugees in camps make the convergence to a single population value a daunting task.

Although the country experienced a significant population growth (3.01%/yr) between 1945 and 1975, the pace slowed down to an annual growth rate of 2.08% in 1997 with a resident population of 4 million people (CAS, 1997), among which 350,000 Palestinian refugees, as estimated by UNRWA. However, with a significant reduction in fertility rate, the natural growth of population is taking a slower rate and national projections estimate an annual growth of 1% between 2000 and 2030 (CDR, 2005).

The population of Lebanon is estimated at 4.16 million inhabitants in 2000 and 4.29 million in 2004 (based on an annual growth rate of 1% to the CDR population record of 1997 of 4 million), 27.3% of which are under 15 years of age and 7.4% are over 65. The country is witnessing a demographic transition. The infant mortality rate has decreased from 33.5/1,000 in 1996/97 to 18.6/1,000 in 2004. This could not have been achieved without substantial reduction of the high mortality rates recorded in 1999 in the North and the Bekaa, and the lowering of regional disparities. Indicators showing the demographic transition in Lebanon between 1996/97 and 2004 are shown in Table 1-1.

Lebanon is classified as a highly urbanized country with more than 85% of its residents living in urban areas, while sustainable urbanization remains a key national development challenge (UN, 2009).

The population in Lebanon is unevenly distributed among regions where one third of the population resides in the Greater Beirut Area (GBA), and only 12.5% of the population resides in the governorate of Bekaa, which is the largest administrative region by surface area (Figure 1-3). The country has one of the highest population densities in the world ranking 11th with 391 persons/km^2, and the city of Beirut has the highest density among all governorates with 21,938 persons/km^2 (CAS, 2004; MoE, 2005).

Table 1-1. Indicators of the demographic transition in Lebanon

	1996-1997	2004
Crude birth rate (per 1,000 mid-year population)	25	16.9
Crude death rate (per 1,000 mid-year population)	7	4.1
Infant Mortality Rate (per 1,000 Live Births)	33.5	18.6
Population <15 years (%)	28	27.3
Population >65 (%)	6.5	7.4
Dependency Rate (%)	62.8	53.3
Total Fertility Rate (Live Births per 1,000 women of childbearing age)	2.5	1.9

Source: Ammar, 2009

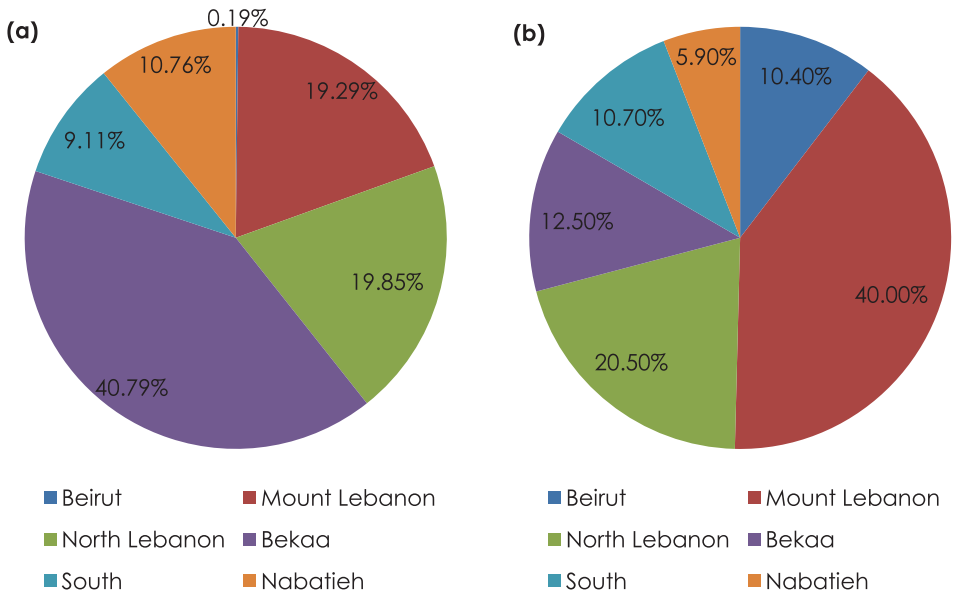

Figure 1-3 (a) Share of the total area by governorate (b) Percent distribution of individuals per governorate

1.4 Economic Profile

1.4.1 GDP evolution

Lebanon is considered a country of "medium high" income with a GDP of USD 16.3 billion in 2000 and USD 22.7 billion in 2006 (Figure 1-4) (MoF, 2008).

The average GDP growth for the period 2000 - 2006 is about 2.9% (Figure 1-4), with a major growth showing for the years 2003 and 2004 at GDP growth rates of 4.1 and 7% respectively. In 2005, growth witnessed a slowdown following the aftermath of Prime Minister Hariri's assassination, with real GDP growth at 1.1%. The first half of 2006 was characterized by a strong revival of the Lebanese economy with real GDP growth estimated by the Lebanese Ministry of Finance to 5 to 6%. However, the July 2006 War and the numerous political tensions in the country had a significant impact on the economy, slowing the real GDP growth down to 0%.

The GDP composition (Figure 1-5) from 2000 to 2006 shows similarities with a dominance of the tertiary sector. The service sector includes commerce, tourism, financial services, health care, higher education, market and non-market services, transport and communication and trade. The primary commodity shares of the economy for the years of 2000 and 2006 are 15.3% and 13.8% respectively.

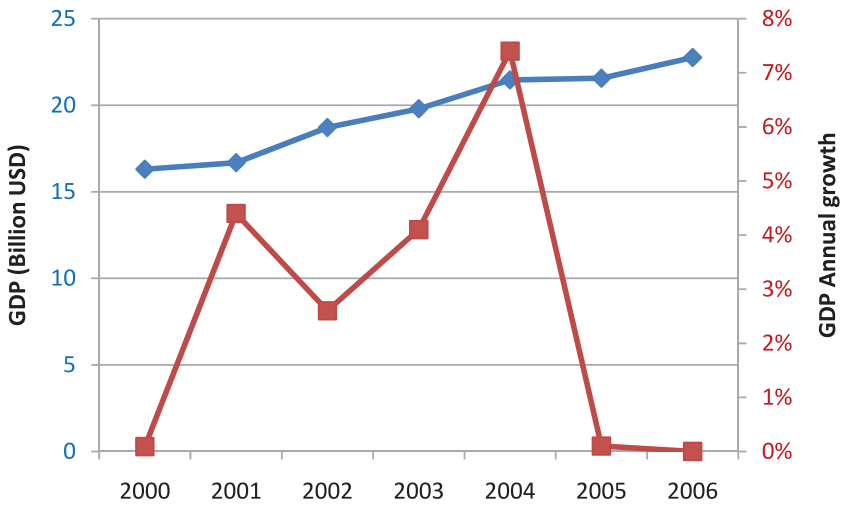

Figure 1-4 GDP evolution and annual growth
Source: MoF, 2008

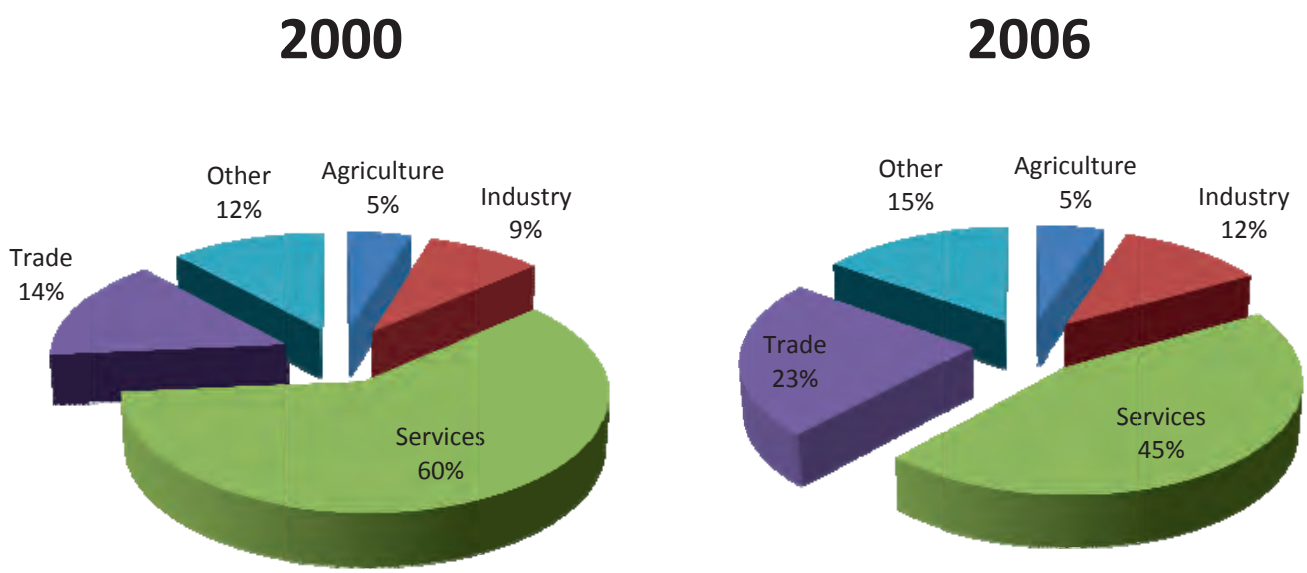

Figure 1-5 Percentage of GDP from agriculture, industry, services in Lebanon for 2000 and 2006
Source: MoF, 2008

1.5 Climate Profile

1.5.1 Precipitation

Lebanon is typically characterized by a Mediterranean climate with precipitation mainly occurring between the months of October and March. Lebanon has four dry months – June, July, August and September – during which water availability is limited due to the very low water storage capacity, the difficulty of capturing water close to the sea, and the shortcomings of the existing water delivery systems and networks.

The topography of the Lebanese territories allows for a wide distribution of precipitation. As a result, five distinct agro-climatic zones are present in the coastal strip, low and middle altitudes of Mount Lebanon, west, central and north Bekaa. Records over 50 years from over 105 stations, spread throughout the different governorates, registered average yearly precipitation ranging from 700 mm in the Beqaa to 1,210 mm over Mount Lebanon (Table 1-2), with the lowest and highest levels of precipitation of 80 mm and 3,010 mm respectively (Hajjar,1997). Coastal areas experience precipitation ranging from 600 to 1,100 mm reaching as high as 1,400 mm on the peaks of Faraya and Becharreh, and as low as 300 to 400 mm recorded inland (Figure 1-6, Figure 1-7).

Table 1-2 Precipitation levels records

	Number of Stations	Station Altitude		Precipitation (mm/year)		
		Low	High	Yearly Average	Min	Max
Beirut	4	15	34	891.75	393	1,600
North	25	2	1,925	1,055.00	425	1,890
Mount-Lebanon	36	45	1,840	1,210.16	421	3,010
South	26	5	1,150	933.27	342	2,139
Beqaa	36	650	1,510	705.42	80	2,374
Lebanon	105	5	1,840	787.00	80	3,010

Source: Hajjar, 1997

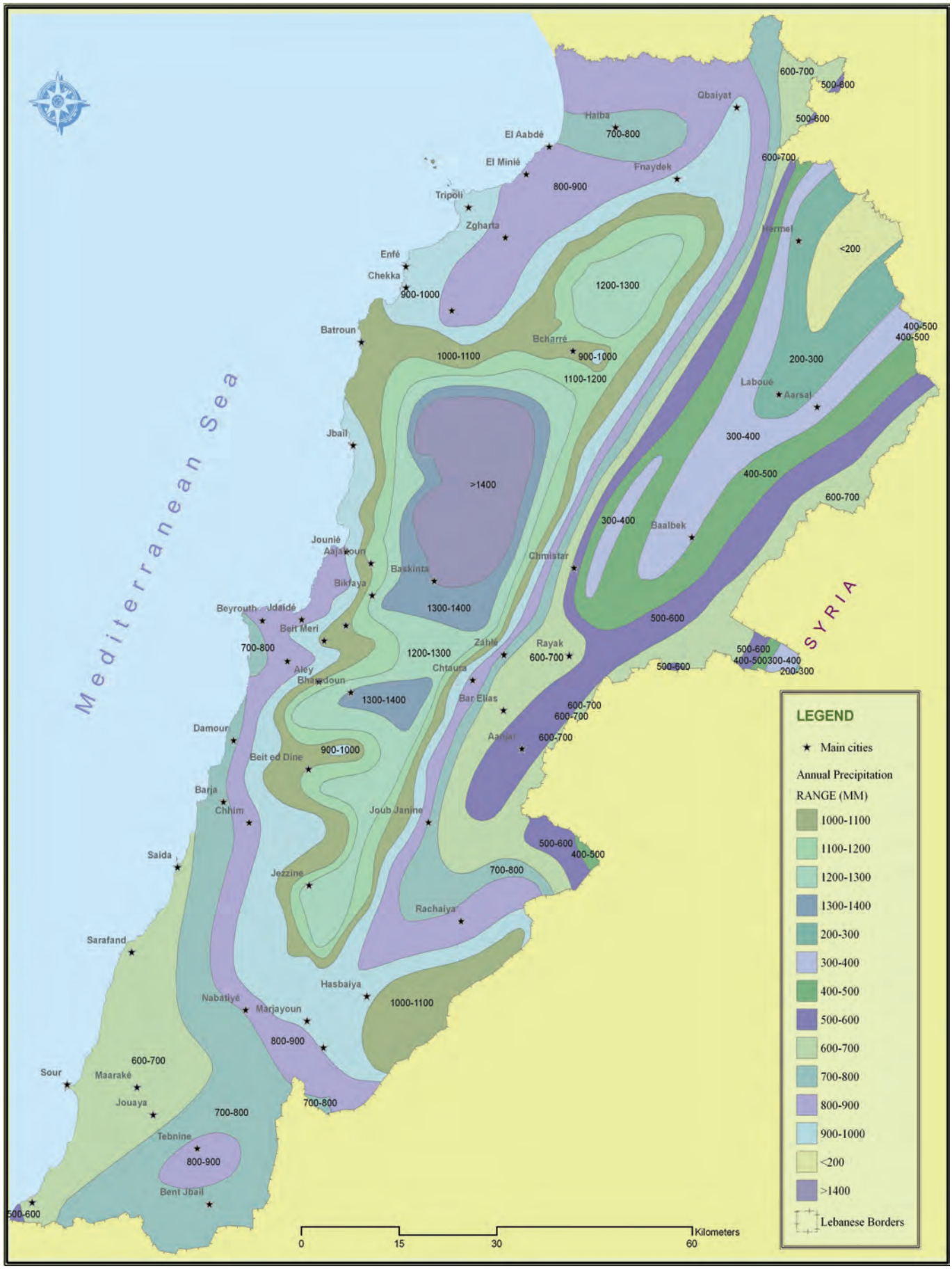

Figure 1-6 Mean annual precipitation over Lebanon

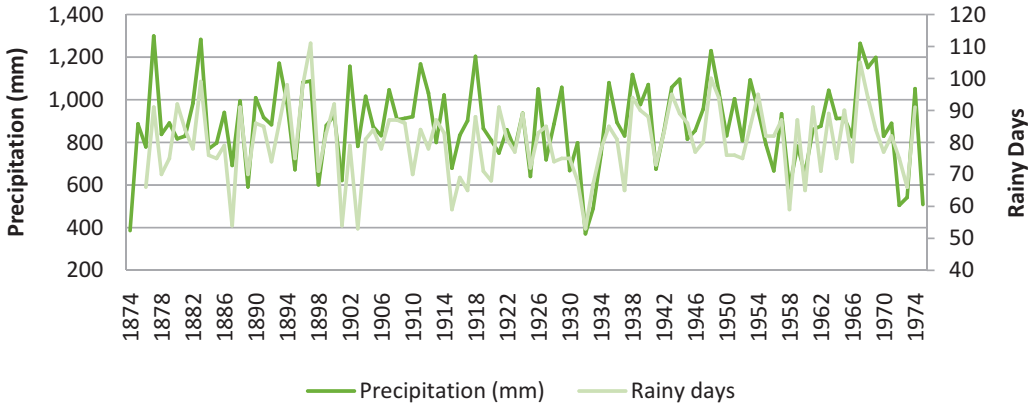

Figure 1-7 Total yearly precipitation levels observed at the American University of Beirut station between 1874 and 1975

Source: adapted from Farajalla et al., 2010

1.5.2 Temperature

Climate in the East Mediterranean is characterized by mild rainy winters from the westward moving cyclonic activity (Maheras, 2001; Alpert et al., 2004) and long, hot dry summers brought about by persistent atmospheric subsidence influenced by the Asian monsoon (Ziv et al., 2004). Lebanon's climate is further shaped by its unique topography with the coastal strip, the Lebanon and Anti-Lebanon mountain ranges, and the inland Bekaa plateau. Thus the coastal area and the western side of the Lebanon mountain range exhibit maritime characteristics, while the climate of the eastern side is more continental (LMS, 1977).

The yearly average temperature pattern (Figure 1-8) in Lebanon ranges from 5°C and 10°C for the region located above 1,800 m altitude except for a small area in the Bekaa plateau where the 10°C line extends to a lower altitude near the town of Serghaya. The region located between 1,100 m and 1,200 m enjoys 15°C yearly average temperature. A slight portion of the littoral benefits from the dampening effect of the sea and has a yearly average temperature above 20°C.

1.6 Water Resources

Lebanon faces significant challenges in meeting the country's water demand in terms of quantity and quality. Unsustainable water management practices, environmental risks and water governance shortcomings are among the main obstacles facing the sector.

1.6.1 Water Balance

Yearly precipitation results in an average yearly flow of 8,600 million m^3 (Mm^3), giving rise to 40 streams and rivers and over 2,000 springs. About 1,000 Mm^3 of this flow comes from over 2,000 springs with an average unit yield of about 10–15 l/s (FAO, 2008). Since Lebanon is at a higher elevation than its neighbors, it has practically no incoming surface water flow (FAO, 2008).

Amid the absence of consistent information, it is generally accepted that approximately 50% of the average yearly precipitation (8,600 Mm^3) is lost through evapotranspiration, while additional losses include surface water flows to neighboring countries (estimated by the Litani River Authority to represent almost 8%) and groundwater seepage (12%). This leaves around 2,600 Mm^3 of surface and groundwater that is potentially available, of which around 2,000 Mm^3 is deemed exploitable (MoE, 2001) consisting of 1,500 Mm^3 of surface water and 700 – 1,165 Mm^3 of groundwater (MED EUWI, 2009). Table 1-3 shows the total annual water balance and water uses as reported in different sources.

1.6.2 Surface Water Resources

The flows in water courses are estimated at 3,400 Mm^3 approximately for an average year, including flows from both national and transboundary rivers. Surface water outflow to the Syrian Arab Republic is estimated at around 425-510 Mm^3 through the El Assi River and about 160 Mm^3 to the north of the occupied territories through the Hasbani/Wazani complex (FAO, 2008; Plassard, 1971). Table 1-4 shows flows in watercourses by Mohafaza during different periods of the year. Lebanon comprises 17 perennial and 23 seasonal rivers and streams (Table 1-5), with more than 2,000 springs with a flow of around 1,000 Mm^3. The combined length of rivers is approximately 730 km (MoE, 2001).

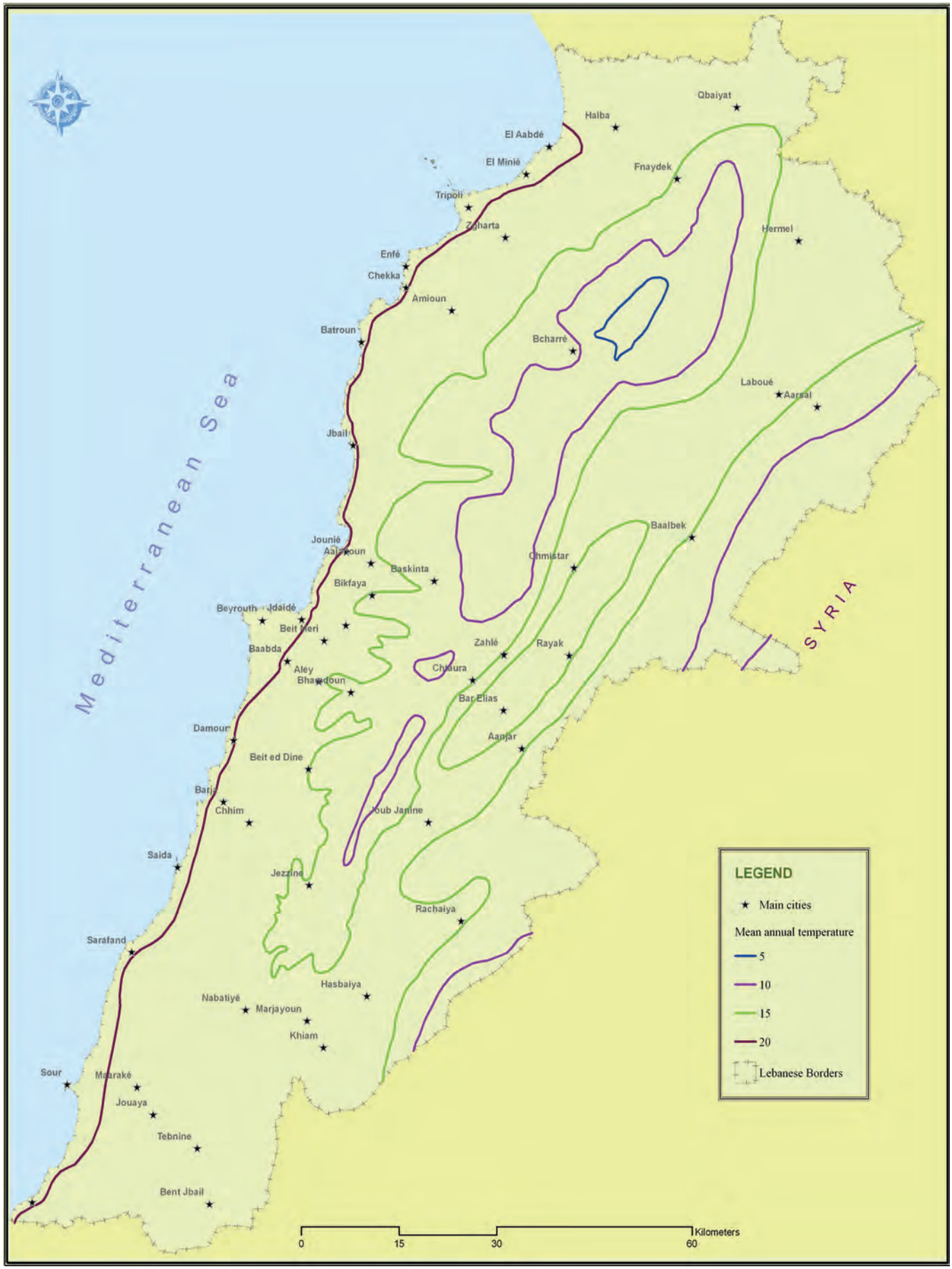

Figure 1-8 Mean annual temperature over Lebanon

Table 1-3 Summary of water balance

Description		MED EUWI (2009)	MoEW (2004)	World Bank (2003)	UNDP (1970)	Geadah (2002)	Plassard (1971)
Precipitation (mm)		800 – 1,000	820	820	940	-	-
Evapotranspiration (mm)		500 – 600	430	380	-	-	-
Precipitation (Mm^3)		8,320 – 10,400	8,600	8,600	9,800	8,600	8,600
Evapotranspiration (Mm^3)		4,300 – 6,240	4500	4,000	-	4,300	4,300
Total flow of the 40 major streams (Mm^3)		3,673 – 4,800	3680	3,800	4,300	1,774	1,800
Surface flow to neighboring countries (Mm^3)		300 – 670	945	700	~ 680	670	160 (Palestine) 510 (Syria)
Groundwater flow to neighboring countries (Mm^3)		310		200	-	300	150 (Palestine)
Flow of submarine sources (Mm^3)		385 – 1,000	385	700	711	880	880
Total resources (Mm^3)	Average year	2,600 – 4,800	-	-	-	-	
	Dry year	1,400 – 2,200	-	-	-	-	
Exploitable resources (Mm^3)	Surface water	1,500	-	-	-	-	1,800
	Groundwater	700 – 1,165	-	-	-	-	800
	Total	1,400 – 2,200	-	-	-	2,000	-

Major surface storage structures such as reservoirs are not abundant in Lebanon. The major reservoir on a river is the Qaraoun Lake which is formed by a rockfill dam constructed on the Litani river with a total reservoir capacity of 220 Mm^3 and an effective storage of 160 Mm^3. It supplies three hydroelectic power plants and provides every year a total of 140 Mm^3 for irrigation purposes and 20 Mm^3 for domestic purposes to the South. A second artificial reservoir and dam was inaugurated in 2007 in Shabrouh, with a static storage capacity of 8 Mm^3 and a dynamic reserve of 15 Mm^3. It is located in the town of Faraya and provides water for domestic and irrigation purposes in Mount Lebanon (the district of Kesrwan and parts of the Metn region) (MoEW, 2010).

There are plans for other dams on the major rivers as per the government's 10-year plan for the water sector presented later in this section; these are to be executed by 2018 (MoE, 2005).

Although surface and groundwater are dealt with separately, it should be noted that almost all surface water resources in Lebanon are attributed to ground karstic aquifers (MED EUWI, 2009).

Table 1-4 Flows in watercourses in Lebanese Mohafa

Flows in water courses (average values) (in Mm^3)	North Lebanon	Mount Lebanon	North Bekaa	Central and Southern Bekaa	South Lebanon	Total
Entire Year	670	990	480	830	430	3,400
May to October (6 months)	270	305	240	240	25	1,080
July to October (4 months)	115	95	155	115	10	490
September	22	18	38	27	2	107

Source: Comair, 2006

Table 1-5 Annual flow of the most important perennial rivers and streams of Lebanon

Region	River	Length (km)		Flow (Mm^3/year)		
		MoE (2001)	Jaber (1993)	MoE (2001)	Bakalowicz (2009)	Jaber (1993)
North	El Kabir	58	58	190	131	190
	Ostuene	44	NA	65	67	65.1
	Araqa	27	NA	59	70	65
	El Bared	24	24	282	72	281.9
	Abou Ali	45	42	262	205	262.4
	Kousba	NA**	NA	NA	NA	NA
	Asamra	NA	NA	NA	NA	NA
	El Jawz	38	25	76	40	75.7
Mount Lebanon	Ibrahim	30	22	508	319	507.9
	Janin	NA	NA	NA	NA	NA
	Khadira	NA	NA	NA	NA	NA
	El Kalb	38	28	254	117	252.6
	Beirut	42	20	101	65	101.4
	Damour	38	30	307	157	256.5
South	El Awali	48	50	299	371	284.4
	Joun	NA	NA	NA	NA	NA
	Saitaniq	22	NA	14	111	NA
	El Zahrani	25	NA	38	13	38.6
	Abou Assouad	15	NA	11	3	NA
Bekaa	Litani	170	NA	793	689	NA
	Upper Qaraon	NA	NA	NA	NA	404
	Lower Qaraon	NA	NA	NA	NA	NA
	Khardali – Sea	NA	170	NA	NA	129.9
	Yammouneh	NA	NA	NA	NA	58.7
	El Assi	46	45	480	656	414.5
	Hasbani	21	NA	151	85	138.3
Total*				3,890	3,171	3,527

*Total figures exclude certain river flows when relevant data is not available.

** Not Available.

1.6.3 Groundwater

Groundwater recharge is estimated around 3,200 Mm^3, of which 2,500 Mm^3 constitute the base flow of rivers (FAO, 2008). Snow cover is the main source of groundwater recharge, in addition to rainwater percolation which is enhanced by fractures and fissures of a heavily dissected limestone karstification along the coast of Lebanon (Saadeh, 2008).

The inadequacy of public water supply to meet the country's growing water needs has led to a shift toward private solutions for water supply. Reliance on private provision of water supply has accelerated the depletion of water resources, and has led to over-abstraction of groundwater. It is estimated that about 70% of wells are illegal due the lack of enforcement of licensing requirements (World Bank, 2003).

Groundwater quality is in an alarming situation, due to the infiltration of pollutants (wastewater, industrial wastes, solid waste leachate, etc.), seawater intrusion, and the increase of uncontrolled drilling of wells (more than 42,000 private wells) (CAS, 1997; CDR, 2005; and MoEW, 2010). This pollution has direct effects on public health and health-related expenditures. The costs of the health impacts of water pollution are estimated at USD 7.3 million/year and the costs of excess bottled water consumption at

Table 1-6 Comparison of water consumption by sector in Lebanon

Sector/Activity		Consumption on %			
	Jaber (1997)		World Bank (2010)	Comair (2006)	JICA, et al., (2003)
Domestic	Cooking	45	26	25	53
	Washing				
	Shower				
	Backyard Irrigation				
Services	Hotels, restaurants & pools	8.5	-	-	-
	Hospitals & health institutions				
	Schools				
	Commercial				
Public	Public Institutions	12	-	-	-
	Military (Caserns)				
	Parks and Municipal				
Agriculture	Cattle	4	65	69	-
	Horses				
Industrial	Light Industries	7.5	9	6	10
Losses		23	-	-	37
Total		100	100	100	100

about USD 7.5 million, noting that these are conservative estimates that do not account for all associated direct and indirect costs (MoE, 2001).

1.6.4 Snow cover

Lebanon, with about 60–65% of mountainous terrain, receives a considerable amount of snow (Shaban et al., 2004). The Mount Lebanon mountain range, at altitudes between 1,700 m and 3,000 m is covered, for around 3 months every year, with an average yearly precipitation of around 3 Mm^3 in the form of snow, with the snowpack reaching its peak in March. Starting February, temperatures are sufficiently high to cause snowmelt at altitudes lower than 2,000 m (Najem, 2007).

The snow that covered Mount Lebanon during the 2000-2001 winter contributed an equivalent of 1,250 Mm^3 (± 10%), compared to a total rainfall volume of 1,875 Mm^3 (CREEN, 2001). Using satellite imagery, the amount of water derived from snowmelt over Mount Lebanon for the years 2001–2002 was estimated to be around 1,100 Mm^3, which suggests that about two thirds of the precipitation is derived from snowfall and not directly from rain, as snowmelt infiltrates the limestone and discharges at several karsts springs (Shaban et al., 2004; Hreiche et al., 2006; Shaban, 2009). Water from melting snow contributes around 40% to 50% of the discharge of coastal rivers (Shaban et al., 2004 and Hreiche et al., 2006), indicating the essential role snow plays in replenishing the water resources in Lebanon.

1.6.5 Water Consumption by Sector

General estimates exist for water demand and water consumption by sector, with water demand values ranging from as low as 445 Mm^3 (JICA et al., 2003) to 985 Mm^3 (Comair, 2006), and as high as 1,338-2,280 Mm^3 (Amery, 2000). Table 1-6 illustrates water consumption by sector in Lebanon.

Greater Beirut has the highest water demand and loss rate, followed by Mount Lebanon. Public supply provides 83% of national water supply, necessitating an additional private supply in all regions amounting to 17% (JICA et al., 2003).

Further studies have assessed agricultural water withdrawal assessment based on 11,200 m^3/ha/yr from surfacewater and 8,575 m^3/ha/yr from groundwater resources (FAO, 2008). The use of groundwater for irrigation has increased during recent years. This situation has encouraged individual farmers to cope with water shortages by increasingly relying on private wells (Hreiche, 2009).

Table 1-7 Environmental stresses on water resources

Economic Activity	Source of Impact	Evidence of Stress
Agriculture	Excessive use of surface and groundwater for irrigation	Seasonal water shortages
	Excessive application of agrochemicals	Possible contamination of groundwater from pesticides and nitrates
Industry	Discharge of liquid waste	Contamination of rivers and coastal waters
	Uncontrolled disposal of solid waste	Possible contamination of rivers and groundwater from leachate seepage
Transport	Disposal of waste oils	Waste oil dispersal in rivers, wells and coastal waters mainly through the sewage system
Energy	Hydropower	Intermittent drying of river beds during summer
Human settlements	Uncontrolled sewage disposal and no monitoring of septic tanks	Bacterial contamination of ground and surface water
	Excessive use of ground water resources for domestic supply	Seawater intrusion in coastal areas

Source: MoE, 2001

1.6.6 Stresses on the water sector

The water sector currently undergoes several environmental stresses resulting from different socio-economic activities and practices, as summarized in Table 1-7.

1.7 Agriculture

The agriculture sector's share of GDP, between 1999 and 2007, averaged 5.8% of the total value-added. For the same period, agriculture's share of employment of the total economically active population has been steadily declining, from 3.9% in 1999 to 2.2% in 2005.

Despite a beneficial variation in temperature and rainfall over the Lebanese territories, under-investment in the agricultural sector has contributed to retraction in its contribution to the national economy and a lack of interest from investors and the young workforce. Only 1% to 3% of the annual public budget is allocated to agriculture services. Another issue which is influencing the decrease in productive lands is the decrease in the average plot size due to inheritance laws, thus rendering agricultural exploitation unprofitable.

The varied elevation offers Lebanon the possibility of extending to an extremely diversified agriculture; from quasi-tropical products on coastal plains to orchards in high-altitude mountains, with a full range of possible intermediary crops in between. Physical configurations of terrains (vast plains, narrow plains, basins, slopes, etc.) determine the possibilities for automation or mechanization, industrial and semi-industrial exploitation (CDR, 2005).

Almost half of Lebanon's total surface area could be cultivated, although with different levels of productivity. The country's "real" arable land resides in large areas, representing altogether around one third of its total land mass (CDR, 2005). The main crop production regions are distributed as follows (Saade, 1994):

- The coastal strip: citrus fruits, bananas, horticulture products and vegetables (predominantly grown in plastic greenhouses);
- The Akkar plains: cereals, potatoes, grapes and vegetables;
- The central Bekaa valley: potatoes, vegetables, grapevine, stone fruits and grains;
- The mountainous region: fruit orchards and vegetables;
- The western slopes of the Mount Hermon and Anti-Lebanon range: grapes, olive and cherry;
- The hills in the South: olives, grains, tobacco and almonds.

Agricultural production is concentrated in the Bekaa valley, which accounted for 42% of total cultivated land in 2005 (Figure 1-9) and the highest percentages of essential crop types such as cereals and vegetables (Figure 1-10).

The most important cereals cultivated are wheat, barley and corn (MoA, 2007) which play an important role in food self-sufficiency. Production of cereals reached 394,400 tonnes in 2005 with a total value of LBP 92.9 billion (MoA, 2007). Durum wheat (used in the local food industry – borghul, freek, kishek, pasta, etc.),

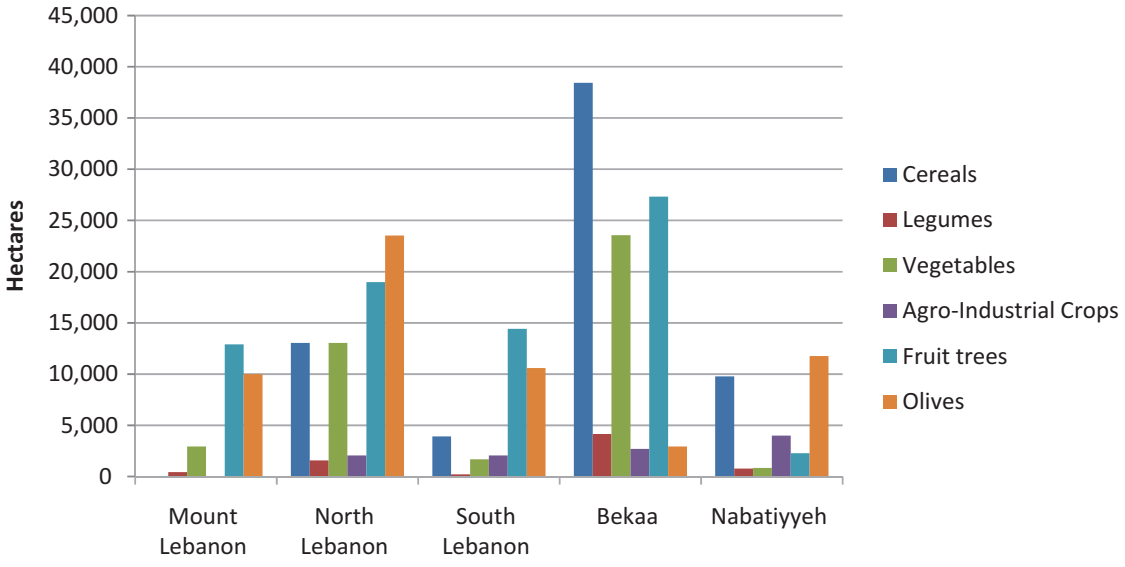

Figure 1-9 Distribution of crop area by governorate
Source: MoA, 2007

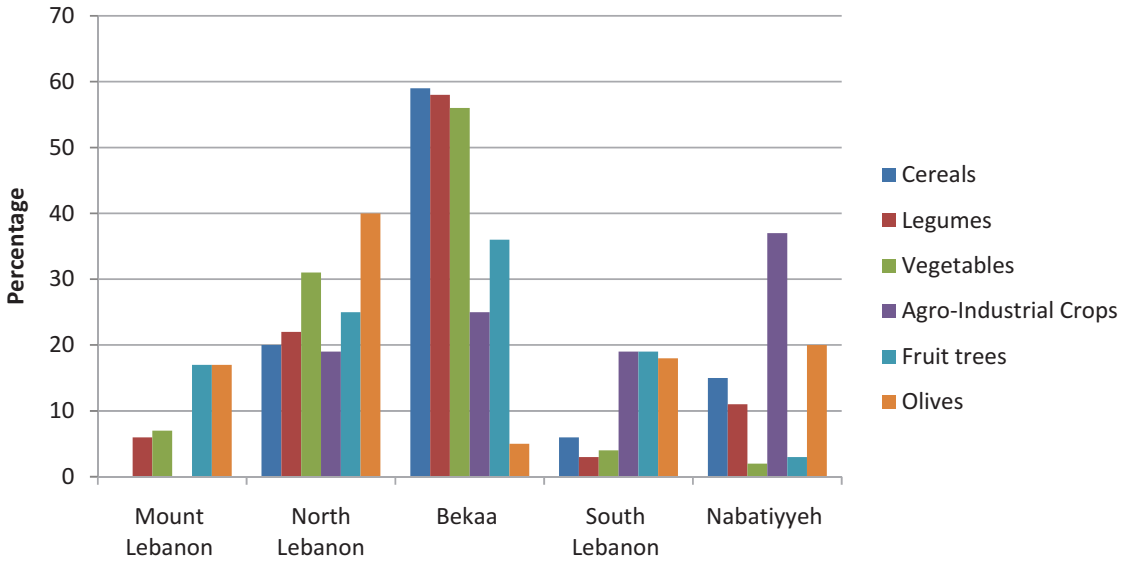

Figure 1-10 Percentage distribution of crops grown by governorate
Source: MoA, 2007

although not suitable for bread production, is the most widely grown cereal crop, and the only type of wheat cultivated in Lebanon, producing 143,700 tonnes valued at 60% of the total value of cereal production in 2005 (FAO, 2009a). Lebanon is a net importer of wheat, with import value reaching LBP 201 billion in 2005. The price of imported wheat is much lower than the farm gate price of locally-grown wheat (MoA, 2007). The government supports wheat cultivation as a strategic crop for food security, and to maintain the value of rainfed arable land.

Lebanon's vegetable production is divided into leafy vegetables (e.g., artichokes, cauliflowers, cabbages, lettuce and salad greens), tuber vegetables (e.g., potato and carrot), and fruit-bearing vegetables (e.g., peppers, cucumbers, eggplants, tomatoes, melons and watermelons). Potato constituted almost half of the total vegetable cultivation in 2005, covering 19,700 ha (or 46.8% of vegetable-cultivated area) and 7.2% of the total cultivated area, followed by tomato (covering 8.8% of the vegetable-cultivated area). Lebanon is a net exporter of potato (Figure 1-11), and a net importer of tomato (Figure 1-12). Despite the decrease in the harvested area of tomato, the yield has been increasing, mainly due to the use of good quality seeds and mechanization in tomato cropping and harvesting.

Fruit (citrus, pome fruits, stone fruits, tropical fruits including, carobs, almonds and nuts) cultivation is one of the most

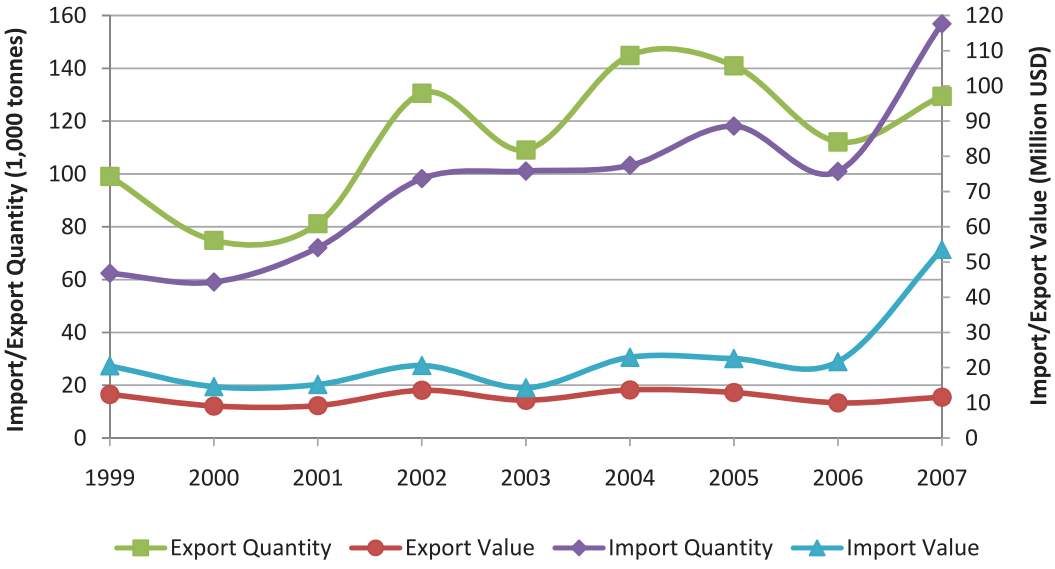

Figure 1-11 Potato import and export quantities and value
Source: FAO, 2009a

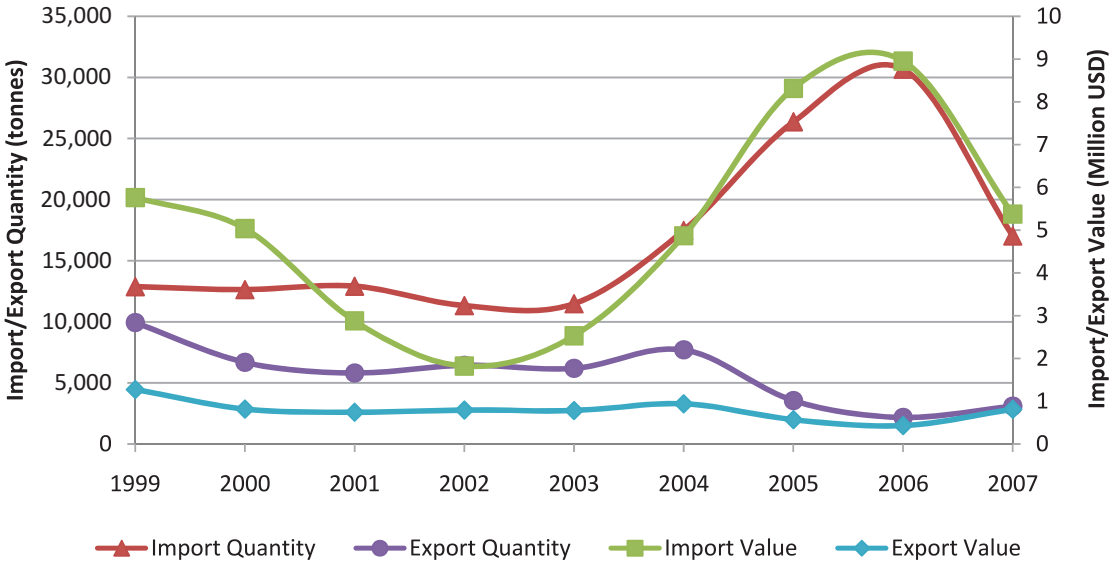

Figure 1-12 Tomato import and export quantities and value
Source: FAO, 2009a

important elements of agricultural income with 40% of total crop production quantity (in 2005), 36.5% of the agricultural value-added (in 2005) and 28% of the total productive agricultural area (FAO, 2009a and MoA, 2007). Fruit trees cultivation is concentrated in the Bekaa (36%), followed by North Lebanon (25%), South Lebanon (19%), Mount Lebanon (17%) and Nabatiyyeh (3%) (MoA, 2007).

Lebanon is a net regional exporter of oranges, apples, bananas, grapes and cherries (FAO, 2009a), thus maintaining a positive trade balance in fresh fruit products. Lebanon grows grapes as an industrial crop for wine making. The local wine industry produces one of the major agricultural exports by value (USD 10.4 million in 2005) (FAO, 2009a).

Although olive trees are technically fruit-bearing trees, the agricultural census of Lebanon considers this crop in a stand-alone category due to its local economic importance. Olives, largely non-irrigated, are the single largest crop by total surface area, grown over 21.5% of the total productive agricultural areas, or 58.8 thousand hectares, in 2005 (MoA, 2007). The North Lebanon governorate retains the largest production areas (40%), followed by Nabatiyeh (20%), South Lebanon (18%), Mount Lebanon (17%) and Bekaa (5%) (MoA, 2007). Olive fruit bearing is not consistent across the years; in 2004, the production reached 167,000 tonnes while it reached 76,500 tonnes in 2005 (MoA, 2007). Olive oil is rapidly becoming an important export commodity; Lebanon exported 29% of its production of

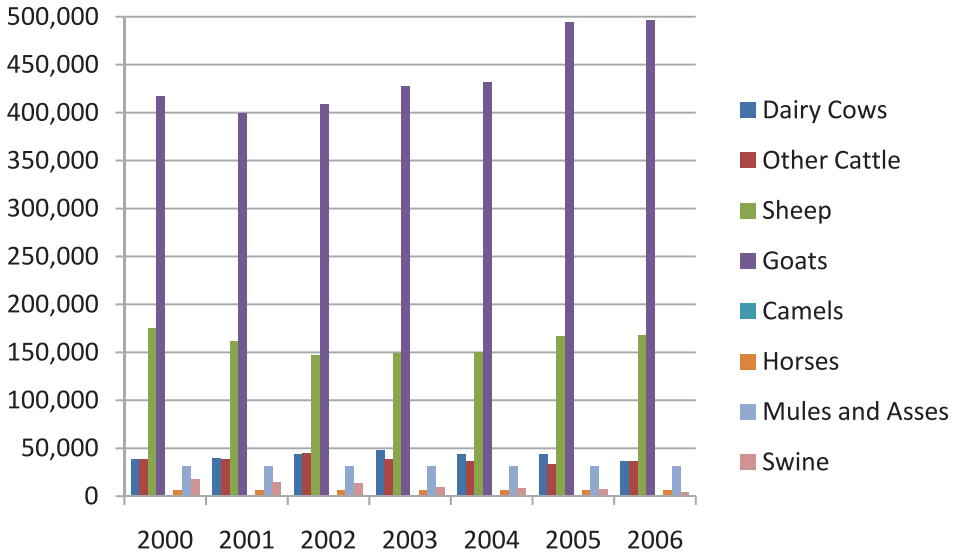

Figure 1-13 Number of livestock heads by type
Source: FAO, 2009

olive oil in 2005 (FAO, 2009a). However, it must be noted that not all of the production is from locally-grown crops. In the same token, imports of virgin olive oil are rapidly increasing due to the removal of trade barriers between Lebanon and the EU.

The livestock sector in Lebanon faces difficulties on the levels of production and marketing. Main livestock products include red meat of different varieties, poultry meat, in addition to milk and its derivatives, eggs, honey and fish. The quantities produced meet a small part of the local consumption demand. Consequently, the country relies on the import of animal products to meet the overall consumption demand. The exception, however, is the poultry sector where national poultry meat and egg production meet the overall demand for these products. Small ruminants include goat and sheep and constitute the largest livestock number (by stock heads) (Figure 1-13). Most of the herds are found in the Bekaa governorate, followed by North Lebanon (MoA, 2007).

Livestock production is an important activity, particularly in the mountains and in the Baalbeck-Hermel area on the eastern mountain chain where soil fertility is relatively low. In recent years, livestock production, especially goats and sheep, has increasingly relied on feed blocks and feed supplements, thereby reducing dependence on wild grazing and ultimately leading to more sedentary animal production (MoE, 2001). Goat meat supply meets the local consumption needs; however, Lebanon imports 65% of the sheep meat consumed. In general, the country is a net importer of dairy products as well (MoA and FAO 2005a).

The local milk production meets more than one-third of Lebanon's consumption needs (in fresh milk equivalent), including butter and cheese (MoA, 2007). The largest amount of milk is produced from farms in the Bekaa region (Figure 1-14). Cow milk represented 75% of the total quantity of milk produced in 2005, while goat and sheep milk represent 16% and 9% respectively. In 2000, sheep and goats produced 23,000 tonnes and 27,000 tonnes of milk respectively, or 25% of the local milk production.

In Lebanon, agriculture is the most water-demanding sector (about 65-70% of water resources) with irrigation being applied in 50% of all agricultural areas (MoA, 2007). The majority of irrigation techniques are gravity (or surface) irrigation, constituting 57.2% of all irrigated lands, while localized irrigation, including drip techniques, represents 7.7% of all irrigated lands (FAO, 2010). It is generally noted that sprinkler and drip irrigation are more commonly used when irrigation relies on groundwater and for specific crops such as potato, sugar beet and cereals.

Commensurate with the decrease in the total agricultural labor force, the agricultural population and its density are also on a decreasing trend. The average annual decrease in the agricultural population between 1999 and 2007 has been estimated at 5.4% (FAO, 2010). The agricultural population density, measured by the agricultural population per hectare of arable and permanent crops, has decreased from 0.7 in 1990-1992 to 0.3 in 2003-2005, despite a decrease in the area of arable and permanent cropland by 7.2% between 1990 and 2005 (FAO, 2010).

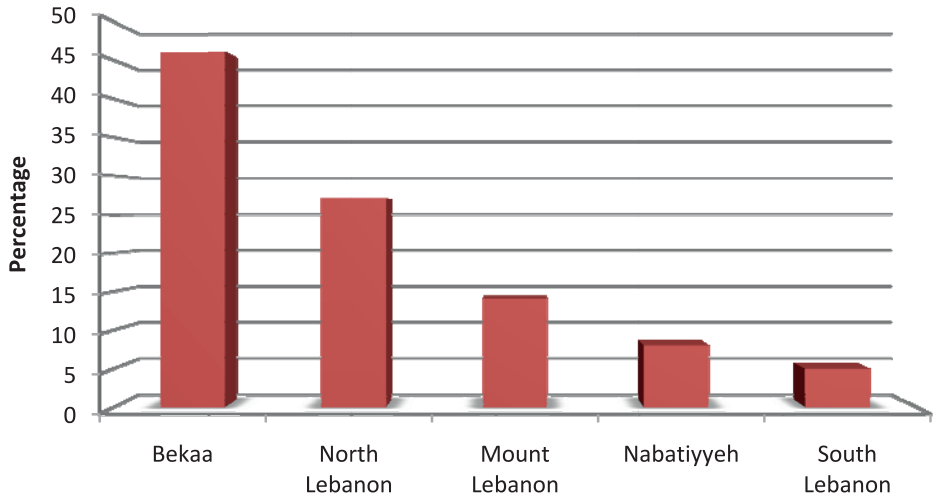

Figure 1-14 Milk production by governorate
Source: MoA, 2007

Population growth has affected the agriculture sector by further increasing urban pressure on agricultural lands, specially that converting agricultural fields to built-up, residential or commercial districts provides a faster return on investment to land owners particularly in coastal and peri-urban areas.

1.8 Forestry

Forests in Lebanon are very particular in their variation and characteristics and represent a unique feature in the arid environment of the Eastern Mediterranean.

In 2000, forests covered 13% (136,348 ha) of the country's overall surface and Other Wooded Lands (OWL) covered 10%. Other lands with trees (including fruit and olive trees) also covered 10% of the surface of the country (Figure 1-15) (MoA and FAO, 2005b).

The main forest species widespread in Lebanon are *Quercus calliprinos*, *Quercus infectoria*, *Quercus cerris, var. pseudocerris* (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). Oak woodlands (*Quercus spp*) constitute the major parts of Lebanese forests and OWL (41.61%), followed by pine forests (*Pinus spp*) (20.28%) while the *Cedrus libani* constitutes a mere 1.6% of the forest cover (MoA and FAO, 2005b).

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. In contrast, cedar forests have received national, regional and international attention due to their historic, symbolic and biological value (Sattout et al., 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).

In Lebanon, 9,119 species have been documented (4,633 flora and 4,486 fauna species). 81% of the floral species are terrestrial, of which 96 species are listed as rare or threatened. Due to Lebanon's geomorphologic diversity and the isolation effect of its diverse topography, 12% of plant species are endemic. Lebanon has 8 nature reserves, 3 biosphere reserves, 16 protected forests, 16 protected natural sites/ landscapes, 4 Ramsar sites and 5 World heritage sites (MoE et al., 2009). Species are distributed and divided into vegetation level zones according to altitude and climatic conditions (Table 1-8).

The forestry sector remains a relatively small employer nationwide; it only contributes to 0.02% of the total labor-force and 0.93% of GDP in 2001 (Sattout et al., 2005). Forest provides several economic resources: forest flora exploitation, beekeeping (USD 14,670,000 (MoA, 2007)), pine nuts production (USD 5,808,000 (Masri et al., 2006)), wood collection and charcoal production (AFDC, 2007), medical and aromatic plants (USD 29,600,000 (MoE et al., 2009), and carob pods (MoA, 2007). The economic value of the different forest ecosystems in Lebanon is estimated at about USD 131,500,000 (Sattout et al., 2005).

Table 1-8 Distribution of vegetation in Lebanon on the different vegetation levels

Floristic ensemble	Vegetation level	Mother-rock		
		Limestone	Marl and Marly limestone	Sandstone
Mediterranean	Thermomediterranean (0-500 m)	*Ceratonia siliqua* & *Pistacia lentiscus* series Thermophilic series of *Quercus calliprinos*	Thermomediterranean series of *Pinus brutia* & *Cupressus sempervirens*	Thermomediterranean series of *Pinus pinea*
	Eumediterranean (500 m – 1,000 m)	Mediterranean series of *Quercus calliprinos* Mediterranean series of *Quercus infectoria*	Mediterranean series of *Pinus brutia & Cupressus sempervirens*	Mediterranean series of *Pinus pinea*
	Supramediterranean (1,000 m – 1,500 m)	Supramediterranean series of *Quercus Calliprinos,* normal series of *Quercus Calliprinos,* Series of *Ostrya carpinifolia* & *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 (1,500 m – 2,000 m)	Series of *Cedrus libani* & *Abies cilicica* Mountainous Mediterranean series of *Quercus cedrorum & Quercus brantii ssp.* Look Mountainous series of *Juniperus excelsa*		
	Oromediterranean (> 2,000 m)	Oromediterranean series of *Juniperus excelsa*		
Mediterranean presteppic		Formation of *Hammada eigii*		
	Mediterranean presteppic (1,000 m –1,500 m)	Presteppic series of *Quercus calliprinos*		
	Presteppic supramediterranean (1,400 m – 1,800 m)	Mixed presteppic series of *Quercus calliprinos & Quercus infectoria*		
	Presteppic mountainous Mediterranean (1,800 m –2,400 m)	Mountainous presteppic series of *Juniperus excelsa*		
	Presteppic oromediterranean (>2,400 m)	Presteppic oromediterranean series of *J. excelsa*		

Source: Abi Saleh and Safi, 1988

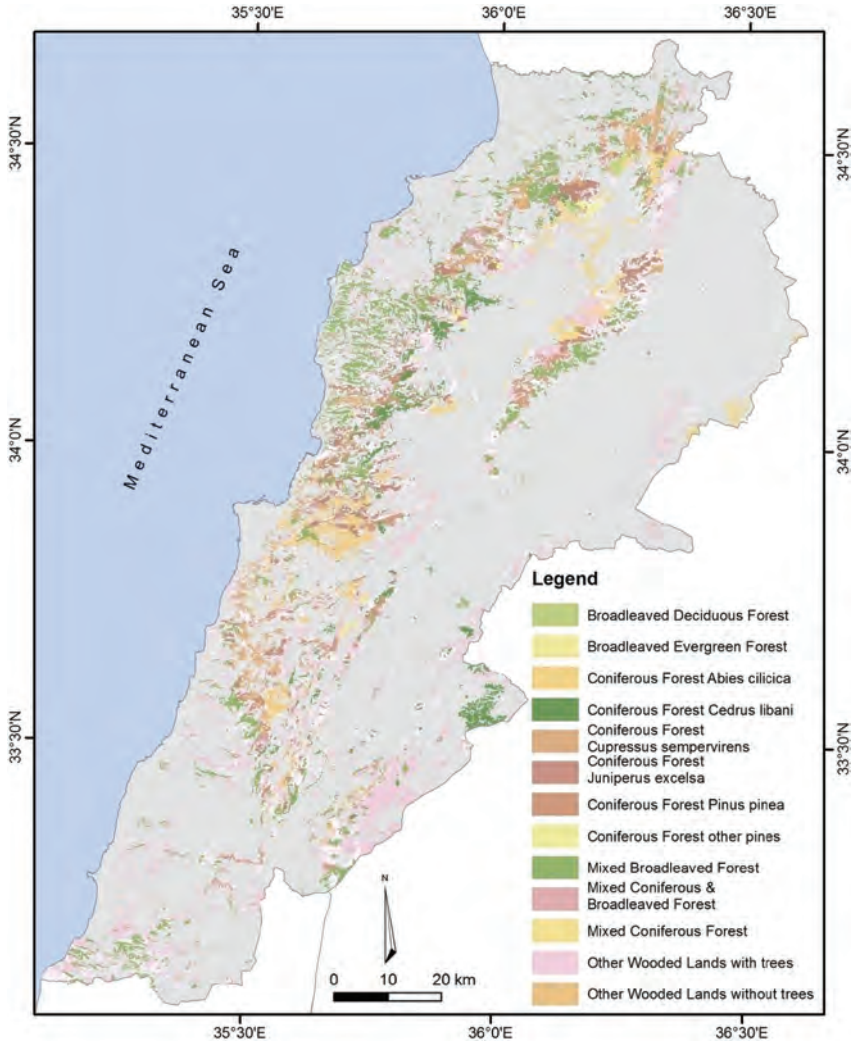

Figure 1-15 Lebanon's derived forest map
Source: MoA and FAO, 2005b

1.9 Energy

1.9.1 Electricity

The Lebanese electricity sector is at the heart of a deep crisis. The sector is unable to supply the reliable electricity needed by homes, offices and industries. It is a massive drain on government finances, crowding out more valuable expenditures on education, infrastructure, social protection, and health, and putting macroeconomic stability at risk. The state of the sector has reached a critical stage, with a massive drain on public resources (estimated at 4% of GDP for 2007 and 4.3% of GDP in 2009), significant revenue loss for industry and commerce, and exorbitant spending on back-up generation by the general population.

Electricity in Lebanon is supplied through Electricité du Liban (EDL), an autonomous state-owned entity under the authority of the MoEW. EDL is responsible for the generation, transmission, and distribution of electrical energy in Lebanon.

Lebanon figures among the countries with high coverage of electric power in the region. In 2002, access to electricity grew to be 96% in Lebanon (IEA, 2004) and it reached 99.9% in 2005 (IEA, 2006).

Demand figures are difficult to estimate for Lebanon, given that total production by existing power plants does not meet actual demand, therefore necessitating imports and self-generation to compensate for the deficit. It is estimated that 33% of the total electricity demand is met through self-generation (World Bank, 2008).

The peak electric load in Lebanon climbed from 1,666 MW in 2000 to 1,936 MW in 2004 (Figure 1-16). In 2009, average demand was 2,000 - 2,100 MW, and the instantaneous peak load in summer was 2,450 MW (MoEW, 2010). However, these figures do not account for the 33% self-generation mentioned above and

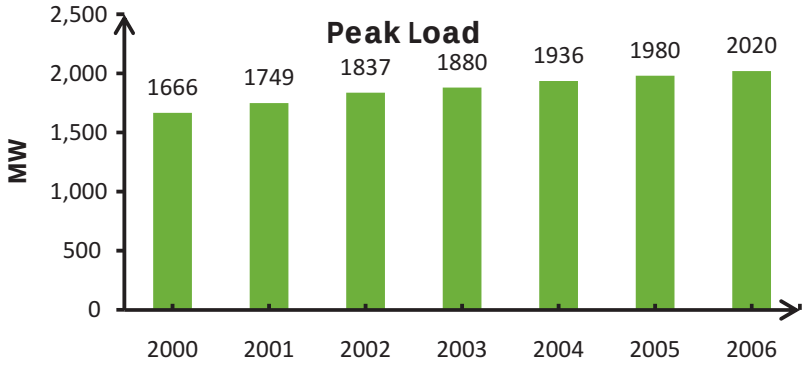

Figure 1-16 Electric Peak Load
Source: OAPEC, 2001-2007

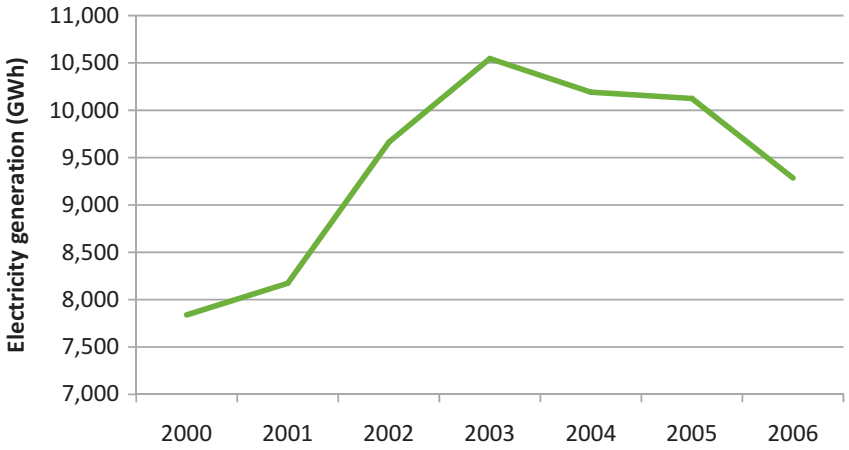

Figure 1-17 Electricity generation from 2000 to 2006.
Source: EDL, 2000 to 2009

when taken into account (i.e., inflate by 33%), the adjusted values show a load of 2,215 MW and 2,575 MW in 2000 and 2004 respectively. Figure 1-16 presents the electric peak load from 2000 to 2006.

Electricity demand met by EDL grew from 7,839 GWh in 2000 to 10,191 GWh in 2004. This represents an increase of around 30% over that period. The trend of electricity generation by EDL from 2000 to 2006 is represented in Figure 1-17.

It is worth noting that the decrease in demand met by EDL in 2006 is partially explained by the destruction of the electricity infrastructure caused by the hostilities with Israel during the July-August 2006 war.

Electricity is produced through 7 power plants and 5 hydropower plants (Table 1-9 and Table 1-10). While public data indicate that the total available capacity amounts to 90% of installed capacity, it is generally accepted that the available thermal power plant capacity currently varies from 1,600 to1,800 MW, i.e., around 70-80% of installed capacity (around 2,200 MW), due to the fact that many power plants are operating below their optimal efficiency. In 2009, installed capacity was 2,038 MW and available capacity 1,685 MW (MoEW, 2010). The total Lebanese hydropower capacity amounts currently to 274 MW, with an actual generation capacity of 190 MW (MoEW, 2010). Hydropower is generated mainly from the three plants installed on the Qaraoun Lake where the three installed turbines have a capacity of 34 MW, 108 MW and 48 MW respectively. The Bared and Nahr Ibrahim plants have an installed capacity of 17 and 33 MW respectively. All the hydropower units are between 40 and 70 years old, but they are not expected to be retired in the near future (CDR, unpublished).

Thermal capacity is divided into Heavy Fuel Oil-fired steam turbines at Zouk, Jiyeh and Hreysheh; diesel-fired Combined Cycle Gas Turbine (CCGT) at Beddawi and Zahrani; and diesel-fired Open Cycle Gas Turbine (OCGT) at Tyre and Baalbeck. As of October 2009, the Beddawi power plant has been operating on natural gas from Egypt, thus reducing demand for gas oil (MoF, 2010).

As already noted, self-generation plays a large role in electricity supply and demand. Power outages are a daily occurrence in Lebanon and in some regions of the country the quality of electricity supply is particularly poor.

Table 1-9 Total capacities and efficiency of thermal power plants in Lebanon

Unit Name	Total installed capacity (MW)	Available capacity (MW)	Efficiency (%)
Thermal			
Zouk	607	520	38
Jiyeh	346	295	33
Tyre	70	70	38
Baalbeck	70	70	38
Zahrani	435	435	48
Deir-Ammar (Baddawi)	435	435	48
Hreisheh	75	N/A*	N/A
Total thermal capacity	2,038	1,770	

* Not available.
Source: EDL, 2009 and World Bank, 2008

Table 1-10 Installed capacity and annual energy of hydropower plants in Lebanon

Unit Name	Installed capacity (MW)	Capacity factor (%)	Annual energy (GWh)
Litani	190	47	775
Al Bared	17	34	50
Safa	13	22	25
Nahr Ibrahim	33	35	100
Qadisha	21	41	75
Total capacity	274	43	1,025

Source: CDR, unpublished

No new power generation capacity has been added since the two combined cycle plants were installed in the 1990s. This has led to a massive investment by low-voltage consumers (households and commerce) and industry in back-up arrangements.

The reason for this is the inability of EDL to meet demand effectively due to insufficient generation capacity, high levels of lost electricity and poor load management. Hence, 33% of total electricity demand in 2003-2004 was met through self-generation, in addition to suppressed demand that is reported to be around 8.8%. Figure 1-18 shows estimated consumption figures for 2006, where self-generation accounts for 33.6% of total consumption, and suppressed demand for 5.3%. Self-generation was reported to increase between 1998 and 2006, and is inflating consumers' electricity bills up to 25% for the sake of "security of supply" (World Bank, 2008).

Electricity has also been imported from Syria for over a decade, and recently (starting 2009) from Egypt, in order to compensate for the shortfall in production. More than 8,000 MWh have been imported since 1998, and the monthly imports usually depend on the availability of surplus in Syria (Byblos Bank, 2010). Table 1-11 shows the annual import figures from 2000 to 2009. In 2006, Lebanon imported up to 200 MW at a price of approximately 12 US¢/kWh (World Bank, 2008), which is cheaper than the cost of electricity generation in Lebanon. Purchases from both countries constitute 7.5% of the total energy production (MoEW, 2010).

Of the electricity supplied by EDL, a significant portion is lost either due to technical losses in the network or due to theft. Technical losses are reported to be in the order of 15% and non-technical losses – which essentially comprise non-billed consumption of electricity through illegal connections on the distribution network – are reported to be about 18%. This 18% of non-billed electricity translates into USD 150 million in lost revenue per year for EDL and is partly explained by a weak billing system within EDL, but also by political interference in the operation of the utility. Over the years, EDL has sought to reduce its non-technical losses, and a decline of about 3% was achieved during 2004-05. As a result of these two types of losses, over 30% of produced electricity is not billed (World Bank, 2008).

In addition, the poor electricity service provided by the public sector is costing the government massive amounts in the form of generalized subsidies required to cover oil bills. These low levels of revenues are caused by the tariffs being set far below cost recovery (as well as an inefficient

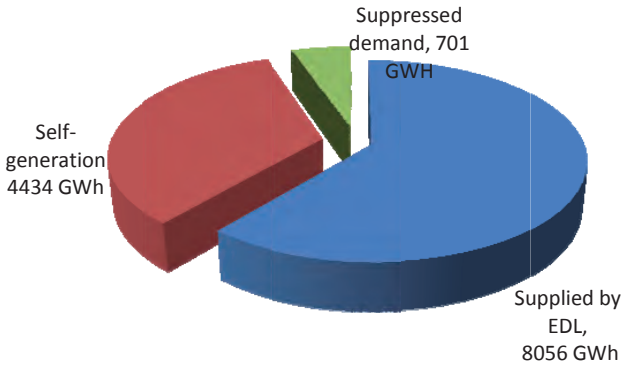

Figure 1-18 Estimated total consumption of electricity in 2006

Table 1-11 Electricity Imports from Syria throughout the years

Year	Imports (GWh)
2000	1,397
2001	1,263
2002	532
2003	-
2004	216
2005	455
2006	929
2007	972
2008	561
2009	1,116*

*** 589 GWh from Syria and 527 GWh from Egypt.**
Source: (EDL, 2000 to 2009)

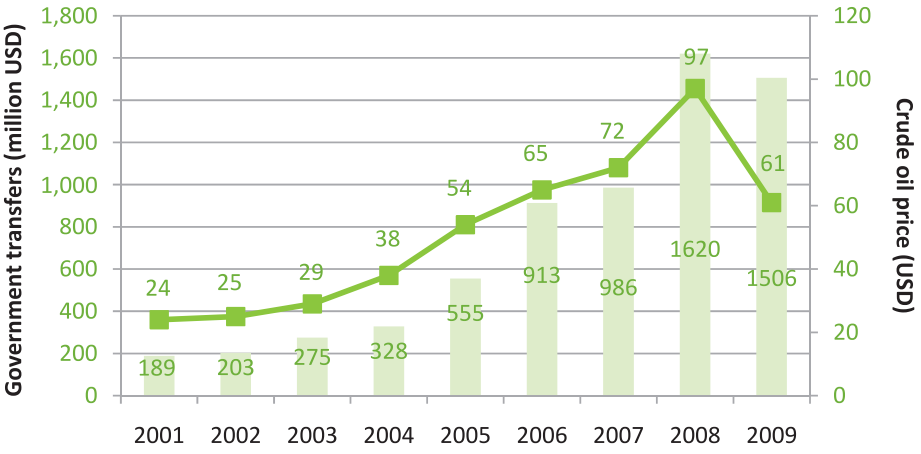

Figure 1-19 Transfers to EDL and crude oil prices (2001-2009)
Source: MoF, 2010

tariff structure), as well as low billings and collections. With the huge increases in international oil prices in recent years, the lack of tariff adjustment since 1996 (when the oil price was USD 21/barrel) has become a clear and present cause of the fiscal drain of the sector (World Bank, 2008).

Moreover, despite the abundance of natural gas in the region, gas-oil (diesel) continued to be used in two major power plants designed to use natural gas, as well as in the gas turbines designed as peaking plants. These turbines were used as base load plants due to insufficient capacity to serve demand, until the end of 2009 when natural gas arrived from Egypt via Jordan and Syria. The high O&M cost of all power plants caused by insufficient regular maintenance, lack of spare parts, and high technical losses, result in very high production costs. Indeed, Lebanon's electricity tariff level is high by regional standards and in relation to service quality, but too low to cover EDL's costs. As a result of the continued service un-reliability, any tariff increase is likely to be met by protest by consumers and a significant decline in the billing and collections (World Bank, 2008).

Given the mismatch between its inlays and outlays, EDL relies considerably on government transfers, aimed primarily at covering the deficit – rather than investment activities – through contributing to the repayment of fuel oil and gas oil bills. The government's financial support to the electricity company dates back to the civil war – although back then, the frequency and structure of transfers was not systematic, as is currently the case (Figure 1-19). The substantial increase in recent years reflects the rise in international oil prices, coupled with growing demand for oil. In 2008, transfers reached USD 1.6 billion, which translates roughly to USD 400/person/year. If total expenditures are taken into account, transfers to EDL constitute the third largest public expenditure item, after interest payments and personnel cost (MoF, 2010).

1.9.2 Transport

The transportation system in Lebanon encompasses land transport, marine transport, and air transport subsystems. The transport infrastructure consists of the road and rail networks, the Beirut-Rafic Hariri International Airport (B-RHIA) and the main sea ports of Beirut, Tripoli, Saida and Tyre. As the existing railway has become idle for the transport of passengers and goods, the land transport infrastructure is practically characterized by the national road network, the vehicle fleet and the public transport system. The government plays an exclusive role in the development, maintenance and management of the transport infrastructure and a limited role in the operation of transport services, namely in the operation of public transport and the currently non-operational railway. The Lebanese road network consisted of 22,000 km of roads in 2001, out of which only 6,380 km (about 30%) were classified as paved roads while the remaining 70% were un-classified roads which are governed by municipalities (MoE, 2005) Classified roads are usually subdivided into international, primary, secondary and local roads and fall under the authority of the MoPWT. The road network suffers from inadequate maintenance and low traffic capacity leading to slow traffic flows, congestion, and poor road safety conditions.

The land transport in Lebanon suffers from major problems including lack of organization. The major cities, particularly the Greater Beirut Area (GBA), suffer from severe congestion and chaotic traffic conditions. Travel demand is growing more rapidly than the transport system's ability to accommodate; in the GBA alone, daily passenger trips are expected to rise to 5 million in 2015 (from 1.5 million in 1995). Major arterial roadways, highways, and intersections suffer from severe under-capacity and delays. The current transport system is dominated by the automobile, which constitutes more than 86% of the fleet. Vehicle kilometers traveled are low, reflecting the fragmentation and the localization of the economy. Private passenger cars account for the majority of intra-city trips (approximately 70%), and both automobile ownership and usage are growing. The total cost of urban congestion in GBA and other major cities and towns is estimated at over USD 2 billion annually, which represents up to 10% of GDP. This, together with other external costs, such as accident and pollution costs, has serious impacts on the economy (MoE, 2005). Road traffic growth in Lebanon from 2003 to 2004 was estimated to be 6.8%, which corresponds to a rate well beyond economic growth, and is expected to remain stable over the coming years. Traffic problems are evident at the entrances to the city of Beirut where bottlenecks develop and long delays are experienced. The coastal highway leading from the north carries a daily traffic volume in both directions of close to 180,000 vehicles while the southern coastal highway has a volume of a little more than 50,000 vehicles. The average speed during the day along the major axes in the GBA ranges between 15 and 30 km/hr, dropping to 10 km/hr and less in the commercial districts within the city at peak times (MoE, 2005).

Intra-city public transport is dominated by service-taxis (shared taxis), with an increasing number of buses, mini-buses, and mini-vans. Most of these vehicles are owner-operated as private enterprises, and function in the absence of regulated schedules or routes. Governmental decisions have resulted in almost a threefold increase in the number of licensed public transport vehicles between 1994 and 2004 (MoE, 2005).

The Lebanese vehicle fleet is dominated by poorly maintained private cars. The vehicle inspections procedure was interrupted for over 15 years up until 2004, which further contributed to poor conditions of the vehicle fleet. In spite of the annual inspection that is undertaken, unlike for trucks and buses, there is no legislation governing passenger vehicle emissions. Decree 6603/1995 sets emission standards for diesel vehicles (trucks and buses) relating to CO, NO_2, hydrocarbons and Total Suspended Particles, but is not enforced.

The fleet size reported in 2003 in Lebanon was 1,081,477 vehicles (MoE, 2005). Figure 1-20 shows the vehicle fleet size between 1997 and 2005 and projections for 2015, when the total size is expected to reach 1,406,103 vehicles – from 1,219,224 in 2005 (MoE, 2005).

The Lebanese vehicle fleet is relatively old and outdated where 60% of the fleet is older than 13 years. Around 40,000 public transport vehicles are distributed between shared-taxis (service-taxis), taxis, buses and minivans, which constitutes an oversupply at very low quality levels. These vehicles are increasing traffic congestion, transport delays and air pollution (MoE, 2005). The occupancy rate of service-taxis is 1.2 passengers/car.

The shared taxi category average age is estimated at 30 years, which consists mainly of Mercedes 200/230 series (1975 to 1979 models) (MoE, 2005). This probably leads to a proportionately higher percentage of emissions released into the atmosphere per vehicle-kilometer or vehicle-hour of congestion than otherwise. Some of the reasons that leads to the conditions above can be attributed to 1) the non-restricted import of vehicles prior to 1995, after which the Lebanese authorities imposed

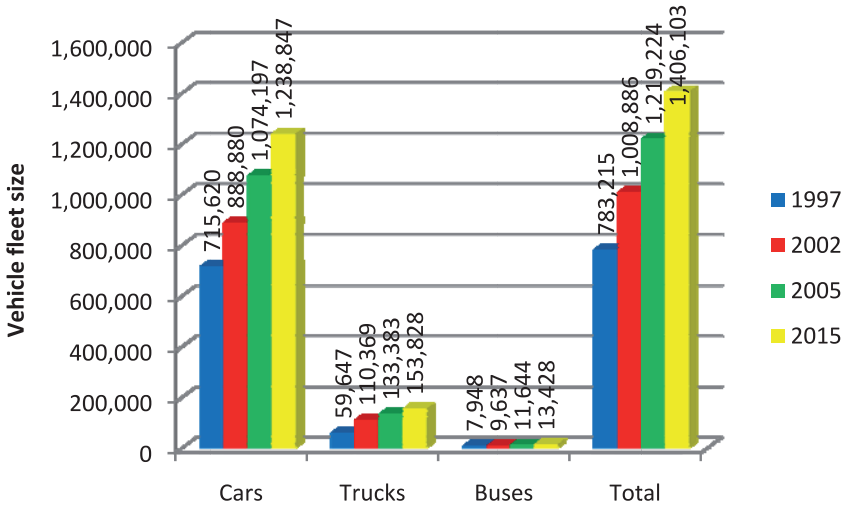

Figure 1-20 Vehicle fleet size between 1997 and 2005 and projections for 2015.
Source: MoE, 2005

new regulations banning the import of vehicles above 8 years old, 2) the existing tax system which imposes higher import taxes on newer (and more expensive) vehicles, 3) the cost of vehicle registration and of the annual license which decreases with vehicle age.

Lebanon has a very high car ownership reaching to around 526 cars/1,000 persons, with car imports in the range of 100,000 annually, out of which 50% are new cars. The high car ownership may be attributed to 1) a weak and unreliable public transport system, 2) weak urban planning practices, 3) socio-cultural stigma associated with bus riding and car ownership, 4) availability and affordability of old vehicles, as well as of credit facilities for the purchase of newer cars (MoE, 2005).

The public transport sector in Lebanon suffers from major organizational and technical problems, including 1) the lack of government planning, regulation and enforcement, and efficient, reliable, clean and cost-effective mass transport system where safety regulations are applied, 2) oversupply of vehicles resulting in low ridership and low revenues among operators, which in turn leads to the neglect of vehicle maintenance and insurance.

Goods distribution in GBA has no clear logistics setup: the location of make-shift warehousing in residential buildings poses a serious safety as well as logistical concern. The chaotic loading and unloading procedures in urban streets are increasing exacerbating roadway congestion. Issues impeding the development of efficient and competitive freight movement also include complex procedures across international borders, licensing requirements, high fees and lack of coordination among authorities. This results in a serious lack of competitiveness and impedes the growth of the Lebanese economy (MoE, 2005).

1.10 Waste

1.10.1 Solid Waste

Lebanon annually generates an estimated 1.56 million tonnes of municipal solid waste. A daily average of 0.75 to 1.1 kg/capita is generated in urban areas, while the daily average in rural areas stands at 0.5 to 0.7 kg/capita (MoE-METAP, 2004). The average annual growth in municipal solid waste (MSW) generation is estimated at 3.62%.

Proper MSW management systems are operational in the GBA, in Zahle and to some extent in Tripoli. Illegal dumping and open burning of MSW are common where most towns or cities operate open dumps within their jurisdictions. The illegal dumping and uncontrolled burning of MSW endangers flora and fauna and their habitats, deteriorates local air quality and creates a nuisance thereby decreasing the quality of life in neighboring areas (MoE, 2005). Table 1-12 indicates the different management systems of MSW by region.

In the GBA, MSW management services are contracted out to the private sector, including street sweeping, collection, sorting, treatment and disposal of waste. The GBA generates 12% of the total MSW stream in Lebanon, of which only 15% are composted and 5% are recycled (EC, 2006). The remaining MSW of GBA (80%) is disposed of by landfilling in the Bsalim landfill (for bulky waste) and

Table 1-12. Summary of MSW management systems in Lebanon by region

Governorates	MSW Management System
North Lebanon	Open dumping and burning, except in five municipalities of Greater Tripoli
Akkar	Open dumping and burning
Mount Lebanon	Covered under the Greater Beirut Area contract except for: the entire District of Jbeil and parts of Aley, Kesrouan, Baabda and Metn
Beirut	Entirely covered under the GBA contract
South Lebanon	Open dumping and burning
Nabatiyeh	Open dumping and burning
Baalbek-Hermel	Open dumping and burning
Bekaa	Open dumping and burning except for 15 municipalities in the District of Zahle which dispose of their MSW in the Zahle landfill

Source: MoE, 2005

in the Naameh landfill (for inert material), dramatically reducing the projected lifetime of the sanitary landfill in Naameh.

Outside the GBA, the MSW management is the responsibility of municipalities. At the national level, recycling rates of MSW remain low (7.7% in 2004) (CAS, 2007).

1.10.2 Wastewater

Lebanon generates an annual average of 250 Mm^3 of domestic wastewater (0.68 Mm^3/day) (UoB, 2004). Less than 68% of dwellings have access to public sewage networks. Beirut has the highest rate of connection to public sewage network while Nabatiyeh has the lowest rate (Table 1-13) (CAS, 2004). Most towns and villages lack public wastewater drainage and infrastructure.

Table 1-13 Percentage of housing connected to the sewage network

Governorate	Percentage (%)
Beirut	99.1
Mount Lebanon	74.9
North Lebanon	61.1
South Lebanon	65.7
Nabatieh	17.9
Bekaa	45.7
Average	67.4

Source: CAS, 2004

The most commonly used wastewater disposal methods at the household level are traditional concrete-lined sanitary pits and unlined boreholes that are dug into the bedrock, which poses a high risk of groundwater aquifer contamination through seepage (EC, 2006; UoB, 2004).

As of 2000, some 30 wastewater treatment plants were planned to be installed in different regions. Wastewater treatment plants are now at various stages of execution: under construction/under preparation/secure funding, which are expected to solve the untreated wastewater problem and to improve the quality of surface water, sea water and groundwater (CDR, 2009).

1.11 Health Profile

While being in the midst of demographic transition, Lebanon is towards the end of its epidemiological transition phase: the health and financial impacts of infectious diseases are declining, whereas the incidence and cost of chronic non-communicable diseases are on the rise (Ammar, 2009), putting the traditional health system under stress.

Health services are abundantly available in Lebanon and the majority of the population has access to an outpatient facility within a 10-minute walk, and a hospital within a 20-minute drive (Ammar, 2009).

By the end of the civil war, only half of the 24 public hospitals were operational, with an average number of active beds not exceeding 20 per hospital. The Government's 1993 Reconstruction Plan aimed at rehabilitating and building public hospitals in order to have at least one in each governorate.

On the other hand, the development of the private hospital sector was relatively less affected by the civil disturbances and continued to grow both in number and capacity to represent more than 90% of the total number of hospital beds in the 1990s, and decreased to 80% with the operationalization of new public hospitals (Ammar, 2009).

In the period between 1975 and 1995, UN agencies played a major role in conducting essential health programs in joint coordination with NGOs. Ever since, NGOs have been successfully providing health services by contributing to joint preventive programs carried out by the MoPH and UN agencies. Furthermore, some NGOs have been playing a meaningful supporting role in the health system by conducting surveys or training workshops, or by providing logistical support through purchasing, stocking and distributing essential medical

Table 1-14 Distribution of health providers by governorate in 2006

	Beirut	Mount Lebanon	South Lebanon	Nabatiyeh	North Lebanon	Bekaa	Total (100%)
Private Hospitals	21	64	24	10	34	38	189
Public Hospitals	2	6	4	6	7	5	30*
PHC Centers	136	402	219	113	63	152	1,085

*Only 23 are operational.
Source: Ammar, 2009

Table 1-15 Budgetary resources in the public health sector

Indicator (Year 2004)	Amount
MoPH allocated budget (as % of total government budget)	3.67
Public expenditure on health (as % of GDP)	2.35
Annual MoPH budget (USD per capita)	63.97

Source: Ammar, 2009

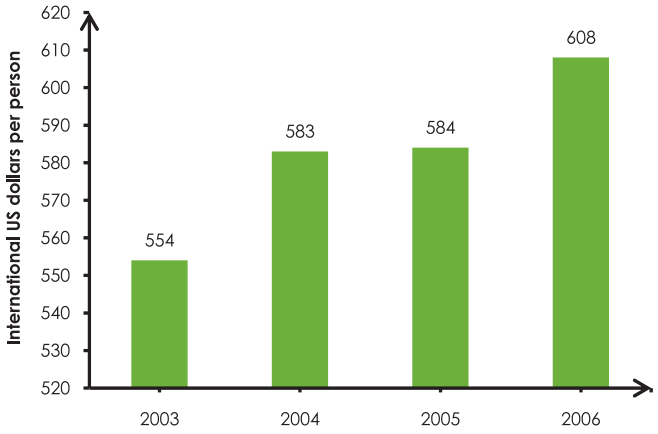

Figure 1-21 Total expenditure on health per capita in Lebanon.
Source: WRI, 2006

supplies to a vast network of primary health care centers (health centers and dispensaries). In 2006, the number of such centers reached 1,085, distributed throughout Lebanon, out of which 142 are affiliated with the MoPH. Each health center has a defined catchment area and provides general medical care including pediatrics, cardiology, reproductive health and oral health.

The distribution of the different types of health service providers by governorate is shown in Table 1-14.

With an allocation that never exceeded 4% of the total government budget, the MoPH has to cover the hospitalization cost of uninsured patients and provide them with expensive treatments that cannot be afforded by some households. In fact, the share of health spending as a percentage of total household spending reached 9.23% per household in 2004 and the households' out-of-pocket direct payments were estimated at 44% of the total health expenditures by households and intermediaries in 2005. Indicators for budgetary resources for the year 2004 are presented in Table 1-15. These allocations have been growing over years with the development of the MoPH's financing function, leaving scarce resources to prevention, public health and regulation functions (Ammar, 2009).

On the overall, public expenditures on health, as a percentage of total expenditure and total expenditures on health per capita in Lebanon have been increasing reaching USD 583/capita in 2004 (Figure 1-21).

After the July War of 2006, the MoPH initiated the Early Warning Alert and Response System (EWARS) in the areas that were most affected by the war. Consisting of mainly health centers and the dispensaries in the South, following it success, it was expanded throughout 2007 to 2009 to cover all regions in the country. The objectives of EWARS are to:

- Establish a surveillance network for the early detection and monitoring of infectious diseases with epidemic potential or those targeted for elimination/eradication, as well as for other, new emerging and re-emerging infectious diseases;
- Enhance the role of health institutions in preventive health activities, by involving them in disease surveillance;
- Strengthen the district, regional and central capacity to respond to potential outbreaks of new emerging and re-emerging diseases through the formation of rapid response teams at each level;
- Enhance communication of public health information about communicable diseases within the health system institutions and at the level of the population (WHO, 2010a).

1.12 Tourism

Lebanon boasts a diverse culture, distinctive geography and rich history on which it has relied to promote its touristic image in the domestic and international tourism and recreation markets. The country receives international tourists from all over the world, but particularly from neighboring Arab states and European countries. Despite having a typical Mediterranean climate, the country faces tough competition from other eastern Mediterranean states over European tourists. Nevertheless, Lebanon's temperate climate relative to that of many Arab states serves to boost its touristic image among Arab tourists.

There are different forms of tourism and recreation that are influenced differently by climate and climatic changes. Touristic activities and infrastructure in Lebanon are concentrated in the high mountains where ski resorts and winter chalets are located, and in the hills overlooking Beirut and the coast where "country clubs" are found (MoE, 2005) (Figure 1-23). The tourism sector in Lebanon is active throughout the year, but peaks during the summer months of July and August (Table 1-16).

In recent years, Lebanon has registered a significant increase in the number of ecotourism providers and in 2004, 56,000 visitors entered Lebanon's nature reserves (MoE, 2008), a growth of around 56% from the year 2000.

The number of international arrivals of non-resident tourists grew steadily between 2000 and 2004, but has been fluctuating since 2005, mainly due to the weak security situation that has prevailed in 2005 and 2006. Tourism is a driving force for the local economy, generating USD 6,000 million in international receipts in 2004, up from USD 742 million in 2000 (Figure 1-22). In 2003, tourism accounted for 34.2 % of GDP, compared to 27.6% in 2004 (UNWTO, 2009).

Table 1-16 Percentage distribution of total arrivals by season between 2000 and 2008

	Percentage of Arrivals								
Season	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Winter	18	20	17	17	17	19	22	22	19
Spring	25	26	24	24	25	26	33	25	22
Summer	34	34	36	38	36	39	21	27	30
Autumn	22	20	22	21	21	35	24	26	29
Total Number of Arrivals* (in Million)	2.7	2.8	3.3	3.5	4.0	3.6	2.0	5.5	6.5

* Figures include arrivals of Lebanese and Syrian nationals
Source: (CAS, 2000-2008)

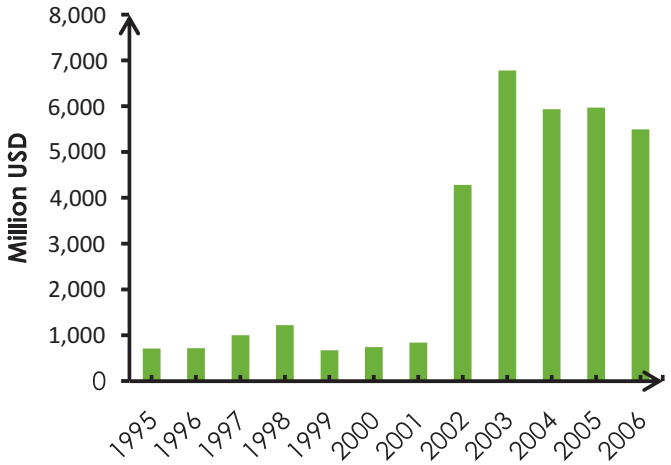

Figure 1-22 International tourism receipts between 1995 and 2006
Source: WRI, 2008

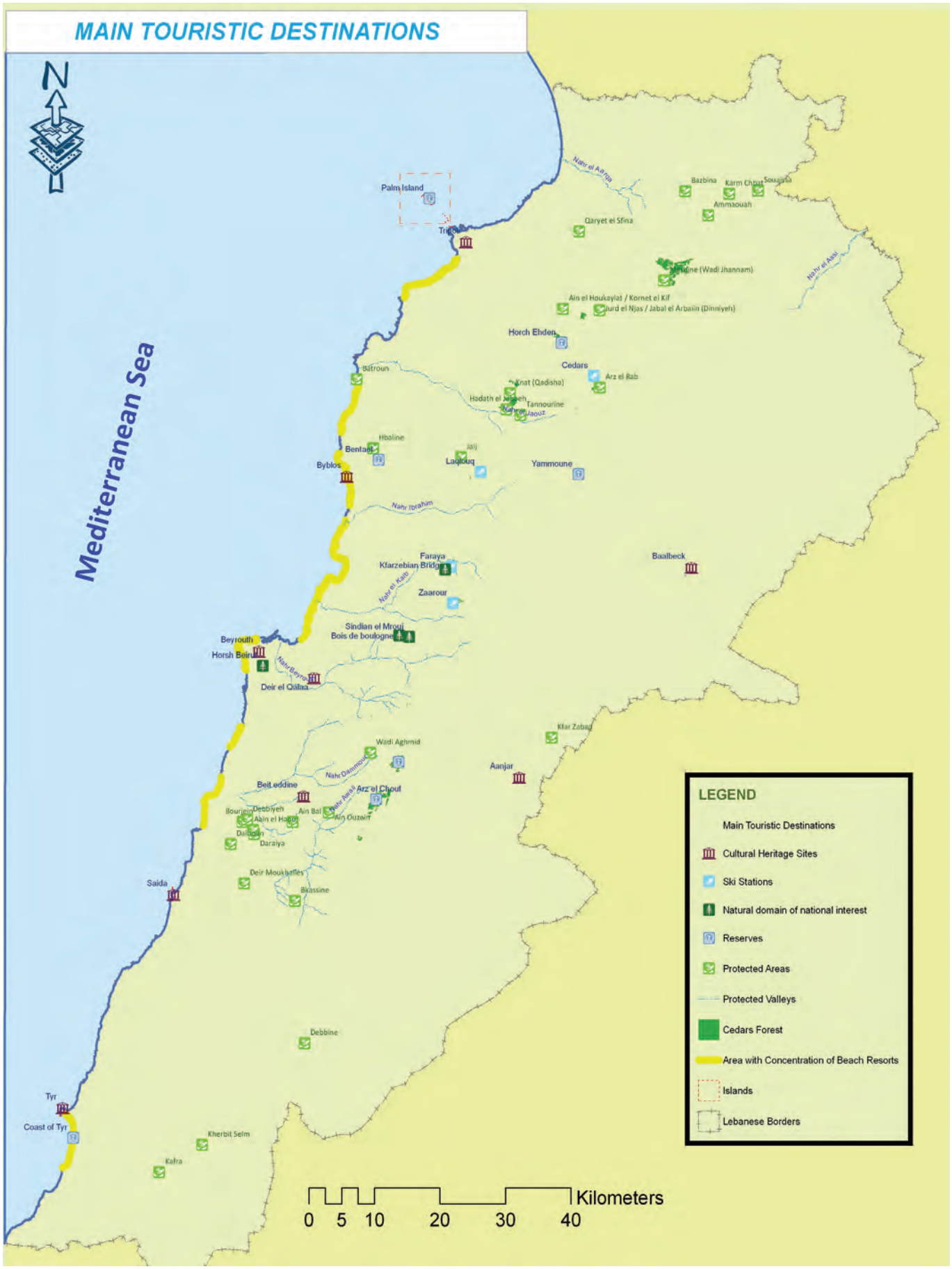

Figure 1-23. Map of the main touristic attractions and areas in Lebanon