

## **ANNEX G – PEST MANAGEMENT PLAN (PMP)**

In line with ESS3, Pesticides should only be used to the extent necessary as part of an Integrated Pest Management (IPM) or Integrated Vector Management (IVM) approach, and only after other pest management practices have failed or proven ineffective.

IPM refers to a blend of ecologically-focused and agriculture-focused pest management practices that aim to reduce reliance on synthetic chemical pesticides. This involves: (i) managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them; (ii) rely, where possible, on non-chemical measures to keep pest populations low; and (iii) select and apply pesticides, where they are to be used, in a manner that minimizes adverse effects on beneficial organisms, humans, and the environment.

IVM refers to integrating both chemical and nonchemical interventions to manage disease vectors, the objective being to limit the reliance on chemical pesticides.

An effective IPM/IVM Plan shall:

- Select cultivars and varieties on an understanding of their characteristics, including response to sowing or planting time, productivity, quality, market acceptability, disease and stress resistance, edaphic and climatic, adaptability, and response to fertilizers and agrochemicals.
- Identify and assess pests, thresholds and control options and the risks associated with those control options.
- Rotate crops to reduce the presence of insects, diseases or weeds in the soil or crop ecosystems and maximize benefits of cultural practices that optimize biological prevention of pests and diseases, and where appropriate inclusion of non-host crops legumes to provide reservoir for natural enemies a biological source of nitrogen.
- Apply fertilizers, organic and inorganic, in a balanced fashion, with appropriate methods and equipment and at adequate intervals to replace nutrients extracted by harvest or lost during production.
- Support beneficial biological control organisms – such as insects, birds, mites and microbial agents – to achieve biological pest control (for example, by providing favorable habitat, such as bushes for nesting sites and other native plants that may harbor predators of pests and parasites).
- Maintaining vegetation cover of the soil to inhibit the build-up of soluble nitrogen by absorbing mineralized nitrogen and minimizing leaching during periods of rain; Prioritize manual, mechanical and/or selective weeding.
- Maximize the benefits to soil and nutrient stability by re-cycling crop and other organic residues.
- Consider using mechanical controls, such as traps, barriers, light and sound, to kill, move or repel pests.
- Use pesticides to complement these approaches, not to replace them.
- Integrate livestock into crop rotations and utilize the nutrient cycling provided by grazing or housed livestock to benefit the fertility of the entire farm.
- Before purchasing any pesticide, assess the nature and degree of associated risks and effectiveness, taking into account the proposed use and intended users.

In 2020, the MOA published the National Agriculture Strategy for 2020-2025. The strategy calls for the adoption of good agricultural practices (GAP), supporting and training farmers on the use of biological pest control and integrated control with the aim of decreasing the use of chemicals and pesticides and mitigating pollution<sup>3</sup>.

The MOA in collaboration with the Food and Agriculture Organization (FAO) has been implementing Projects with the objective of reduction of pollution through the promotion and application of IPM-Good agricultural practices by farmers. GATE project can build on the

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<sup>3</sup>MoE, UNDP, UNHCR, UNICEF, 2020

previous experiences and achievements of the MOA in collecting baseline data, developing IPM training curricula and technical capacities of MoA technical staff and farmers to promote and develop further the adoption of the IPM concept in Lebanon<sup>4</sup>.

Where the use of pesticides is justified, they should be stored, handled and applied in accordance with the recommendations for the management of hazardous materials presented in the General EHS and Agribusiness/Food Production Guidelines of the World Bank and the National regulations under the control of the Ministry of Agriculture. The objective being to prevent, reduce or control potential contamination of soil, wildlife, groundwater or surface water resources from accidental spills during transfer, mixing, storage and application of pesticides,

Pest control in Lebanon is regulated by:

- Law 728/2006: Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.
- Law 432/2002: Stockholm Convention on POPs and classification of POPs according to their source as pesticides, industrial (IPOP) and unintentionally released (UPOP).
- Law 6/68: Regulation of trade of pesticides
- Various decisions by the Ministry of Agriculture (MoA) such as (i) MoA Decision 310/1-2010 that regulates the import, registration and use of agricultural pesticides in Lebanon and defines the requirements and conditions for registration and (ii) MoA Decision 311/1-2010 that requires that pesticide consignments be inspected at the port of entries and samples analyzed for active ingredient content and impurities that may have toxicological characteristics

Staff handling and applying pesticides should be appropriately trained. The staff shall:

- Ensure that all pesticides used are manufactured, formulated, packaged, labelled, handled, stored, disposed of and applied in accordance with the FAO International Code of Conduct on Pesticide Management.
- Not buy, store, use or trade pesticides that fall contain active ingredients that are restricted under the international conventions and protocol and under the World Health Organization (WHO) recommended classification of pesticides by Hazards and Guidelines to Classification 2019.
- Not use pesticides listed in WHO Hazard Class II (Moderately Hazardous), unless the project has appropriate controls established regarding manufacture, supply or distribution and/or the use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment and facilities to handle, store, apply and dispose of these products correctly.
- Preferably use selective pesticides with a low Environmental Impact Quotient (EIQ) where appropriate, rather than broad-spectrum products, in order to minimize impacts on non-target species.

### Storage

In Lebanon, pesticides are predominantly stored by farmers in agricultural areas. However, some of the pesticides are stored in residential areas (10% of the pesticides in the South and 17% in northern Mount Lebanon) are stored in residential areas.<sup>5</sup> Recommended practices for storing pesticides are summarized below:

- Store all pesticides in a lockable container or warehouse with a barrier that has enough space to collect any spills without contaminating the environment. Stores should be away from water sources, residential and built-up areas, and livestock and feed storage areas.
- Obtain spill kits and institute appropriate control measures in case of accidental spills.
- Store all pesticides in their original labeled containers and ensure that storage instructions are followed.
- Keep a record of all pesticides purchased, noting when they were received, the amount used, the amount left in store and their location.
- Keep product Safety Data Sheets (SDSs) in appropriate places in storage facilities.

<sup>4</sup> FAO (2020) Briefing note on Integrated pest management. Retrieved March 2023, from <https://www.fao.org/3/cb1199en/CB1199EN.pdf>

<sup>5</sup> MoE, UNDP, UNHCR, UNICEF, 2020

- Warehouses should have adequate ventilation, secondary containment, showers and emergency kits.

#### Handling

- Operators must read, understand and follow product label instructions for safe mixing, application and disposal; use qualified personnel for critical operations (eg mixing, transfers, tank filling and application).
- Insist that the correct Personal Protective Equipment (PPE) (eg gloves, coveralls, eye protection) for each route of exposure listed in the SDS is worn at all times when handling and applying pesticides.
- Require that all mixing and filling of pesticide tanks be done in a designated filling area. It should be away from waterways and sewers. If on concrete, liquids spills should be collected and disposed of as hazardous waste and ensure spills are cleaned up immediately using appropriate spill kits; spills should not be washed into waterways or sewers.

#### Application

- Use the method of application with the lowest EHS risk and ensure that non-target organisms are not affected.
- Select pesticide application technologies and practices designed to minimize offsite movement or runoff (e.g., low drift nozzles, using the largest droplet size and lowest pressure appropriate for the product).
- Establish buffer zones around waterways, residential and built-up areas, and livestock and feed storage areas.
- Ensure all equipment is well maintained and properly calibrated to apply the correct dosage.
- Insist that applications take place under appropriate weather conditions; avoid wet weather and windy conditions.

#### Arrangement

- Any unused diluted pesticides that cannot be applied to the crop, as well as rinse water and pesticides that are obsolete or no longer approved, should be disposed of as hazardous waste, in accordance with FAO guidelines.
- The majority of farmers in Lebanon burn empty containers (87% in Akkar and 64% in the South) or throw them with the municipal waste (60% in northern Mount Lebanon and 50% in Central Bekaa). Other practices include throwing empty containers in fields or rivers, handing them over to municipalities or selling them.<sup>6</sup> Empty pesticide containers, foil seals, and lids should be triple-rinsed, and washings used in the pesticide tank should be sprayed on the field or disposed of as hazardous waste in a manner consistent with FAO guidelines and according to the manufacturer's instructions. Containers should be stored safely under cover prior to safe disposal; they must not be used for other purposes.

#### Fertilizers

- Store fertilizers in their original packaging and in a dedicated lockable room clearly identified by signs, access to which is limited to authorized persons.
- Ensure that SDSs and inventories are available at fertilizer storage facilities and available to first responders if needed.
- Buy and store only the fertilizers that are needed, and use older fertilizers first.
- Keep fertilizer stores separate from pesticides and machinery (fuels, ignition or heat sources).
- Know and understand the fertilizer needs of each crop and apply only what is needed, when needed, to minimize losses to the environment.
- Set up a suitable training program for personnel responsible for the transport, handling, loading, storage and application of fertilizers.

Any agricultural sub-project to be funded by the Gate project, shall submit an IPM Plan that shall contain the following components and activities:

- Technical plan on how IPM will be implemented
- Training and Awareness raising Plan. The sub-project proponent can seek advice from MoA professionals and trainers. Specific training and awareness raising activities on IPM shall be conducted based on need assessment.

<sup>6</sup> MoE, UNDP, UNHCR, UNICEF, 2020

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- Safety and Storage of Pesticides Plan following the instruction of the MoA for the safe use, handling and storage of pesticides, and the proper use, maintenance and storage of pesticide spraying equipment and the provisions of this Annex on IPM and pesticide management
- Monitoring and Reporting: The sub-project shall have means to demonstrate implementation of the IPM.

## **ANNEX H FULL ENVIRONMENTAL BASELINE DESCRIPTION**

This chapter presents the environmental and social baseline and settings related to the GATE project. This Chapter will present general background information about Lebanon.

### **1. ENVIRONMENTAL OVERVIEW**

#### **(a) GEOGRAPHICAL LOCATION**

Lebanon is a Middle Eastern country located in Western Asia and bordered by the Syrian Arab Republic from north and east, Palestinian territories from the south, and the Mediterranean Sea from the west. The country extends over an area of 10,452 square kilometers only. Despite the small area of Lebanon, the country has been a host of civilizations and cultures throughout history, similarly to many other Mediterranean countries.

#### **(b) CLIMATE AND METEOROLOGY**

Lebanon has a typical Mediterranean climate characterized by a long, hot, and dry summer, and cool, rainy winter. Temperatures gradually decrease during winter season and precipitations either accumulate in groundwater reservoirs through infiltration, or run-off. When springs and water courses are revived again, the spring season begins.

The topography of the country, with an elevation gain that extends only about 40 kilometers, affects the climatic patterns. Along the coast, summers are hot and humid, with little or no rain.

Temperatures may vary from one area to the other, depending on the time during the day and the altitude. Temperatures may reach above 38° C in the daytime and below 16° C at night. The proximity of the sea to the coastal area acts as a buffer effect on the climate, making the range of temperatures narrower than it is inland.

Precipitation records vary from one year to the other, with major rainfalls occurring during the month of December and January. The influence of the Mediterranean Sea is abated by the altitude and, although the precipitation is even higher than it is along the coast, the range of temperatures is wider, and the winters are more severe. The Beqaa Valley and the Anti-Lebanon Mountains witness less precipitation and humidity levels than other parts of the country, as the Mount Lebanon Mountains Chain creates a microclimate for the former areas.

The average annual precipitation in Lebanon is reported to be between 8.6 billion m<sup>3</sup> and 9.7 billion m<sup>3</sup>, of which 1 billion m<sup>3</sup> is due to snow (MoEW/UNDP, 2014; Fayad et al., 2017).

Figures referenced by Ziad Hajjar (1997) and recorded at 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 B). Measurements were taken over several years ranging from 3 years in Terbol and Mayfouq stations to 51 years in the Tripoli station. The lowest level recorded for the country was 80 mm while the maximum observation reached 3,010 mm.

**Table B Precipitation levels recorded by region**

|                      | NUMBER OF STATIONS | STATION ALTITUDE |      | PRECIPITATION (MM/YEAR) |     |      |
|----------------------|--------------------|------------------|------|-------------------------|-----|------|
|                      |                    | LOW              | HIGH | YEARLY AVERAGE          | MIN | MAX  |
| <b>Beirut</b>        | 4                  | 15               | 34   | 891.75                  | 393 | 1600 |
| <b>North</b>         | 25                 | 2                | 1925 | 1055                    | 425 | 1890 |
| <b>Mount-Lebanon</b> | 36                 | 45               | 1840 | 1210.16                 | 421 | 3010 |
| <b>South</b>         | 26                 | 5                | 1150 | 933.27                  | 342 | 2139 |
| <b>Beqaa</b>         | 36                 | 650              | 1510 | 705.42                  | 80  | 2374 |
| <b>Lebanon</b>       | 105                | 5                | 1840 | 787                     | 80  | 3010 |

Source: Hajjar, 1997

The dominant wind direction is westerly from sea to land during the day, while it reverses at night (from land to sea).

Monthly and long term mean wind speed data at 10 m above ground level from the Météo Liban meteorological stations measurements showed wind velocities in the range of 1.6 to 9.1 m/s throughout the country (MOEW/UNDP, 2011)

### **(c) TOPOGRAPHY**

The landscape of Lebanon is influenced by natural systems that extend outside the country. Thus, the Beqaa valley is part of the Great Rift system which stretches from Southern Turkey to Mozambique in Africa.

A major feature of Lebanese topography is the alternation of low lanes and high land running in a parallel manner with a north-to-south orientation. There are four longitudinal strips between the Mediterranean Sea and Syria, which are from west to east as follows:

- A flat and narrow coastal strip (maritime plain) parallel to the Mediterranean Sea
- The Mount-Lebanon chain
- The Beqaa Valley (Central plateau)
- The Anti-Lebanon Mountains Chain

The steepness in Lebanese mountains highly affects the climate and weather in the Beqaa Valley, and at high altitudes.

### **(d) GEOLOGY**

The current geomorphological matrix of Lebanon is highly influenced by the historical geological events that occurred. The main tectonic events that happened are uplift, collision and changes in sea level, which have shaped the structural features and depositional environments of the country.

The uplift in the late Jurassic to early Cretaceous Eras was the first major tectonic event that is documented in the geological history of Lebanon (MOEW/UNDP, 2014). The second tectonic event is the closure of the Tethyan Sea in the early Tertiary Period. The first event led to the exposure, erosion and karstification of the Jurassic Limestone. The second event induced the formation of a collision zone, which has led to the first gentle uplift of Mount Lebanon and Anti-Lebanon Ranges (MOEW/UNDP, 2014). These events were separated by times of rise in sea level,

which has caused the deposition of thick limestone units mainly in the early Jurassic, late Jurassic and middle Cretaceous periods. The early Cretaceous period was characterized by the delta river deposits that were mainly sands and clay and that reach a thickness of 300 m in central Lebanon.

At the end of the Miocene epoch, the Messinian Salinity Crisis occurred, which is a major regional event. This event led to the deposition of thick salt layers and the development of karstification due to a major drop in sea level by about 1000 m following the closure of the Mediterranean Sea. The presence of these salt deposits has been well documented by the recent offshore seismic surveys conducted for oil exploration (Kosi et al, 2012). Moreover, the collision of the Arabian and Asian plates, during the Eocene and Oligocene epoch, led to the shaping the NNE-SSW trending features (MOEW/UNDP, 2014).

The main structural features are shaped by the major tectonic events that are recorded in the geological history of Lebanon (Figure H). These structures have an impact on controlling the groundwater flow directions; they can serve either as a preferential pathway or as a flow-restricting boundary. They are divided into primary and secondary structures. The Primary structures are divided into: 1) primary faults (Yammouneh, Rashaya, Hasbaya, Roum and Serghaya) 2) primary folds (North Mount Lebanon Anticline, Barouk-Niha Anticline, Beqaa Syncline/garben, North Anti-Lebanon Anticline and Mount Hermon Anticline) and 3) platforms (Akkar, Tyre and Saida-Damour) as per the MOEW/UNDP Study (2014). The secondary structures are divided into secondary faults, which are trending in a NW-SE, NE-SW, ENE- WSW and E-W direction, and secondary folds, mainly trending in an NNE-SSW direction parallel to the primary faults (MOEW/UNDP, 2014).

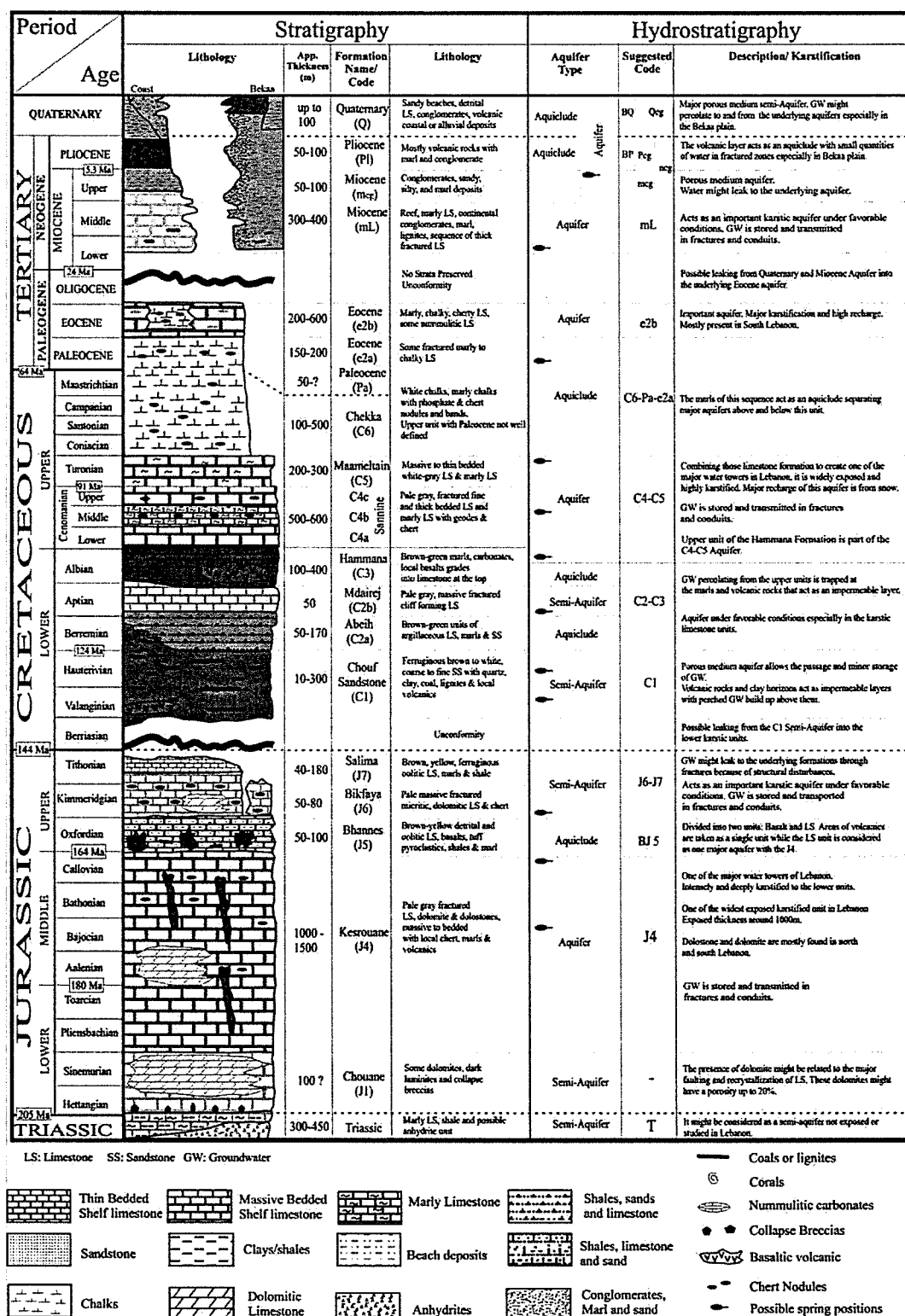


Figure H Stratigraphy and Hydro-stratigraphy of Lebanon (Source: MoEW/UNDP, 2014)

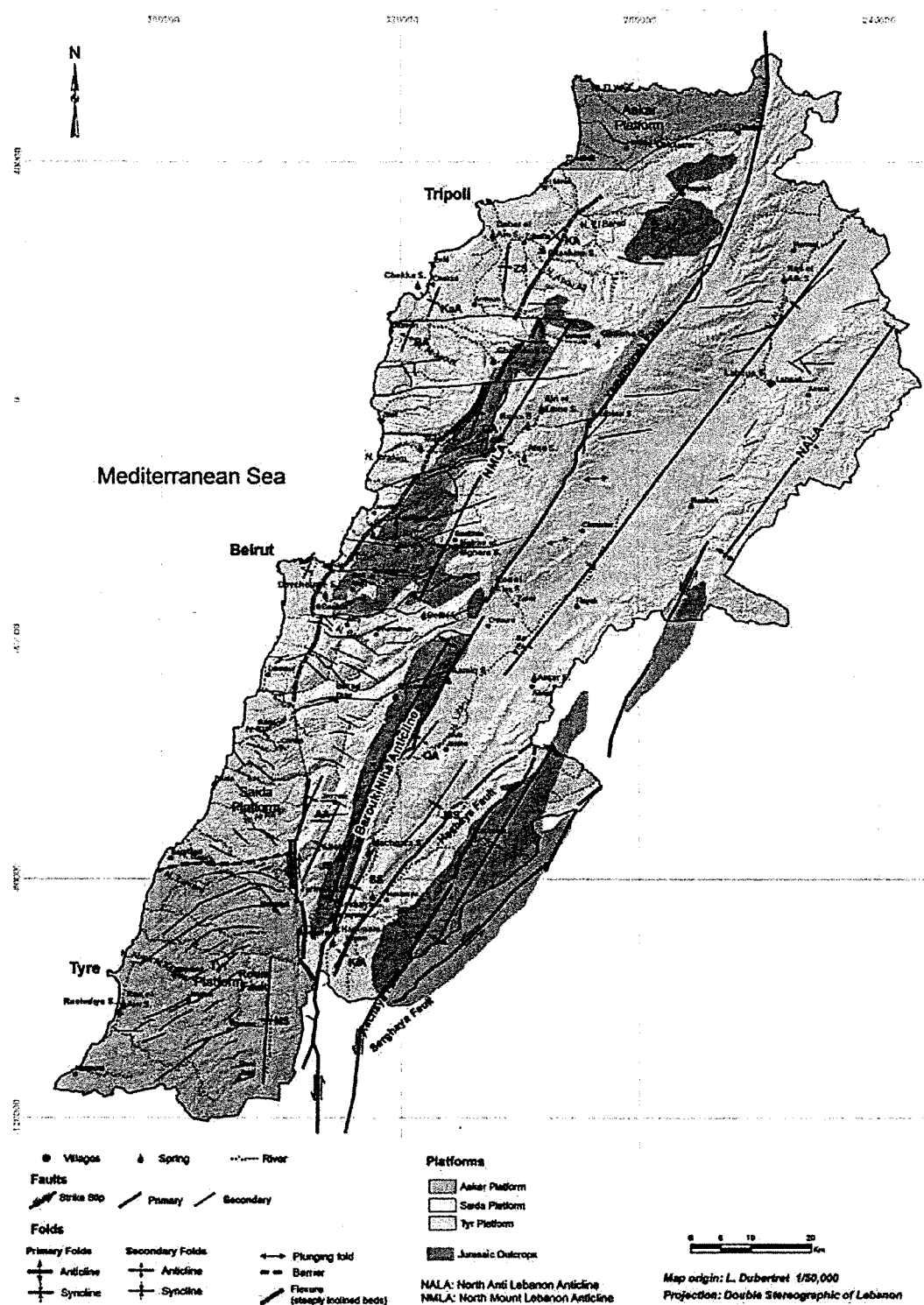


Figure I Major geological structural features of Lebanon (Source: MoEW/UNDP, 2014)

### **(e) HYDROGEOLOGY**

The hydro-stratigraphic units of the country are classified into three (3) main groups: aquifers, semi-aquifers and aquicludes.

A total of three (3) hydro-stratigraphic units are considered as karstic aquifers in Lebanon, two (2) of which are considered the main aquifers of the country (the Kesrouane aquifer J4 aquifer) and the Sannine-Maameltein aquifer (C4-C5 aquifer). They are the two (2) water towers (Chateau-D'eau) of Lebanon and cover about 5590 km<sup>2</sup>, which is about 54% of the country's surface area. The third aquifer is the Upper Eocene Formation (e2b). Given their highly karstified nature and extent that favor a high storage and recharge capacity, all three aquifers were considered to be karstic. The recharge of the aquifers in Lebanon mainly occurs through rainfall, snow and sometimes through losing streams. Infiltration in karstic aquifers is usually highest along high altitudes where precipitation increases. Groundwater tends to flow along preferential pathways enhanced by fractures and cavities in karstic limestone such as the e2b, C4-C5 and J4 aquifers making them highly vulnerable to groundwater pollution. Moreover, the presence of the Yammouneh Fault System and Roum Fault System along with other fault systems in Lebanon (Figure J), helps in enhancing the fractures and cavities in karstic aquifers (MOEW/UNDP, 2014).

Besides aquifers, several semi-aquifers are present in Lebanon. The semi-aquifers usually have medium vulnerability to surface water pollution. This is because some semi-aquifers such as the Chouf Sandstone (C1) and Quaternary/Neogene (Q/n including mcg and mL) have the tendency to filter the percolating water. However, some semi-aquifers (mainly Mdairej C2b) are considered as highly karstified, especially in the presence of nearby faults (MOEW/UNDP, 2014).

Aquicludes are considered to have very low vulnerability to surface water pollution. This is mainly due to the lithostratigraphic characteristics of an aquiclude that limits the groundwater interaction between the overlying and underlying geological formations (MOEW/UNDP, 2014).

Figure K provides a Simplified Stratigraphy and Hydro-stratigraphy of Lebanon (adapted from Walley 1995; Abbud & Aker, 1986).

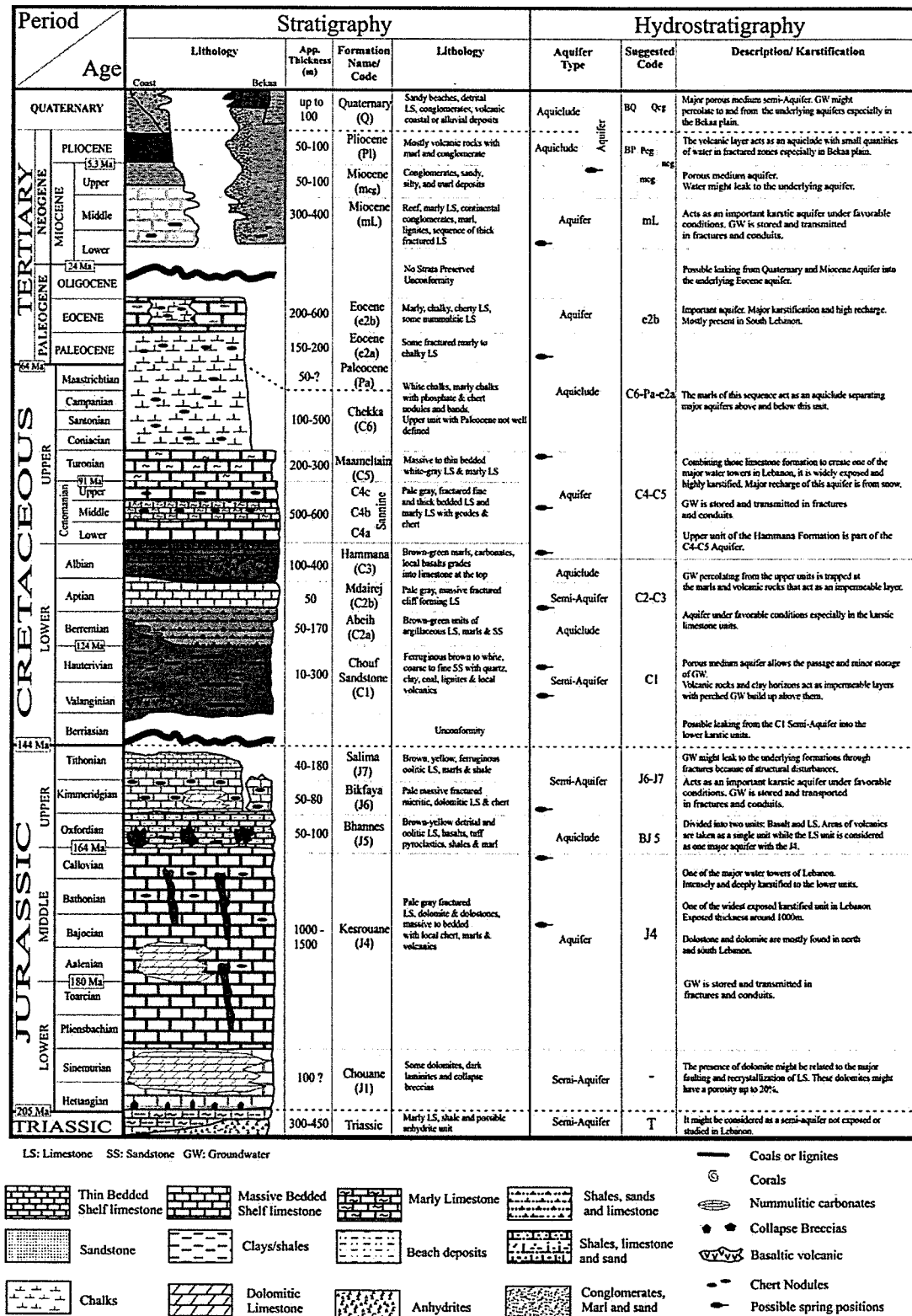


Figure J Stratigraphy and Hydrostratigraphy of Lebanon

## Springs and Wells

### Springs

A total of about 5,050 springs are depicted in the 1:20,000 topographic maps of Lebanon. The major springs in Lebanon are fed by either the Sannine-Maameltain (C4-C5) Aquifer such as Afqa Spring, Keserouane Aquifer (J4) such as Ain El Delbi, or both, which is the case in the Wazzani Spring (MOEW/UNDP, 2014).

### Wells

The UNDP 2014 study revealed the presence of 841 public wells in Lebanon. The survey showed that the operational public wells are exploiting the various aquifers at an estimated rate of about 248.7 million m<sup>3</sup>/year. The water of the wells is mainly used for domestic purposes. As for private licensed wells, the UNDP, 2014 study revealed the presence of 20,537 wells. More than 50% of the private licensed wells are located in Beirut and Mount Lebanon areas. The estimated number of unlicensed private wells is almost three (3) times higher than the number of licensed private wells (about 55,000 to 60,000 wells). The water extracted from private wells is being used for agricultural, domestic, industrial and commercial purposes (MOEW/UNDP, 2014).

It should be mentioned that the Water Law 192/2020 that amends the Water Code (Law 77/2018), article 37, urges citizens who have an unlicensed well to settle their violation and legitimize their status within a period of two years, the consequence of not doing so being the closing of the well. A committee or unit should be established at MoEW to support the practical execution of this article that includes, at least, a hydrogeologist, a legal counsel, a representative from the concerned WE and evaluates the applications put forth by the public, the well's effect on aquifers and other sources, and the WE's capacity to supply water (MOEW, 2022).

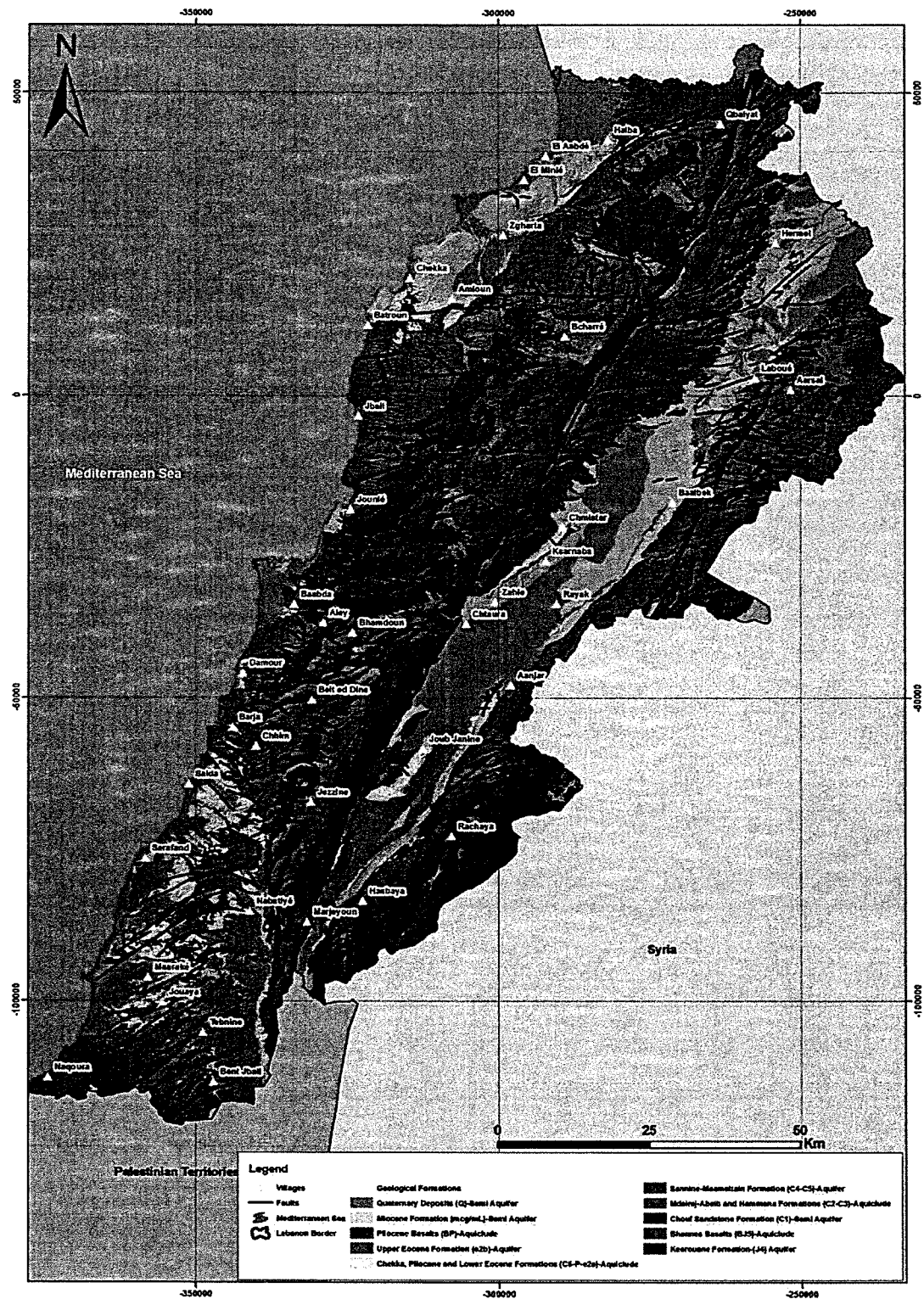


Figure K Simplified Geological Map of Lebanon

Source: Dubertret, 1953

## **(f) SURFACE HYDROLOGY**

More than thirteen (13) rivers cut through Lebanon as shown in **Error! Reference source not found..** The main rivers with recognizable flow rates are the Litani River, Orontes (Assi) River, El Kebir River and Hasbani River. With the exception of the Litani River, which flows entirely within the country's borders, all other main rivers are Transboundary Rivers (MOEW/UNDP, 2014).

The Litani River originates from Baalbek Caza and flows south towards Zahle and West Beqaa where it is trapped by Qaraoun Dam. From Qaraoun Dam it flows toward South Lebanon and Nabatieh governorates before discharging into the Mediterranean Sea. Its total length reaches about 170 Km. The estimated average annual flow volume of the Litani River at Qillaya Gauging Station is around 51 million Cubic Meters (MCM). It is worth noting that the upper watershed of the Litani River is heavily polluted, more than the lower basin (MOEW/UNDP, 2014).

The Orontes River, also named as Al Assi River, is a transboundary river that originates in Lebanon, and flows into Syria to discharge into the sea in Antakya, Turkey. It initiates in Lebanon and is mainly fed by two major springs; Al Assi and Ain Ez Zarqa Springs. It also receives surface runoff from areas located at both sides of its course. Its average flow rate, estimated from the flow record collected between 2001 and 2013, is about 11 m<sup>3</sup>/s (MOEW/UNDP, 2014).

El Kebir River is a permanent river that flows along the Lebanese-Syrian country border in a west-northwest direction and discharges into the Mediterranean Sea. El Kebir River is gauged at the sea mouth, having an estimated yearly average flow of 474 million Cubic Meters (MCM).

The Hasbani River is a permanent river that flows south for about 40.2 km from its starting point before exiting the country and crossing into bordering nations. The Wazzani Spring emerges on the side of the Hasbani River and discharges into it. The estimated average annual flow volume of the Hasbani River (segment within Lebanon) is around 149 million Cubic Meters (MCM) (MOEW/UNDP, 2014).

Besides the main rivers, several small-scale rivers (such as Damour River, El Bared River, Ibrahim River, Nahr el Kalb, etc.) are present in Lebanon (**Error! Reference source not found.**). All those rivers tend to flow towards the west, eventually discharging into the Mediterranean Sea (MOEW/UNDP, 2014).

It is worth noting that inland wetlands are also present in Lebanon. The wetlands are located in Ammiq and Kfarzabad villages and are considered as Himas (protected areas) with high ecological value.

According to the Updated Water Sector Strategy 2020-2035, there are six operational dams/hill lakes in the country: Chabrouh Dam (Mount Lebanon), Ballout Lake (Mount Lebanon), Qaysamani Lake (Mount Lebanon), Kouachra Lake (Akkar), Yammouneh Lake (Baalbek-Hermel) and Qaraoun Dam (Beqaa) with a total dynamic capacity of around 314 MCM/year, mainly concentrated in Qaraoun and Chabrouh dams (MoEW, 2022). There are also other dams under construction, on hold or requiring repair, as shown in **Error! Reference source not found..**

**Table C Total Dynamic Storage Capacity of Existing Dams**

| Dam                | Static Storage (Mm³/y) | Dynamic Storage (Mm³/y) | Dam Height (m) | Status       | Usage                         |
|--------------------|------------------------|-------------------------|----------------|--------------|-------------------------------|
| <b>BMLWE</b>       |                        |                         |                |              |                               |
| Chabrouh Dam       | 9                      | 11                      | 65             | Operational  | Potable/Irrigation            |
| Ballout Lake       | 0.5                    | 0.5                     | 15             | Operational  | Potable/Irrigation            |
| Qaysamani Lake     | 1                      | 1                       | 15             | Operational  | Potable                       |
| Janneh Dam         | 38                     | 95                      | -              | Under Const. | Potable/Irrigation/Hydropower |
| Boqaata Dam        | 6                      | 12                      | 71.5           | Under Const. | Potable                       |
| Bisri Dam          | 125                    | 125                     | 73             | On Hold      | Potable/Irrigation            |
|                    | 180                    | 245                     |                |              |                               |
| <b>NLWE</b>        |                        |                         |                |              |                               |
| Kouachara lake     | 0.4                    | 0.4                     | 11             | Operational  | Irrigation                    |
| Brissa Dam         | 0.8                    | 0.8                     | 35             | Needs repair | Irrigation                    |
| Mseilha Dam        | 6                      | 12                      | 71.5           | Under Const. | Potable/Irrigation            |
| Balaa Dam          | 1.2                    | 2.2                     | 35             | Under Const. | Potable                       |
|                    | 8.4                    | 15.4                    |                |              |                               |
| <b>BWE</b>         |                        |                         |                |              |                               |
| Yammouneh Lake     | 1.45                   | 1.45                    | 7              | Operational  | Irrigation                    |
| Assi Dam - Phase I | -                      | 63                      | 10             | On Hold      | Irrigation                    |
| Qaraaoun Dam       | 220                    | 300                     | 62             | Operational  | Potable/Irrigation/Hydropower |
|                    | 221.45                 | 364.5                   |                |              |                               |

Total storage capacity at country scale: Static = 410 Mm³/y - Dynamic = 625 Mm³/y

Source: MOEW, 2022

According to the Green Plan report of 2016, since 2012, Green Plan has been implementing Hill lakes for farmer groups. The Hill lakes designated for groups of farmers are shown in Map 1 and either have been completed or are being studied.

There are 33 lakes in total, with a 1,465,000 m³ capacity. The following assumptions should be noted:

- All hill lakes that were supposed to be built in 2016 were finished on schedule (funds are available and reserved)
- Each lake is efficiently exploited to 70% of its capacity (the rest is lost by evaporation and other factors)
- As supplemental irrigation from the lake, each beneficiary from the common Hill lake will irrigate 2.5 dunums (0.25 ha).
- 3000 m³/ha is the projected average water need.

The total irrigated area every year will be 342 ha, and there will be 1,367 beneficiary farms overall.

Green Plan helps beneficiary farmer groups to create water users groups (water user association), in collaboration with the municipalities where municipalities exist, in order to manage the lakes.

**Error! Reference source not found.** illustrates hill lakes that have been constructed, are under construction or were supposed to be executed in 2016-17 for farmers groups by Green Plan.

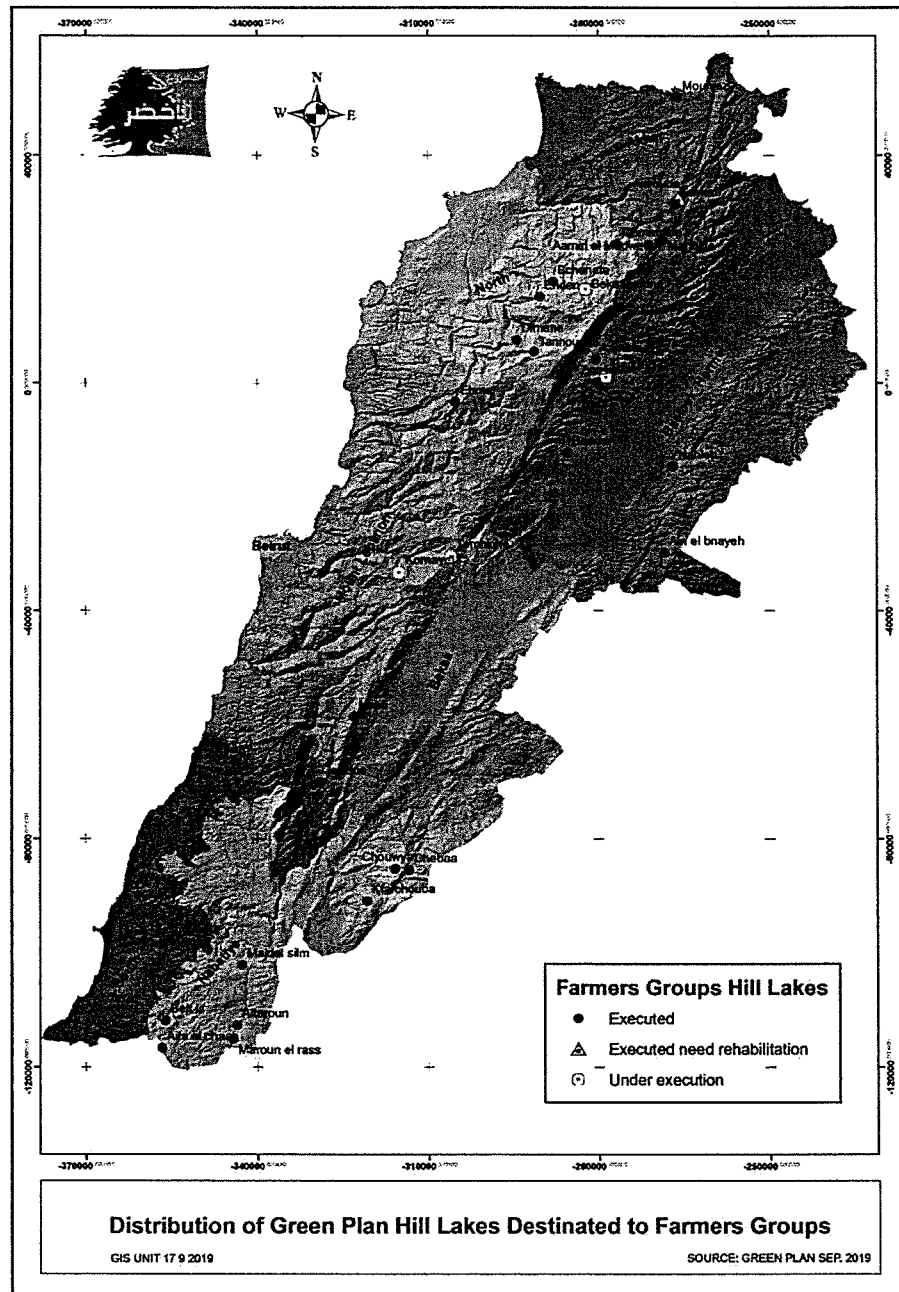


**Figure 1 Distribution of Common Hill Lakes Executed and those that will be Executed in years 2016 – 2017 and Related to Farmer Groups**

Source: Green Plan, 2019

Green Plan has received support from various international organizations to execute projects within its mandates, including the construction of hill lakes (Green Plan, 2016):

- The Hilly Areas Sustainable Agricultural Development Project (HASAD) project funded by the International Fund for Agricultural Development (IFAD) comprised the construction of a minimum of 18 small and a maximum of two medium size hill lakes for storing water from springs, runoffs and harvested water for irrigation by small groups of farms. Each hill lake has a capacity between 20,000 m<sup>3</sup> and 100,000 m<sup>3</sup>. The total capacity of water that will be harvested through HASAD project will be around 800,000 m<sup>3</sup>.
- The Agriculture and Rural Development Programme (ARDP), funded by the European Union under the framework of the European Neighborhood Policy (ENP) comprised the construction of hill lakes with a total capacity of 160,000 m<sup>3</sup> (8 medium-sized hill lakes), in addition to provision of support to farmers and cooperatives to manage irrigation networks and to adequately use modern irrigation systems, and development of their capacities.
- The Climate Smart Agriculture: Enhancing Adaptive Capacity of the Rural Communities in Lebanon (AgriCAL) project funded by IFAD aimed to increase community resilience and adaptive capacity to climate change in the Project Areas (Akkar-Donniyeh, North Baalbek-Hermel, South Litani (downstream of Qaraoun Lake). The project covered the following activities: rainwater harvesting from greenhouse roof tops, roads rehabilitation and water efficient irrigation systems deployment.

**Error! Reference source not found.** present the hill lakes executed/under execution by the Green Plan for groups of farmers between 2010 and 2019. Their total capacity is 1,293,000 m<sup>3</sup>; and the corresponding total irrigated area is 6,465 dunums.

Table D Collective Hill Lakes Executed by the Green Plan between 2010 and 2019

| Nb | Name of the lake    | Casa           | Capacity m <sup>3</sup> | Financial source for execution | Status                       | Cost LL       | Ystereo | Xstereo | Year of execution | Irrigated area (dunum) | Nb of beneficiaries |
|----|---------------------|----------------|-------------------------|--------------------------------|------------------------------|---------------|---------|---------|-------------------|------------------------|---------------------|
| 1  | Aainata             | Baalback       | 20,000                  | ARDP                           | Executed                     | 339,486,495   | 4101    | -280441 | 2019              | 100                    | 33                  |
| 2  | Amiri el Madwe      | Hermel         | 55,000                  | Hassad                         | Executed                     | 749,674,500   | 24264   | -271018 | 2018              | 275                    | 92                  |
| 3  | Aarouba             | Hermel         | 120,000                 | National budget                | Executed need rehabilitation | 2,940,374,150 | 32400   | -265816 | 2013              | 500                    | 167                 |
| 4  | Ain el Beniye       | Baalback       | 30,000                  | Hassad                         | Executed                     | 668,571,000   | -29772  | -268304 | 2015              | 150                    | 50                  |
| 5  | Alita el Chaab      | Bint jbeil     | 18,200                  | Hassad                         | Executed                     | 443,842,500   | -116647 | -356745 | 2016              | 91                     | 30                  |
| 6  | Aitaroun            | Bint jbeil     | 12,300                  | Hassad                         | Executed                     | 179,890,500   | -112659 | -343530 | 2015              | 61.5                   | 21                  |
| 7  | Baraka              | Baalback       | 40,000                  | Hassad                         | Under execution              | 429,861,000   | 1010    | -278573 | 2019              | 200                    | 67                  |
| 8  | Bchenata            | Minyeh Daniyeh | 75,000                  | ARDP                           | Executed                     | 265,823,205   | 17768   | -287945 | 2019              | 375                    | 125                 |
| 9  | Beit Leif           | Bint jbeil     | 28,000                  | Hassad                         | Executed                     | 544,942,500   | -111860 | -356053 | 2016              | 115                    | 38                  |
| 10 | Bekaasafine         | Minyeh Daniyeh | 100,000                 | Hassad                         | Under execution              | 805,347,000   | 16454   | -282198 | 2019              | 500                    | 167                 |
| 11 | Boudai              | Baalback       | 47,000                  | Hassad                         | Executed                     | 731,605,500   | -12174  | -285355 | 2016              | 235                    | 78                  |
| 12 | Chebaa              | Hassbaya       | 30,000                  | Hassad                         | Executed                     | 469,764,000   | -85495  | -313420 | 2015              | 150                    | 50                  |
| 13 | Chouwaya            | Hassbaya       | 15,000                  | ARDP                           | Executed                     | 288,275,025   | -85218  | -315864 | 2019              | 75                     | 25                  |
| 14 | Deir el Moukhalles* | Shouf          | 55,000                  | NA                             | Executed                     | US\$ 257,392  | NA      | NA      | NA                | NA                     | NA                  |
| 15 | Dimane              | Bcharreh       | 100,000                 | National budget                | Executed                     | 2,948,758,943 | 7559    | -294362 | 2013              | 600                    | 200                 |
| 16 | Ehden               | Zgharta        | 25,000                  | National budget                | Executed                     | 573,579,026   | 15104   | -290277 | 2014              | 102.5                  | 34                  |

| Nb | Name of the lake   | Casa           | Capacity m <sup>3</sup> | Financial source for execution | Status                       | Cost LL       | Ystereo | Xstereo | Year of execution | Irrigated area (dunum) | Nb of beneficiaries |
|----|--------------------|----------------|-------------------------|--------------------------------|------------------------------|---------------|---------|---------|-------------------|------------------------|---------------------|
| 17 | Ehmej              | Jbeil          | 30,000                  | Hassad                         | Executed                     | 390,981,000   | -3342   | -305154 | 2016              | 150                    | 50                  |
| 18 | Hadaith el Jebbeh* | Bcharreh       | 34,000                  | NA                             | NA                           | US\$ 372,947  | NA      | NA      | NA                | NA                     | NA                  |
| 19 | Jezzine            | Jezzine        | 27,000                  | ARDP                           | Executed                     | 384,998,355   | -70024  | -328985 | 2019              | 135                    | 45                  |
| 20 | Kaykab             | Hermel         | 67,000                  | Hassad                         | Under execution              | 659,358,000   | 31457   | -266300 | 2019              | 335                    | 112                 |
| 21 | Kfarchouba         | Hassbaya       | 45,000                  | Hassad                         | Executed                     | 737,934,000   | -90840  | -320702 | 2018              | 300                    | 100                 |
| 22 | Kornayel           | Baabda         | 20,000                  | Hassad                         | Under execution              | 358,168,500   | -33337  | -315067 | 2019              | 325                    | 108                 |
| 23 | Majdel Silm        | Marjeyoun      | 24,000                  | Hassad                         | Executed                     | 529,248,000   | -102078 | -342692 | 2018              | 90                     | 30                  |
| 24 | Makneh*            | Baalbek        | 28,900                  | NA                             | Executed, temporary handover | US\$ 394,233  | NA      | NA      | NA                | NA                     | NA                  |
| 25 | Marjhine           | Hermel         | 16,500                  | Spanish grant                  | Executed                     | 621,385,470   | 25045   | -268582 | 2013              | 202.5                  | 68                  |
| 26 | Maroun el Ras      | Bint jbeil     | 25,500                  | Spanish grant                  | Executed                     | 558,099,113   | -115069 | -344221 | 2012              | 127.5                  | 43                  |
| 27 | Medwi*             | Hermel         | 53,500                  | NA                             | Executed                     | US\$ 53,500   | NA      | NA      | 2019              | NA                     | NA                  |
| 28 | Mounjez            | Akkar          | 46,000                  | Hassad                         | Executed                     | 614,116,500   | 50164   | -265965 | 2019              | 250                    | 83                  |
| 29 | Mristi             | Chouf          | 50,000                  | National budget                | Executed                     | 1,533,216,443 | -58555  | -323023 | 2012              | 250                    | 83                  |
| 30 | Nahle              | Baalback       | 20,000                  | Hassad                         | Executed                     | 477,183,000   | -14619  | -266790 | 2016              | 100                    | 33                  |
| 31 | Qemamine           | Minveh Daniyeh | 18,500                  | Spanish grant                  | Executed                     | 508,345,583   | 24438   | -276612 | 2013              | 102.5                  | 34                  |
| 32 | Tannourine         | Batroun        | 20,000                  | National budget                | Executed                     | 658,590,000   | 5486    | -291266 | 2016              | 150                    | 50                  |
| 33 | Tarchiche          | Baabda         | 38,500                  | ARDP                           | Under execution              | 491,906,100   | -30508  | -306047 | 2019              | 192.5                  | 64                  |

| Nb           | Name of the lake | Casa     | Capacity m <sup>3</sup> | Financial source for execution | Status          | Cost LL                                            | Ystereo | Xstereo | Year of execution | Irrigated area (dunum) | Nb of beneficiaries |
|--------------|------------------|----------|-------------------------|--------------------------------|-----------------|----------------------------------------------------|---------|---------|-------------------|------------------------|---------------------|
| 34           | Zrazir           | Baalback | 45,000                  | Hassad                         | Under execution | 333,672,000                                        | 107     | -280114 | 2019              | 225                    | 75                  |
| <b>Total</b> |                  |          | <b>1,379,900</b>        |                                |                 | <b>LBP 21,236,997,408</b><br><b>US\$ 1,078,072</b> |         |         |                   | <b>6,465**</b>         | <b>2,155</b>        |

\* Added based on an update by the Green Plan

\*\* Excluding the lakes of Deir el Moukhalles, Hadath el Jebbeh, Makneh, and Medwi.

Source: Green Plan, 2019

Green Plan's objectives are to:

- Increase the irrigation water harvesting and storage capacity by 2.35 million cubic meters through supporting the construction of 400 individual hill lakes and 30 collective hill lakes, as well as 1,500 tanks.
- Improve the efficiency of irrigation water use of Green Plan constructed lakes through reaching 5,000 farmers, connecting 30 collective hill lakes to a distribution network down to the parcel level, and enhancing their cooperative management, rehabilitating 16 small springs' canals, and supporting the conversion of 425 ha to more efficient irrigation systems.

### (g) OVERVIEW ON IRRIGATION

There are currently about 100,000 hectares of irrigated land in the country, according to an inventory of irrigation schemes (MOEW, 2022).

**Irrigation efficiency is between 50 and 60% under the current irrigation conditions, taking network losses and irrigation practices into account. At the national level, a representative hectare's (ha) average annual irrigation water need is presently 8,400 m<sup>3</sup>/ha. Current irrigation water demand is illustrated in**

Table 2-2.

**Table E Present irrigation water demands**

| WE    | Irrigated area (ha) | Commonly used rates in Lebanon (m <sup>3</sup> /ha/year)                                       | Total needs Mm <sup>3</sup> /year |
|-------|---------------------|------------------------------------------------------------------------------------------------|-----------------------------------|
| NLWE  | 23,600              | 7,500<br>(most of the area is coastal)                                                         | 177                               |
| BMLWE | 5,835               | 6,500<br>(most of the irrigated area is at high altitude)                                      | 38                                |
| BWE   | 66,115              | 9,000<br>(most of the irrigated area is inland/dry weather)                                    | 595                               |
| SLWE  | 4,210               | 7,500<br>(most of the area is coastal)                                                         | 32                                |
| TOTAL | ~100,000            | 8,435<br>(Average irrigation water requirement for one representative ha at the country level) | 842                               |

Source: MOEW, 2022

According to the Agricultural National Census (MoA, 2010), only 50% of the area that is irrigated is supplied by natural surface water, with the remaining 50% coming from either "expensive" subsurface water or hill lakes. Additionally, 35% of the irrigated areas are only partially irrigated, while 65% of the irrigated areas are permanently irrigated. It is therefore estimated that approximately 75% of the current irrigation water requirement, or about 630 Mm<sup>3</sup>, are currently supported by available water for irrigation and reflect the actual irrigation water consumption figure throughout the nation. Out of these 630 Mm<sup>3</sup>, 315 Mm<sup>3</sup> are thought to be covered in surface water and the remaining by groundwater.

According to calculations of the water balance at the distribution system level, the dynamic seasonal variation of the population and the irrigable land assumptions, the total annual

ESMF

demand for the year 2020 is estimated to be 1,505 Mm<sup>3</sup> (1,837 Mm<sup>3</sup> for a network efficiency of 50%).

A rough estimate of the water demand for irrigation is 842 Mm<sup>3</sup> per year, or around 55% of the overall water demand (MOEW, 2022).

Future irrigation development is dependent on:

- Executing new projects
- Securing new sources of water (storage structures & water wells).

At the national level, the development of the proposed projects would enable the irrigation of an additional 38,000 acres (

**Table F Irrigable land in Lebanon**

|                    | Presently Irrigated area<br>(ha) | Proposed irrigation projects<br>(ha)    | Total<br>(ha)  |
|--------------------|----------------------------------|-----------------------------------------|----------------|
| NLWE (18 schemes)  |                                  | Noura el Tahta & Dar Baachtar dam 4 200 |                |
|                    |                                  | Hill lakes 730                          |                |
|                    | 28 600                           | 4 930                                   | 33 530         |
| BMLWE (15 schemes) | 5 835                            | Hill lakes 540                          | 6 375          |
| BWE (36 schemes)   |                                  | Aassi dams 6 000                        |                |
|                    |                                  | Massa dam 1 600                         |                |
|                    |                                  | Younine dam 1 200                       |                |
|                    | 66 115                           | 8 800                                   | 74 915         |
| SLWE               | Qasmieh Ras El Ain 3 200         | Conveyor 800 13 250                     |                |
|                    | Saida Jezzine 430                | Khardale dam 1 300                      |                |
|                    | Small local projects 580         | Choumaryeh dam 4 000                    |                |
|                    | 4 210                            | Ibl es Saki dam 3 800                   |                |
|                    |                                  | Hill lakes 1 235                        |                |
|                    |                                  | 23 585                                  | 27 795         |
| <b>Total</b>       | <b>104 760</b>                   | <b>37 855</b>                           | <b>142 615</b> |

Source: MOEW, 2022

**(h) TOTAL WATER SUPPLY**

The yearly renewable accessible water volumes are projected to be around 2,050 Mm<sup>3</sup> from springs, 1,475 Mm<sup>3</sup> from rivers, and 700 Mm<sup>3</sup> from wells (public and private). Regarding supply, they vary depending on the types of sources and the extracted resources. It is important to note that groundwater is overexploited by about 300 Mm<sup>3</sup> annually and that dams are typically topped off with surface water, primarily from rivers. These numbers are summarized in Table 2-4.

**Table G Available and exploited water resources for 2020**

| Source                    | Available Resources<br>(Mm <sup>3</sup> /year) | Exploited Resources<br>(Mm <sup>3</sup> /year) |
|---------------------------|------------------------------------------------|------------------------------------------------|
| Rivers                    | 1,475                                          | 14                                             |
| Springs                   | 2,050                                          | 594                                            |
| Public and Private wells  | 700                                            | 990                                            |
| Dams (Static)             | -                                              | 314 (232)                                      |
| <b>Total Water Supply</b> | <b>4,225</b>                                   | <b>1,912</b>                                   |

Source: MOEW, 2022



Figure M Map Showing the Major Surface Water Bodies in Lebanon (mainly Rivers and Wetlands)

**(i) SOIL**

Based on the soil map of Lebanon, there are twelve (12) soil types in Lebanon. The extent of the soil cover layer is shown in Figure N. Leptosols tend to cover the largest surface area out of the twelve soil types. Soil cover characteristics are described in the paragraphs below (Encyclopedia Britannica, no date).

- Cambisols are developed in medium and fine-textured materials (mostly colluvial and onalluvial deposits) which justifies their presence in the Beqaa valley. Cambisols are good for agricultural usage and can be one of the most productive soils in terms of agriculture if the climate is appropriate.
- Leptosols are shallow soils overlying calcareous rocks. Leptosols are unattractive for rainfed agricultures because of their inability to hold water. However, they allow shrubs and small trees to grow over the rocky terrain, which gives them their importance in sustaining such terrestrial ecosystems.
- Fluvisols are mainly composed of river sediments and are genetically young soils within the alluvial deposits. Those soils can be found around water courses.
- Gleysols are wetland soil that is saturated by groundwater. They are usually found in depression areas and low landscape positions. Within Lebanon, they are mainly found at Ammiq and Kfarzabad Wetlands.
- Luvisols are present usually in forested regions. Such soils are characterized by their high content of clay minerals; thus, they do not bear water.
- Regosols are shallow soils with low-humus surface horizon overlying directly the weathering rock in an actively eroding landscape. Such soils allow orchards to grow and thus are important in sustaining such terrestrial ecosystems.
- Anthrosols are formed from heavily modified soils due to long term human activities related to irrigation and cultivation.
- Arenosols are sandy-textured soils that lack any significant soil profile development. Such soils have high permeability and low nutrient content, making their agricultural usage problematic.
- Calcisols are characterized by a layer of calcium carbonate. They are well drained soils and relatively fertile soils given their high calcium content.
- Andosols are dark colored soils of volcanic origin (ash, tuff...). Such soils tend to form good agricultural soils given their richness in nutrients and their water-bearing characteristics.
- Lixisols are soils with "low levels of plant nutrients and a high erodibility, making agriculture possible only with frequent fertilizer applications, minimum tillage, and careful erosion control".
- Vestisols contain high levels of plants with high clay content. Hence, they are not well suited to cultivation without careful management.

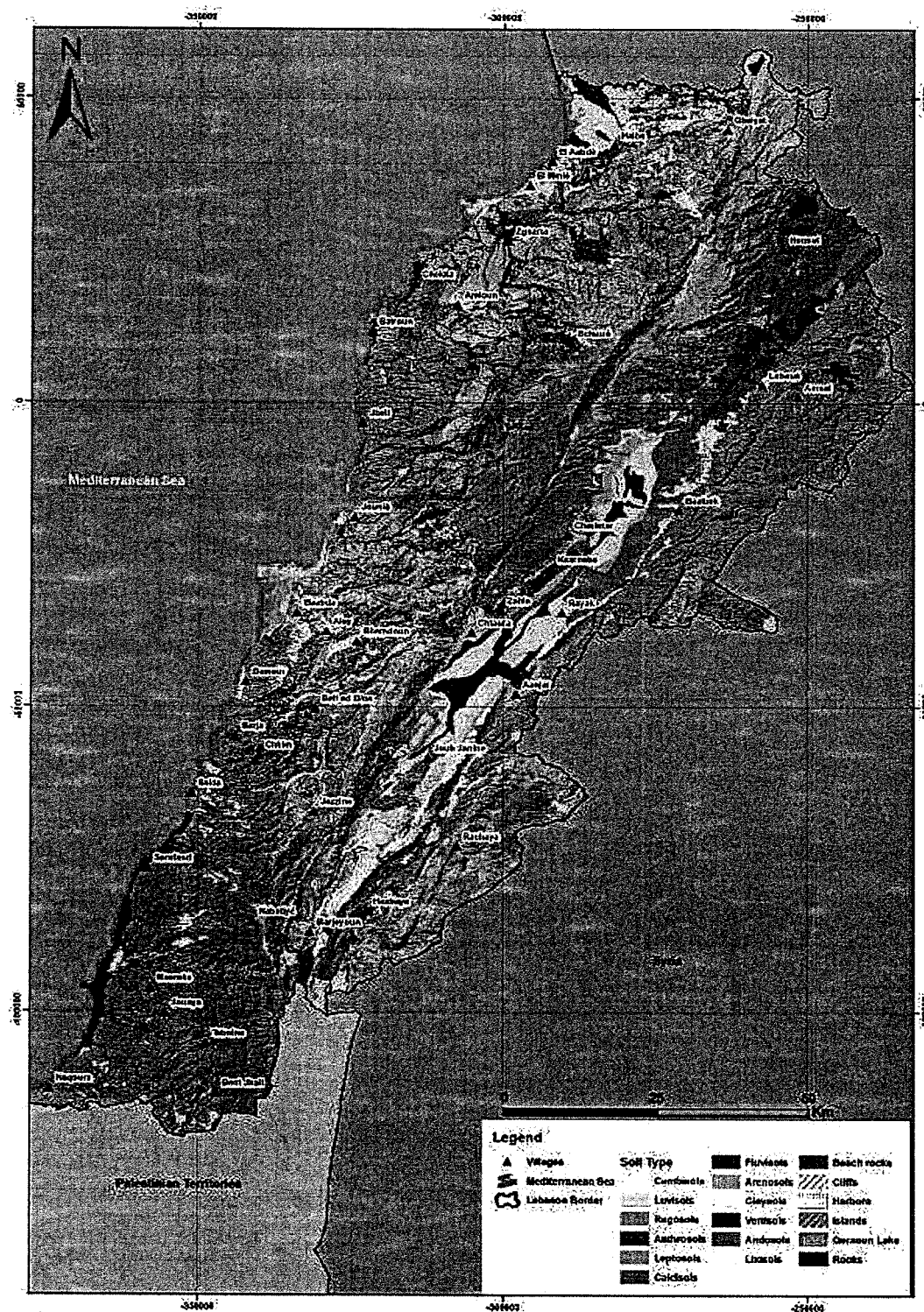


Figure N Soil Types in Lebanon (Source: CNRS-L, 2005)

Many improper human practices are leading to loss of natural resources including soil through erosion and mismanagement. In 2018, the Final National Report on Land Degradation Neutrality (LDN) Target Setting Programme was published, giving an insight about Land Productivity Dynamics (LPD) in Lebanon, and the most vulnerable areas to land degradation and soil erosion (Figure O ). The standard LPD classification is used, made of five distinct classes as follows:

- LPD 1: Declining productivity;
- LPD 2: Early signs of decline;
- LPD 3: Stable, but stressed;
- LPD 4: Stable, not stressed; and
- LPD 5: Increasing productivity.

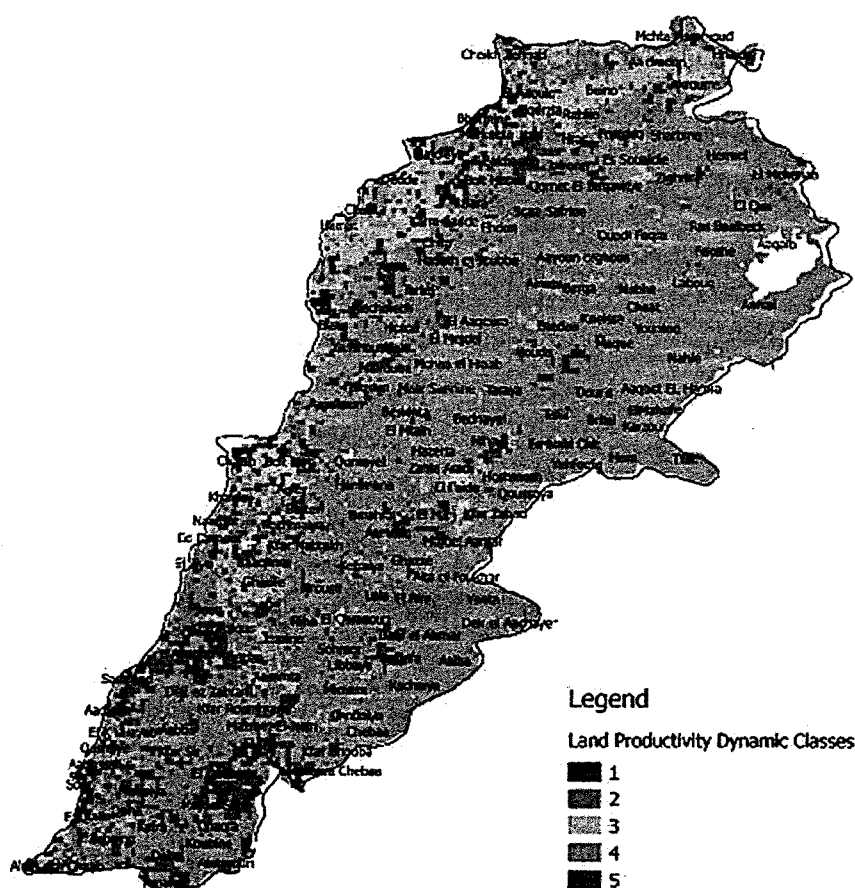


Figure O Land Productivity Dynamics trends of Lebanon (Source: Lebanon LDN TSP Country Report)

## **(j) LAND RESOURCES**

Land usage in Lebanon can be classified into four main categories: agricultural areas, urban areas, natural areas, and mixed rural areas. Natural and agricultural areas, with the latter expanding mostly over the Beqaa Valley, the South, Nabatiyeh, Akkar, Zgharta, Koura, and Minieh-Dannieh as shown in Figure P, are the most prominent land use/cover in Lebanon. The main agricultural crops comprise fruit trees, vineyards, olives, bananas, citrus fruits, and field crops. Most of the agriculture in Lebanon is subject to fertilizers and pesticides (agrochemicals). It is generally known that many farmers do not abide by the correct dosage of fertilizers and pesticides usage, which find their way into the soil and into groundwater by leaching down due to irrigation, and into surface water through runoff. On the other hand, the highest concentrations of urban areas are found in Tripoli, Beirut and the coastal line of Mount Lebanon to the North of Beirut, Saida, Nabatiyeh, Tyre, as well as Zahle and Baalbek (CDR, 2005). Soil nutrition and plant protection are mismanaged with Lebanon showing some of the highest per hectare use of fertilizers (331 Kg/ha) and pesticides (7 Kg/ha) in the world (MOA, 2020).

**Akkar** is known to have many assets that allowed it to be the third major area of agricultural production after the Bekaa and Baalbeck/ El Hermel. Its lower plain is one of the most productive agricultural regions of the country. The main reason for Akkar's high potential is due to the fertility of the soil and gentle slopes, water abundance, and agro-climatic zones diversity. The FAO estimates that 42,000 hectares, or around half of Akkar's total surface area, consist of arable land, with 43% of that area irrigated. Agriculture is Akkar's second-largest economic sector, providing a source of income for 30% of families (UN, 2011). The plain's high concentration of agricultural activity provides 47% of household income (Mouchref, 2008). According to IDAL, around 38% of cultivated lands are used for the cultivation of cereals, followed by 25% for vegetables. More than 18% of olive oil production in Lebanon takes place in Akkar, making it a prominent location for agro-food processing.

**The North's** main advantage is access to resources. 15% of the governorate area is considered to be an agricultural area, whereby 62% of its area is dedicated for the cultivation of olives and hence makes up around 50% of total olive groves in Lebanon.

**Baalbek's** soil texture provides great possibilities for agricultural development. The area owns the largest portion of Lebanon's total arable land (25%). **Hermel**, on the other hand, benefits from the Assi River's presence, making the district Lebanon's principal hydrographic zone.

**Bekaa** is known to be an agricultural land in its three districts, which is crucial for the local economy and culture. Arable fields in the Bekaa Governorate make up around 18% of all arable lands in Lebanon, according to the Ministry of Agriculture's Census (MOA, 2010).

**The South** is a significant agricultural region of Lebanon as well. In South Lebanon, greenhouse agriculture has an area of 6,277 dounoum (2010), 78% of which is planted with fruit trees. A total of 201,539 dounoum are utilized for permanent agriculture, 38.9% of which is planted with olives, and 31.6% with citrus crops.

**Nabatieh** can take advantage of the resources available because of its fertile soil, moderate climate, and water resources. To begin with, 18% of olives cultivation in Lebanon is situated in Nabatieh, which is considered to be the 2<sup>nd</sup> concentration in Lebanon, only preceding it North Lebanon and Akkar. In addition to that, Nabatieh has a growing livestock sector with a high number of cattle and goats.

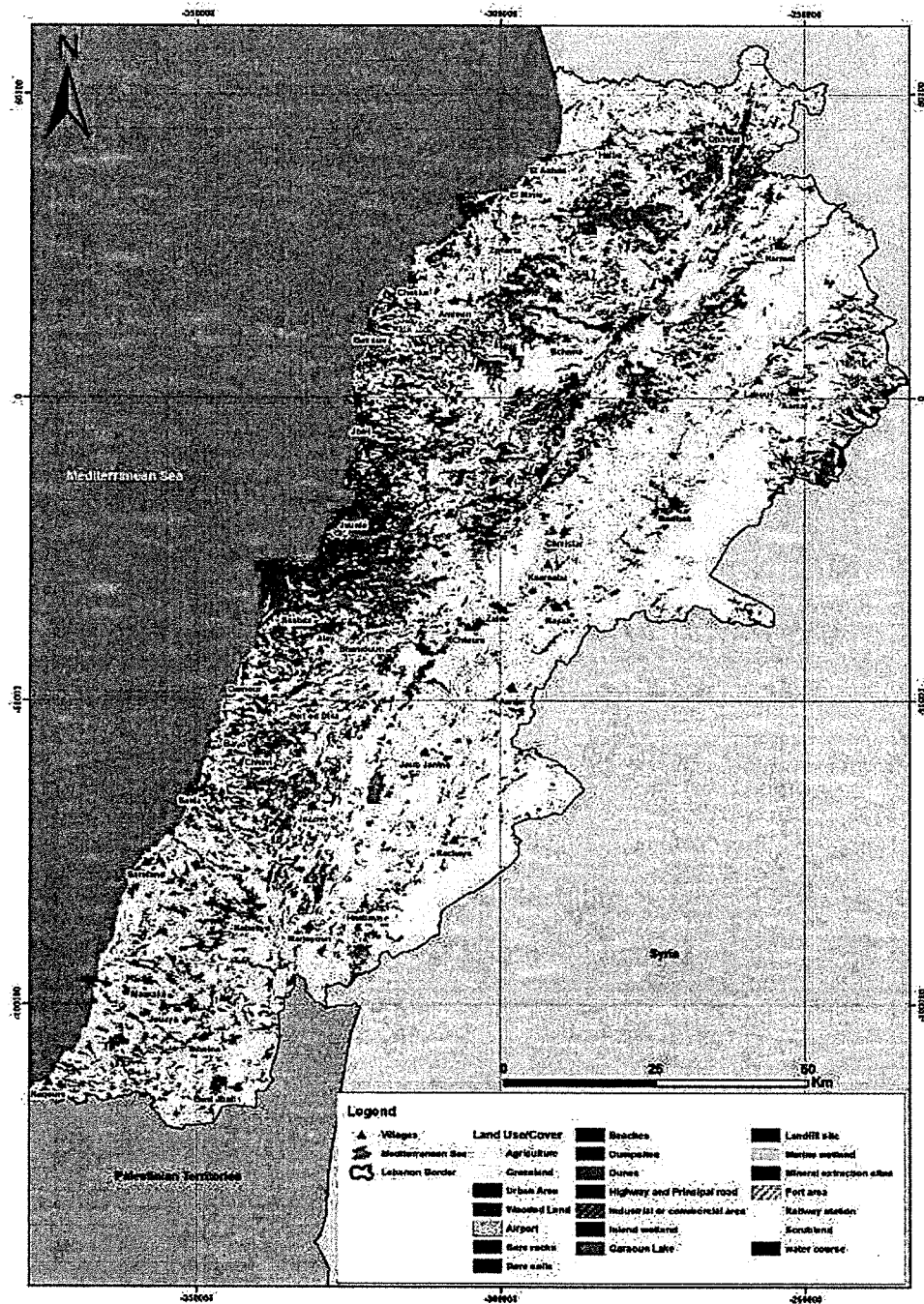


Figure P Land Use/Cover of Lebanon (Source: SDATL, 2013)

**(k) ECOLOGICAL ENVIRONMENT STATUS**

i. *Overview of the Ecological Context*

Due to its location in the Mediterranean Basin, Lebanon has a rich biodiversity and is a biodiversity "hotspot". The country hosts around 9,116 known species distributed over its different geomorphologies. Given its diversity and significant ecological profile, 4 Ramsar sites, 15 Important Bird Areas (IBAs) (under Birdlife International), 24 Important Plant Areas (IPAs), and 20 Key Biodiversity Areas (KBAs) have been designated in Lebanon so far (Figure Q) (MOE/UNEP/GEF, 2016).

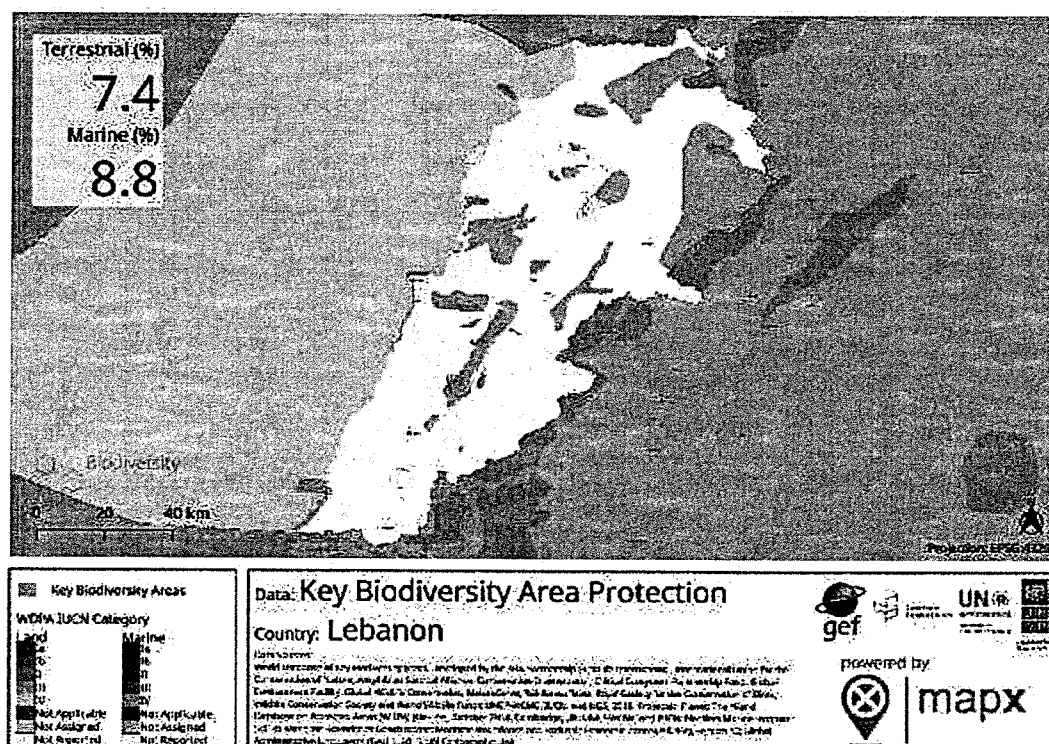


**Figure Q Key Biodiversity Areas (KBAs) in Lebanon**

As shown in the figure above, with regards to the targeted project areas, the KBAs are mainly located in Akkar, Baalbeck-Hermel and the Bekaa.

**Akkar** is known for its exceptional landscape and heritage features and hosts a rich biodiversity and three major eco-zones and embraces four Mediterranean vegetation zones. In addition to that, the presence of plains and mountains explains the diversity of the climate, hydrology, soil, and vegetation; all three eco-zones play a crucial role in agricultural production and tourism.

The Akkar-Hermel Cazas region has 21% forest cover, which is thought to be the largest continuous forest cover in Lebanon. Most of the Lebanese flora is also found in this region, which is home to a few distinct ecosystems. These ecosystems include the Mount Tabor oak (*Quercus ithaburensis*) woodlands in Dreib and the Qammouaa Fir Forest, which is the habitat of several species that are uncommon in other natural ecosystems in Lebanon. Additionally, the region is home to 69 different kinds of animals and 294 different bird species. One of the

main forest hotspots is the wetland of Cheikh Zennad that has important bird areas and bottlenecks in addition to the ecological corridors that include the riverine corridors that go from the northern Lebanese mountain system, forest corridors such as the Lebanese Cedar, coastal corridors, and migratory bird routes.

### North

Most of the forest species found in Lebanon can be found in the forests of North Lebanon, which make up about 21% of the northern governorate. These species include the Palestine oak *Quercus calliprinos*, the Aleppo oak *Quercus infectoria*, the Turkey oak *Quercus ceris*, the Greek juniper *Juniperus excelsa*, the Syrian juniper *Juniperus drupacea*, the Lebanon cedar *Cedrus libani*, the Ci (Mediterranean cypress).

The **Hermel** region is characterized by its nature reserves especially cedar trees and perennials. Cultivated land area (3 km<sup>2</sup>) is equivalent to 5.38% of the total area, which is very little in relation to the area of arable land (15 km<sup>2</sup>). It is mainly composed of agricultural areas such as terraces, fallow lands, and cultivated trees, in addition to grasslands whereby some are degraded and others are used for grazing, agriculture and forage.

The **Bekaa** region comprises several mountains that reach around 2,740 m above sea level, plains, valleys that reach down to around 600m in altitude, rivers such as the Litani River that is the longest river in Lebanon, wetlands, and an artificial lake, Qaraoun. Bekaa's unique topography and diversity in climate justifies the diversity in its habitats and ecosystems; this leads to the richness in its wildlife, offering unique species to the area. Henceforth, this allows it to be characterized as an important and rich natural heritage.

The forests that are on the eastern slopes of Mount Lebanon are mainly Calliprine Oak, Aleppo oak, Grecian Juniper. As for the western slopes of Anti Lebanon, they are dominated by Calliprine and Aleppo oak. Unfortunately, the forests only represent a small portion of the area compared to pastures due to land degradation and deforestation that have taken place throughout the years.

The **South** is mainly covered by Aleppo Pine Forests. The cultivated land area is 11% and mainly consists of citrus fruits trees, tropical fruit trees, bananas, sumac, carob and sesame (UNDP 2016).

The presence of natural sites in the Governorate is an important location for the conservation of flora and fauna species, providing opportunities for eco-tourism. The sandy beaches of Tyre and the historical ruins of Sidon and Tyre attract numerous visitors (IDAL, 2018).

**Nabatieh** represents 6% of the total forests in Lebanon (SOER, 2020). The cultivated land area is 11% and mainly consists of citrus fruits trees, tropical fruits trees, banana, sumac, carob and sesame (UNDP, 2016). Nabatieh is the second olive producing region in Lebanon after North Lebanon and Akkar; furthermore, its richness in natural and archeological attractions endow it with a strong touristic potential (IDAL, 2018).

Most of the wildlife consists of livestock-rearing animals like sheep and goats (IDAL, 2018). Common species, however, might also exist, mostly in the nearby natural environments. Moreover, despite the governorate having the third-highest percentage of goats in Lebanon (IDAL, 2018).

## ii. Overview of Protected areas

In addition, the Government of Lebanon has designated 17 sites across the country as nature reserves under the responsibility of MOE. Most recently was the designation of Mount

Hermon as a nature reserve in December 2020; and the Abbassiyeh coast, South Lebanon nature reserve in May 2020. Table 2-5 presents the nature reserves and Himas located in the targeted project areas. These are two categories of protected areas (PAs) as per the latest PAs Law, Law 130/2019. The other two categories are 1) natural sites or monuments, and 2) natural parks. These four categories were created in order to meet Lebanon's commitments arising from the relevant international conventions ratified by Lebanon (the United Nations Framework Convention on Biological Diversity - Rio de Janeiro 1992, the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, the Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, and the Euro-Asian/African Migratory Waterbird Agreement), and to make sure all categories of natural and cultural heritage are covered and protected.

**Table H List of Nature Reserves and Himas in Targeted Project Areas (adapted from SOER, 2020)**

| Governorate        | Nature reserve                                                                                                                                                                                                       | Hima                                                                                                               |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Akkar              | Karm Chbat                                                                                                                                                                                                           | Qammouaa forests, Bazbina zone, Andket, Menjez, Rouaime, Al Maabour Al Abyad                                       |
| North              | Horsh Ehden and Tannourine Cedars Forest designated as IBA<br>Hamat/Deir El Nouoriyeh Cliffs of Ras Shaqaa as Ramsar site                                                                                            | Anfeh                                                                                                              |
| Baalbeck-El Hermel | Yammouneh                                                                                                                                                                                                            | Hima of West Baalbek, Charbine and Fakiha                                                                          |
| Bekaa              | The communal lands of Niha, Jbeih, Mrousti, Khraibe, Maasser, Barouk, Bmohreh, Ain Dara, Ain Zhalta villages, Shouf Biosphere Reserve and Mount Hermon Nature Reserve.                                               | Hima Anjar, Hima Kfar Zabad (Zahle district) Hima Kherbet Kanafar, Hima Ain Zebde, Hima Qaraoun, and Hima Aitanit. |
| South and Nabatieh | Tyre Coast<br>Ebel Es Saqi area designated as an Important Bird Area (IBA)<br>Wadi Al Houjeir, Kafra, Ramya, Beit Leef, Debel, Abbassiyeh Coast, Mount Hermon, Nmayrieh Abbassiyeh, Jabal el Rihan Biosphere reserve | Ebel El Saqui ; Arnoun, Qaytouli, Roum, Qoleileh and Mansouri                                                      |

Moreover, Lebanon hosts a variety of unprotected natural important ecological areas such as grottos, mountain tops, natural bridges, forests, valleys, rivers, and holes. These areas are however threatened by anthropogenic and natural threats such as fragmentation, unsustainable exploitation of natural resources, pollution, and climate change.

Local communities in Lebanon have also implemented initiatives for community-based approaches for the protection and conservation of ecologically important sites across the country, such as those established in Anjar-Kfar Zabad (Beqaa) and Jdeidet el Fekha (Baalbek) (UNDP/MOE, 2019).

## 2. SOCIAL BASELINE

### (a) SOCIOECONOMIC PROFILE

#### i. Demography

With a population density of 669 inhabitants/km<sup>2</sup>, Lebanon ranks in the top 20 list of the most densely populated countries (World Bank Group, 2021). With the start of the Syrian war, millions of Syrians fled their home country and settled in different regions in Lebanon, which led to an increase in the total number of population (Table 2-6). The growth of the population led to an over-exploitation of natural resources, and resource depletion intensified to cater for a larger population. Mismanagement of natural resources has led to exacerbated environmental degradation, and pressure was added on an already resource-strapped management infrastructure.

**Table I Population Number and Density (2011-2018) (Source: World Bank, 2021)**

| Year | Total Population (including Refugees and displaced) | Total Population Density in Lebanon (inhabitants/km <sup>2</sup> ) | World Population Average Density (inhabitants/km <sup>2</sup> ) |
|------|-----------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------|
| 2018 | 6,848,925                                           | 669                                                                | 60                                                              |
| 2017 | 6,811,873                                           | 665                                                                | 59                                                              |
| 2016 | 6,711,121                                           | 656                                                                | 58                                                              |
| 2015 | 6,532,678                                           | 638                                                                | 58                                                              |
| 2014 | 6,262,410                                           | 612                                                                | 57                                                              |
| 2013 | 5,914,621                                           | 578                                                                | 56                                                              |
| 2012 | 5,538,634                                           | 541                                                                | 56                                                              |
| 2011 | 5,202,343                                           | 508                                                                | 55                                                              |

Roughly, 65% of the population in Lebanon is between 15 and 64 years old (Figure R). 51.6% of the total population are women, and 48.4% are men (EU/CAS/ILO, 2019).

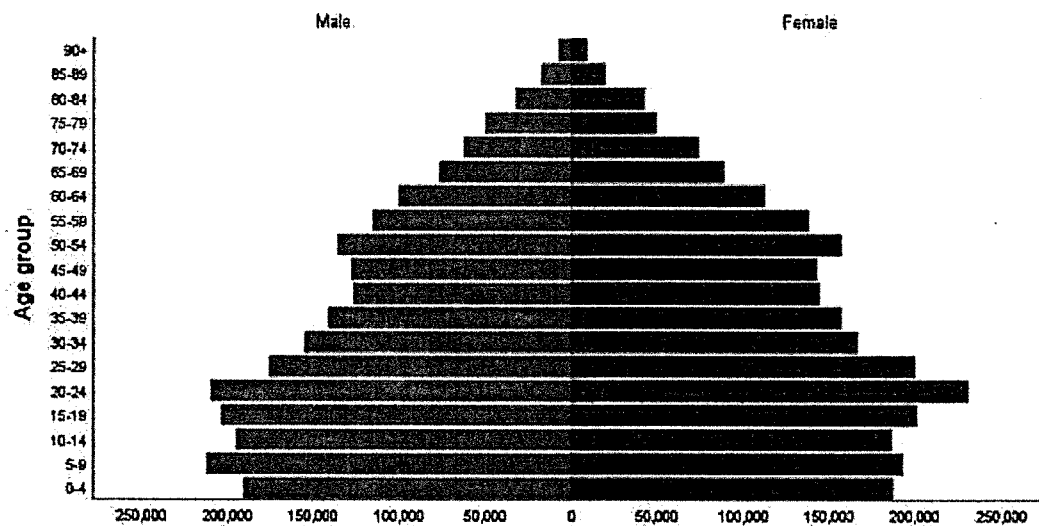


Figure R Age Pyramid of the Lebanese Residing Population (Source: EU/CAS/ILO, 2019)

The segregation of the Lebanese population located in the targeted project areas is shown in Table 2-7.

Table J Population Distribution by Governorate and Caza (Source: EU/CAS/ILO, 2019)

| Governorate    | Caza       | Population per Caza | Percentage from Total Lebanese Population |
|----------------|------------|---------------------|-------------------------------------------|
| Akkar          | Akkar      | 324,000             | 6.7                                       |
| Baalbek-Hermel | Baabek     | 214,600             | 4.4                                       |
|                | Hermel     | 30,500              | 0.6                                       |
| Bekaa          | Rachaya    | 33,800              | 0.7                                       |
|                | West Beqaa | 86,400              | 1.8                                       |
|                | Zahle      | 177,400             | 3.7                                       |
| Nabatieh       | Bint Jbeil | 96,200              | 2.0                                       |
|                | Hasbaya    | 28,700              | 0.6                                       |
|                | Marjaaoun  | 74,000              | 1.5                                       |
|                | Nabatieh   | 180,200             | 3.7                                       |
| North Lebanon  | Batroun    | 58,900              | 1.2                                       |

| Governorate   | Caza           | Population per Caza | Percentage from Total Lebanese Population |
|---------------|----------------|---------------------|-------------------------------------------|
|               | Bcharre        | 22,100              | 0.5                                       |
|               | Koura          | 84,600              | 1.7                                       |
|               | Minieh-Dannieh | 140,800             | 2.9                                       |
|               | Tripoli        | 243,800             | 5.0                                       |
|               | Zgharta        | 87,700              | 1.8                                       |
| South Lebanon | Jezzine        | 32,100              | 0.7                                       |
|               | Sidon          | 296,600             | 6.1                                       |
|               | Tyre           | 255,700             | 5.3                                       |
| TOTAL         |                | 4,842,500           | 50.9                                      |

Note: Excludes people living in non-residential units, such as army barracks, refugee camps and adjacent gatherings, and informal settlements.

## ii. Persons with Disability

Based on the guidelines of the Washington Group on Disability Statistics, about 4 per cent of Lebanese residents suffer from a disability, or have difficulty functioning, which restricts their participation because of difficulties in one or more of the following six core functional domains: seeing; hearing; walking or climbing steps; remembering or concentrating; self-care; and communicating (EU/CAS/ILO, 2019). Table K below provides details about people with disabilities based on their gender.

**Table K Disability status of the Lebanese population based on their gender (Source: EU/CAS/ILO, 2019)**

| Disability status                     | Percentages |       |       |
|---------------------------------------|-------------|-------|-------|
|                                       | Women       | Men   | Total |
| Person with a disability              | 4.1         | 3.9   | 4.0   |
| Person without a disability           | 94.4        | 94.5  | 94.5  |
| Not applicable (infants and newborns) | 1.4         | 1.5   | 1.5   |
| Total                                 | 100.0       | 100.0 | 100.0 |

The total percentage (4%) of Lebanese residents with a disability can be divided into two groups:

- Persons with only one disability (2.5%); and

- Persons with more than one disability (1.5%).

Several types of disabilities are reported in Lebanon, as shown in Figure S

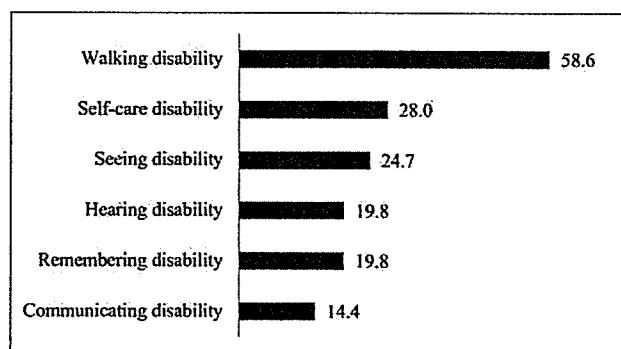


**Figure S Percentage of Each Type of Disability in Lebanon (Source: CAS/EU/ILO, 2019)**

Table 2-9 presents the percentage of persons with disabilities in the targeted project areas.

**Table L Persons with Disabilities in the targeted project areas (Source: CAS/EU/ILO, 2019)**

| Governorate       | Persons with Disability (%) |
|-------------------|-----------------------------|
| Akkar             | 6.1%                        |
| North             | 6%                          |
| Baalbek-El Hermel | 4.9%                        |
| Bekaa             | 4.7%                        |
| South             | 4.4%                        |
| Nabatieh          | 3.7%                        |

### iii. Female-headed Households

Lebanese heads of households represent 85 per cent, while non-Lebanese heads of households made up the remaining 15 per cent before the economic crisis. Around 18 per cent of households were headed by women and 82 per cent by men (EU/CAS/ILO, 2019). Figure T presents the percentage of heads of households by age group and sex.

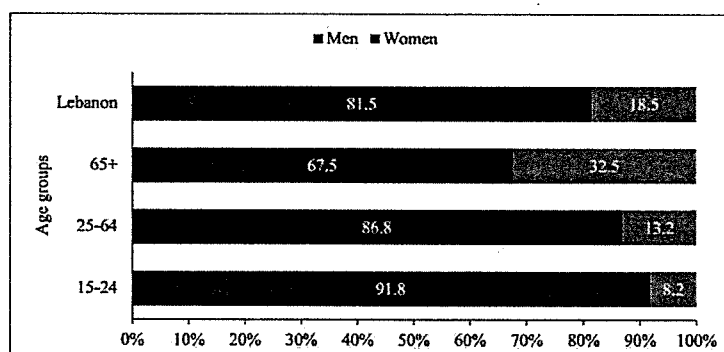


**Figure T Distribution of Heads of household by age group and sex**

(Source: CAS/EU/ILO, 2019)

Table M Percentage of Female headed Households in the Targeted Elderly.

While the information relating to elderly is limited, it is worth noting that single-person households make up to 10.2 per cent of total households; half of them older adults, mostly elderly women who are generally widows (CAS/EU/ILO, 2019). People aged 65 years-old and above make up to 12.5% of the total Lebanese population, and half of those reported with a disability in Lebanon. Roughly one third of elderly people do not benefit from any health insurance coverage.

Table 2-10 presents the percentage of elderly in the project targeted areas.

**Table N Percentage of Elderly in targeted areas)**

| Governorate        | Percentage of Elderly |
|--------------------|-----------------------|
| Akkar              | 5.4%                  |
| North              | 5.8%                  |
| Baalbeck el Hermel | 8.8%                  |
| Bekaa              | N.A.                  |
| South and Nabatieh | 13.5%                 |

(Source: CAS/EU/ILO, 2019)

#### iv. Sexual Exploitation and Abuse / Sexual Harassment

69% of gender-based violence (GBV) incidents reported through the GBV information management system (GBVIMS) in 2020 were incidents of domestic violence. The GBVIMS is an inter-agency partnership between the United Nations Population Fund (UNFPA), the International Rescue Committee (IRC), and the United Nations High Commissioner for Refugees (UNHCR), in consultation with the Inter-Agency Standing Committee Sub-Working Group on Gender and Humanitarian Action and the Gender-Based Violence Area of Responsibility Working Group of the Protection Cluster. The system enables those providing services to GBV survivors to effectively and safely collect, store, analyze and share data related to the reported incidents of GBV.

Numbers were reportedly increasing due to the cumulative effect of both lockdown and economic collapse (UNFPA, 2020).

Women and girls with intellectual disabilities are particularly vulnerable to sexual violence and are often prevented from accessing a range of services and face un-adapted facilities, poverty, inadequate behavior of service providers. Elderly women are the most at risk due to their suffering from disparities that they experience throughout their lifetime (UNFPA, 2020).

In 2021, UNICEF reported that one in two children in Lebanon is at serious risk of physical, emotional, or sexual violence, as families struggle to cope in the country's deepening economic crisis.

#### v. Poverty

Due to the financial crisis facing the country, the poverty rate increased exponentially with time starting in 2019. According to a study prepared by the UN-ESCWA titled Poverty in Lebanon: Solidarity is vital to address the impact of multiple overlapping shocks (UN, 2020), the portion of Lebanese households living in multidimensional poverty was estimated at 82% of the total

population, out of which 40% live in extreme multidimensional poverty. Only 18% of the population is not poor. Roughly 1.8 million children (more than 80 per cent) are now experiencing multidimensional poverty – up from around 900,000 in 2019 (UNICEF, 2021).

The financial crisis is disproportionately affecting lagging and under-served rural areas. According to the Lebanon Multidimensional Poverty Index (MPI) for Lebanon (CAS & World Bank, 2019), the governorates of Akkar (69.6%) and Bekaa (67.0%) have the highest levels of MPI and incidence of poverty. Out of a total population of 1.1 million people in Northern Lebanon, 708,000 live under the poverty line. Vulnerable Lebanese households face challenges accessing food, healthcare, education, and other basic services. The unemployment rate reached 30% in 2022 – up from 11% in 2019 (ACAPS, 2022) and as a result demand for employment opportunities across the country is high. The highest concentration of displaced populations is found in the Bekaa region (UNHCR, 2022). This has put strains on already fragile services in the Bekaa and increased the vulnerability of host communities, as they compete over employment, accommodation, access to public services, and infrastructure.

#### vi. Displaced Populations

Lebanon, a small country of 5.2 million people (July 2021 estimate), hosts the highest per capita concentration of displaced populations in the world.

Roughly 1.5 million Syrians had fled their country since 2011 and resettled in Lebanon. Only 879,529 displaced populations are registered as of 2020. The highest concentration of displaced populations is found in the Bekaa region (UNHCR, 2022).

The Bekaa valley and Akkar have been most heavily affected by the Syrian crisis. In fact, the agri-food sector is one of the three sectors where Syrian displaced populations are legally allowed to work, and agriculture is the second-highest employer of displaced Syrians. Child labor among displaced populations is the highest in agriculture in rural areas; a 2019 UNICEF survey in the Bekaa Valley, where migrants are concentrated, showed that around 75 percent of children from displaced populations engaged in labor worked in agriculture.

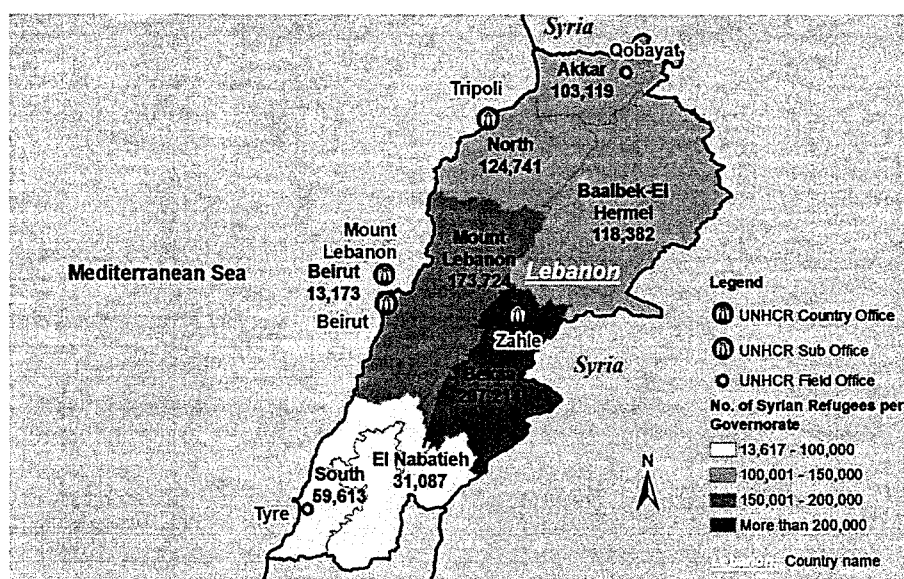


Figure U Number of Syrian refugees per Governorate

Source: UNHCR, 2022

vii. *Basic Services and Utilities*

1. *Access to Solid Waste Management Services*

Municipalities are responsible for collecting and transporting solid waste from collection points to designated facilities in a manner that does not harm the environment, in accordance with the standards and conditions set by and subject to approval of MoE, as per Decree No. 118 of 1977 and Law 80 of 2018.

Small-scale facilities in remote areas of the North, South and Bekaa regions provide those areas with Solid Waste Management (SWM) services. These facilities are managed by the Office of the Minister of State for administrative Reform (OMSAR) in coordination with local authorities.

Community-run systems in some regions consist of basic sorting, composting, and final disposal of MSW.

Approximately 2 million tons/year of Municipal Solid Waste (MSW) are generated in Lebanon. Daily MSW generation is estimated at 1.05 kg/capita/day (CDR, 2019). MSW is mainly composed of 51% of organic waste, while the remaining is comprised of recyclables like paper and cardboard, plastic, glass, textiles, metals; demolition/construction waste and others (CDR, 2019). Most of this waste is collected and disposed of by landfilling/ dumping, while some of the waste is being treated at Solid Waste Management Facilities (SWMF) which are distributed all over the country.

Many of the remaining rural areas that are unserved by SWM facilities collect municipal solid waste and dispose of it by open dumping and burning.

Dumpsites and open dumping and burning are frequent in Lebanon. Two types of dumpsites are identified in Lebanon: 1) MSW dumpsites and 2) Construction and Demolition Waste (CDW) dumpsites.

Table 2-11 presents the number of operational MSW dumpsites by governorate according to the Updated Masterplan for Closure and Rehabilitation of Uncontrolled Dumpsites (UNDP, 2017).

**Table O Operational MSW Dumpsites by Governorate**

| Governorate        | Operational Dumpsites |
|--------------------|-----------------------|
| Akkar              | 19                    |
| North              | 19                    |
| Baalbeck           | 39                    |
| Hermel             | 3                     |
| Bekaa              | 54                    |
| South and Nabatieh | 127                   |

Source: UNDP, 2017

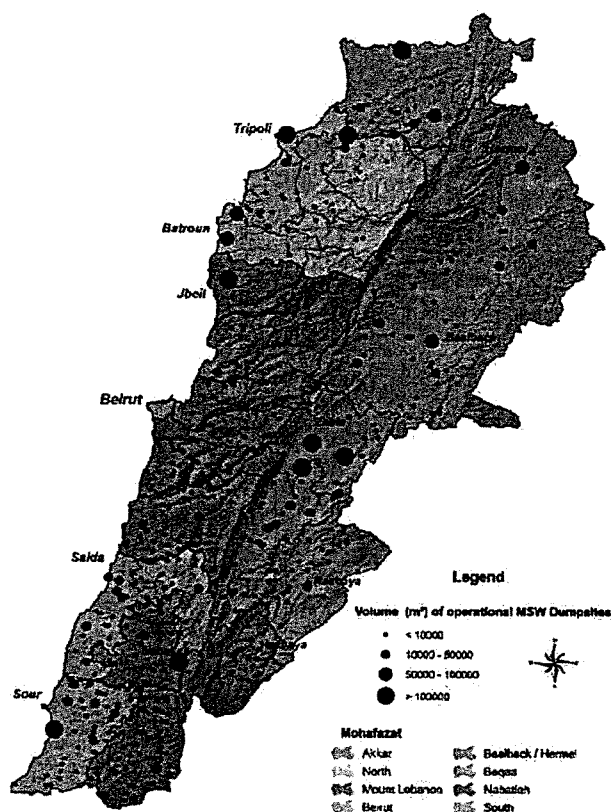


Figure V Map showing the MSW dumpsites locations and volumes

Source: UNDP, 2017

The operational SWMFs are mainly located in Akkar (1), North Lebanon (4), Bekaa (7), Nabatieh and South of Lebanon (13). None exists in Hermel, while one facility is operational in Baalbek.

**Error! Reference source not found.** presents the operational SWMFs in the project areas while Figure W, Figure X and Figure Y show the distribution of operational SWMFs in addition to the non-operational and planned ones.

Table P Summary of SWMFs by Governorate

| Governorate   | Caza           | Location   | Type of operational SWMF |
|---------------|----------------|------------|--------------------------|
| Akkar         |                |            | 1                        |
| Akkar         | Akkar          | Michmich   | Sorting and Composting   |
| North Lebanon |                |            | 4                        |
| North Lebanon | Batroun        | Chekka     | Sorting                  |
|               | Koura          | Bsarma     | Sorting                  |
|               |                | Bichmezine | Sorting                  |
|               | Minieh-Dannieh | Minieh     | Sorting and Composting   |

| Governorate              | Caza          | Location            | Type of operational SWMF      |
|--------------------------|---------------|---------------------|-------------------------------|
| Bekaa & Baalbek-Hermel   | 7             |                     |                               |
| Bekaa                    | Zahle         | Barr Elias          | Sorting and Composting        |
|                          |               | Barr Elias          | Sanitary landfill             |
|                          |               | Qabb Elias          | Composting                    |
|                          |               | Qabb Elias (SICOMO) | Thermal treatment             |
|                          |               | Zahle (arcenciel)   | Autoclaving                   |
|                          |               | Zahle               | Sanitary landfill             |
|                          |               | Zahle               | Sorting                       |
| Nabatieh & South Lebanon | 13            |                     |                               |
| Nabatieh                 | Bent Jbeil    | Aaitaroun           | Sorting and composting        |
|                          |               | Bent Jbeil          | Sorting and composting        |
|                          |               | Khirbet Selm        | Sorting and composting        |
|                          | Hasbaya       | Rachaya El Foukhar  | Sorting                       |
|                          | Marjeyoun     | Khiyam              | Sorting and composting        |
|                          |               | Meiss Ej Jabal      | Sorting and composting        |
|                          |               | Qabrikha            | Sorting and composting        |
|                          |               | Qlaiaa              | Sorting and composting        |
|                          |               | Taybet Marjeyoun    | Sorting and composting        |
|                          | South Lebanon | Saida               | Saida/ Arc en ciel            |
| Saida Zahrani / IBC      |               |                     | Sorting, composting and RDF   |
| Zrariyeh/ Green Ecotech  |               |                     | Sorting and thermal treatment |
| Sour                     |               | Ainbaal             | Sorting and composting        |
|                          |               |                     |                               |
|                          |               |                     |                               |
|                          |               |                     |                               |

Source: UNDP, 2017

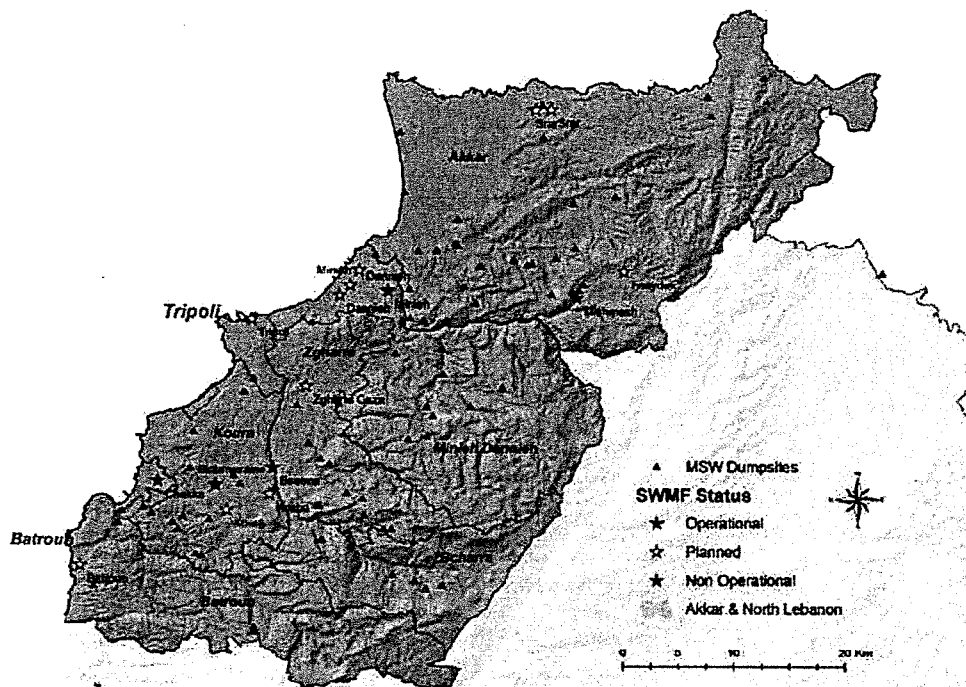


Figure W Akkar & North Lebanon SWMFs distribution

Source: UNDP, 2017

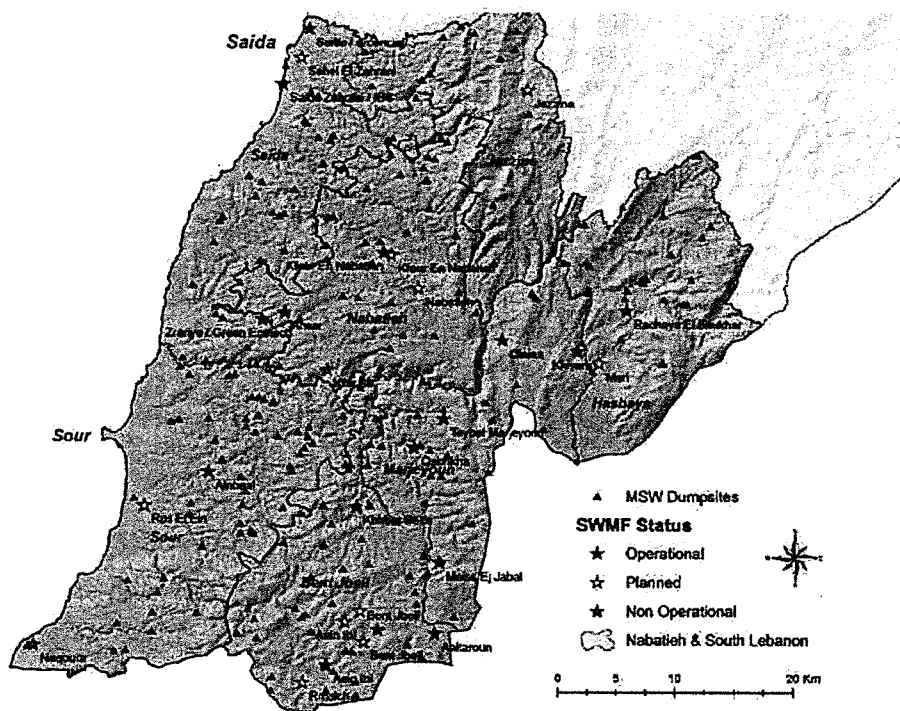


Figure X Nabatieh & South Lebanon SWMFs distribution

Source: UNDP, 2017

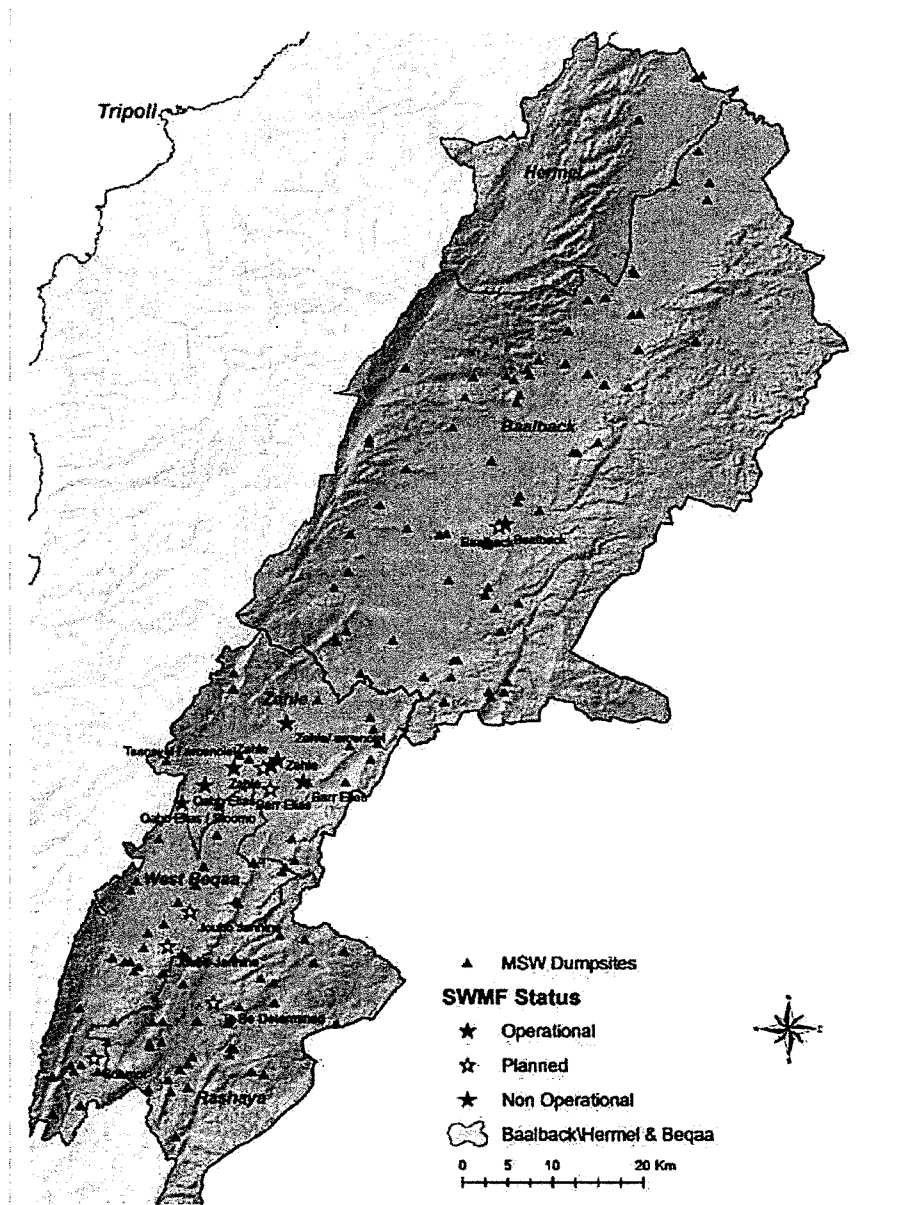


Figure Y Baalbeck/ Hermel &amp; Bekaa SWMFs Distribution

Source: UNDP, 2017

## 2. Access to Water Supply

The water sector in Lebanon is facing detrimental challenges, hindering the ability of the government to supply adequate and reliable water services while conserving Lebanon's water resources. Although the national coverage of water networks is around 80%, the quality of the supplied public water is questionable due to the lack of protection of water resources, insufficient water treatment at the supply level, deteriorated distribution networks, and the absence of continuous monitoring. Untreated wastewater, which accounts for around 70% of the total generated wastewater, is being directly discharged into the environment, thus polluting the groundwater and surface water resources that supply a significant portion of Lebanon's

potable water. The pollution of water resources, in addition to the poorly managed water supply networks, have impacted the quality of water at the household level. An estimated 65% of the population does not have access to safely managed drinking water services (MoEW, 2022).

Lebanon's available renewable water resources have dropped below the 1,000 m<sup>3</sup> /capita/year threshold that defines water stress: in 2010, the MoEW estimated that the total renewable resources per capita per year were 926 m<sup>3</sup> and predicted that it will continue to fall reaching 839 m<sup>3</sup> by 2015 (MoEW, 2012). Since then, population growth, climate change, and the influx of displaced have further strained the available resources and as a result, the total renewable resources per capita have reached 700 m<sup>3</sup> /capita/year (IFI, 2014). In addition to the challenges associated with ensuring that the water sources are effectively managed to meet the demands of the different sectors, pollution levels in many of these freshwater systems have made them either unable to meet their designated uses, or requiring expensive treatment prior to use (SOER, 2020).

With the ongoing multiple crises since 2019, water supply and access to water has become challenging to most of the Lebanese population. In addition to the decrease in available water resources per capita, the infrastructure of the sector has become very vulnerable lately, which has increased the risk of water shortage in many regions of the country, notably Baalbek-Hermel Governorate and West Beqaa district (UNICEF, 2021), as shown in Figure 2-6 below.

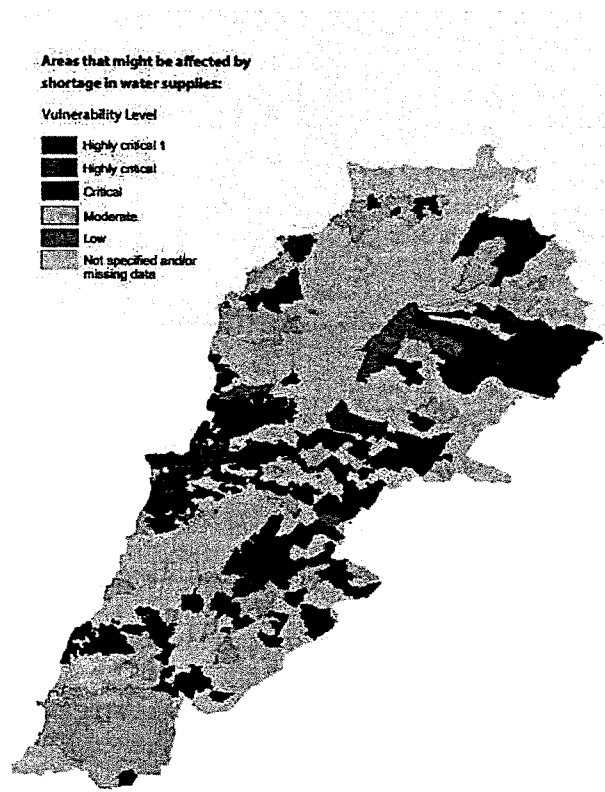


Figure 2 Vulnerability Level to water shortage in Lebanon

Source: UNICEF, 2021

With the cumulative consequences that climate change, infrastructure deterioration, population growth, and climate change have, the vulnerability to water shortage situation of 33% of the total population is classified as Highly Critical 1 (**Error! Reference source not found.**). The severe power outages have also further aggravated the problem of water supply.

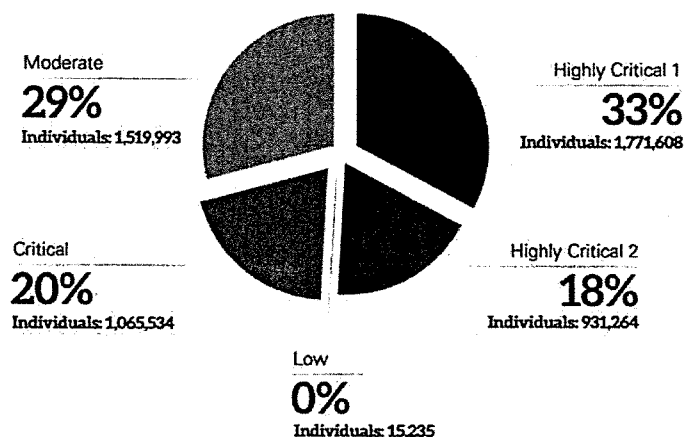


**Figure AA Levels of vulnerability of the Lebanese population**

Source: UNICEF, 2021

The NLWE provides potable water services in the two governorates (North and Akkar), reaching over 549,639 people, or 61% of the population within its service area (LWP, 2017). Irrigation services are also provided by the Establishment, but are restricted to the areas of Batroun, Dannieh, Minieh, and Halba (USAID3, 2019).

#### **Akkar**

Access to improved drinking sources has decreased in Akkar from 99% in 2020 to 90% in 2021 (UNHCR, 2021). As for the sources of the drinking water, they vary whereby 21% is from bottled mineral water, 37% is from protected wells, and 5% are from the water network (UNHCR, 2021).

#### **North**

Access to water in the North is poor, with only 57 percent of households connected to the water network, poor hours of public water supply, and overall water scarcity in the region. The average number of hours of public water supply for summer and winter was 11.7 hours before the severe outage in power supply over the last 2 years.

The BWE governs the entire Bekaa region including Hermel, Baalbek. It operates over 196 potable water supply systems, 36 of which depend on local springs of various sizes and the rest are supplied by more than 238 wells. The only operating water treatment plant within the BWE jurisdiction is located in Zahleh, where over 8,000 m<sup>3</sup> are treated per day, which are then distributed through a water network of 3,000 km in length (including parts under construction) (USAID2, 2019).

#### **Baalbek-El Hermel**

There is a huge water wealth in the Hermel district that is not well utilized, mainly due to the historical neglect and marginalization by the authorities and agencies concerned with securing this service

on the one hand, and the misuse of this wealth by the local community on the other hand, as it is noted that some of these families are collecting winter water in wells or purchasing it through tanks, or by relying on artesian wells, which negatively affects the living standards of the population. But the main problem is the presence of an old and worn-out water network that is more than seventy years old, and it is still a common network in the city (OMSAR, 2016).

Water pollution is another problem that is due to the disposal of wastewater into sanitary pits which overlap with the drinking water sources. The city of Hermel relies on several sources of water, which are: The ever-flowing Orontes River, which has a length of 25 km inside Hermel, and a speed of water flow per second of 13 m<sup>3</sup>/s, but it is not used for drinking, and there are encroachments on it by the owners of tourist restaurants and cafes; the springs that are used for irrigation of agricultural lands, including: the capital spring, the main spring, Bedita spring, the Daffash spring, and Ain Al-Zarqa; two ponds, Al-Tal Pool and Al-Qamou Pool, are used for irrigation; State water / central water tanks; water from private artesian wells; purchasing water through tankers.

### **Bekaa**

Bekaa suffers from an estimated deficit of 12,384.2m<sup>3</sup>/day while the needed water supply is of 127,918 m<sup>3</sup>/day under acceptable conditions. Unfortunately, the deficit is greater when the current actual unaccounted-for Water (UFW) is considered since it can reach 57,155 m<sup>3</sup>/day.

According to the UNHCR 2016 project, to meet the water demand through the year 2035, two extraction zones in the Zahle and West Bekaa Districts have been suggested for well drilling. Regarding Rachaya District, three extraction zones for well drilling were suggested to meet the water requirement until 2035 (UNHCR, 2016). Additionally, according to the Water Master Plan for the Bekaa (KREDO 2015), nine (9) water supply systems are planned for Rachaya District, six (6) water supply systems for Zahle District, and one (1) for West Bekaa in order to meet the water demand through the year 2035.

The SLWE operates over 500 potable water supply systems, 14 of which depend on springs of various magnitudes, the rest are supplied by over 324 wells. Water is pumped from the source and stored in over 510 reservoirs distributed across the South, distributing water to households (SLWE, 2017). Water is distributed through a network of approximately 3,350 km long (USAID1, 2019).

### **Nabatieh**

The city of Nabatiyeh depends mainly on the wells of Fakhr El-Din, the spring of Al-Tasa, and private wells. Some citizens resort to meeting their water needs by purchasing water through tanks. The city has networks for service and drinking water and needs to increase its water lines and coverage.

The city of Nabatiyeh suffers from a lack of water services, despite the passage of the Litani River and the Zahrani River close to it, as they can be exploited for domestic purposes and for drinking water. The Al-Tasa spring feeds four old neighborhoods, while the new neighborhoods are fed from Fakhr El-Din wells, and there is the Al-Rahebat neighborhood that is fed from Al-Najdah well.

#### **a. Access to Sanitation**

In 2015, 81% of the total Lebanese population had access to improved sanitation facilities, and 19% relied on unimproved facilities other than open defecation and shared facilities (WHO/UNICEF JMP, 2015). As of 2017, residents that have access to safe sanitation facilities were reported at 98% of the

total population (WHO/UNICEF JMP, 2019). However, it must be noted that although access to proper sanitation is high, wastewater treatment remains very low and surface water contamination remains high.

### 3. *Economy, Livelihood and Employment*

The on-going financial crisis in Lebanon has led to an increase in poverty and highly impacted the country's economy. By the end of 2021, Lebanon's real GDP index had contracted by 34.6 percent since 2018, comparable to Lebanon's real GDP index in 2007. In July 2022, the World Bank downgraded Lebanon's economic standing to a low-middle income country (WB, 2022).

The adverse shocks have driven an overwhelming share of the population into poverty and vulnerability to food insecurity. Food price inflation was further exacerbated by the removal of subsidies, particularly impacting the poor and vulnerable.

At the governorate level, the unemployment rate has increased in all governorates without exception. The largest increase in unemployment was observed in Baalbek-Hermel (40.7 percent), followed by South Lebanon (36.5 percent) in 2022. Employment in the informal sector (in terms of the characteristics of the establishment in which the person works) has increased by 13.1 percentage points, from 35.2 percent in 2018-2019 to 48.3 percent in January 2022 (ILO, 2022). The sector with the highest share of informal employment is Agriculture, Fishing and Forestry with 98.1 percent (ILO, 2022).

The gender gap in labor force participation (LFP) stands at 44 percent, with female LFP at 22.2 percent versus a male LFP at 66.2 percent.

#### **(b) OVERVIEW OF THE AGRICULTURE SECTOR**

The agro-food industry is the largest industrial sector in Lebanon, accounting for 18% of all industrial companies," claims IDAL, since it contributes around 4.7% of Lebanon's GDP" (IDAL, 2017). This makes the Bekaa governorate's agricultural, agro-pastoral, and tourism industries vital. Wineries-focused tourism and farming activities connected to wine production are two examples of rural tourist activities in West Bekaa, Rachaya, and Zahle.

Lebanon offers a range of agroecological zones well suited to the production of diverse agricultural products and with potential for exports. Five distinct agro-climatic zones are present in the coastal strip, low and middle altitudes of Mount Lebanon, West, Central and North Bekaa. The most fertile and productive lands are located in the Bekaa Valley, the Plain of Akkar and the thin strip of coastal plains. Crop production represents about 60 percent of agricultural output, while livestock production accounts for 40 percent and contributes a critical year-round source of livelihoods. Mountain agriculture is characterized by small holdings sustaining poor farmers and many households for whom agriculture is a secondary source of income. Agriculture in the coastal plains is dominated by permanent crops (e.g., citrus and banana), while the plains of Akkar and Bekaa Valley are dominated by cash crops (potatoes and vegetables). Lebanon's domestic agribusiness market has potential for steady growth. Lebanon has a revealed comparative advantage for vegetable, fruit, nuts and other high-value agriculture products with fruit and vegetable production also representing an important segment of Lebanon's agribusiness sector. It also has a significant comparative advantage for exporting high-value agri-food to premium markets thanks to agri-climatic conditions, favorable trade agreements with Europe and the GCC

and the recent defacto devaluation of the currency. According to the International Trade Centre, the untapped agricultural and agri-food export potential exceeds US\$450 million, with 65 percent coming from fruits, food products and vegetables. Expanding agri-food exports can increase foreign currency inflows, which are much needed given the current context. Increasing local production offers opportunities for import substitution. This can be achieved by supporting small producers and SMEs to comply with stringent food safety, quality, traceability, labeling and environmental sustainability requirements imposed by high-value export markets.

The primary agricultural production's contribution to GDP increased from 3.2 percent (USD 1.77 billion) in 2018 to 8.9 percent (USD 2.32 billion) in 2020. It is estimated that approximately 20 percent of Lebanese households generate primary or secondary income from the broader agri-food sector, with agribusiness as the largest industrial sub-sector of the economy (World Bank, 2021). The agri-food sector accounted for over 17 percent of total exports in 2020 (or USD 0.7 billion on average between 2014 and 2020 (International Trade Center, 2020). Lebanon's top five categories of agricultural and food exports by value were preparations of vegetables, fruit, or nuts; edible fruits and nuts; beverages, spirits, and vinegar; miscellaneous edible preparations; and animal or vegetable fats and oils. Although domestic agri-food production satisfies only 20 percent of local demand, it contributes the largest share to livelihood generation for poor segments of society and is concentrated in the poorest areas, the Bekaa valley and Akkar in particular, which have been most heavily affected by the Syrian crisis. In fact, the agri-food sector is one of the three sectors (other than construction and cleaning) where Syrian displaced populations are legally allowed to work, and agriculture is the second-highest employer of displaced Syrians. The multiple challenges facing the sector are putting its resilience and sustainability at risk and posing threats to food security and rural livelihoods.

Increasing global fertilizer prices and energy costs compounded by the foreign exchange crisis are undermining the viability of agriculture and threaten to diminish the contribution of local production to food security. According to a survey of agricultural households carried out in July and August 2022 by FAO, over 80 percent of crop producers faced production difficulties, with the most frequent being access to fertilizers (72 percent) and pesticides (59 percent).

Lebanese farmers and agri-food SMEs lack the necessary access to finance to invest in sustainable, climate smart and modern modes of production. Small and medium-sized farmers relying only on farming income have been particularly affected by the high input prices, reducing input application, or substituting with lower quality, leading to lower marketable production and incomes (MoA, 2020).

### **(c) CHILD LABOR**

Children in Lebanon are subjected to the worst forms of child labor, including use in the production and trafficking of drugs, sometimes as a result of human trafficking, and in forced labor in agriculture (US Department of Labour, 2022). In Lebanon, food insecurity and child labour have increased in 2020 and both are correlated in vulnerable communities. In addition, 60% of child labor is in agriculture. In the Bekaa region in 2019, 30% of working children reported injuries at work and 42% were insulted at work. Children have also reported physical abuse as 24% of boys and 16% of girls have been threatened (IRC & LPC, 2021).

The NGOs that are working on preventing child labor in Lebanon are Himaya, Lebanese Union of Child Welfare (LUCW), Lebanese Organization of studies and Training (LOST) in addition to the international NGO Humanium.

ILO, Lebanon's Ministry of Labour and Beyond Association launched in 2016 a joint initiative to establish and support a series of community centers to provide a range of services aimed at combatting child labor across the country. The centers that are currently operational are in the Bekaa, Nabatieh and Ouzai (Beirut suburbs) (ILO, no date).

There is no recent data on child labor in Lebanon with reliable information. A large number of children work in the following sectors: auto repair (e.g. Mechanical work, car painting), construction and metalworking including aluminum and forged iron, and sanitary installations. In addition, there are many children working in the agricultural sector in Akkar, Hermel and Baalbek districts.

As for the Syrian displaced populations, a survey conducted in 2019 by the AUB for the Bekaa region showed that most working children ( $\geq 4$  to  $\leq 18$  years) in this study worked in the agricultural sector (about 75%). Many of these children were subject to harsh working conditions. Workplace injuries were quite common (30%). When children experienced an accident or injury at work, they or their families usually had to pay for the cost of treatment (86%) (AUB, 2019).

Only 18.3% of working children attended some form of schooling at the time of the study. Working children in compulsory school age ( $\geq 6$  to  $\leq 15$  years) constituted 72.6% (3,178 children) of the total population of working children. Half of the working children did not go to school because they had to work as a consequence of dire familial financial circumstances (AUB, 2019).

#### **(d) OVERVIEW OF THE NATIONAL SOCIAL PROTECTION STRATEGY**

In Lebanon, the social protection system is scattered and non-unified. Several schemes exist, including social insurance programmes for public servants and for military and private sector workers, syndicate pension plans, and small social assistance programmes.

Vulnerable people including those with disabilities, elderly, women, and children rely on unsustainable sources of income including informal employment and family support. The country lacks a coherent national social protection system, which has led so far to fragmentation and duplication of assistance while coverage and provision of protection to the poorest and most vulnerable remain inadequate.

The GOL adopted two national plans in an attempt to alleviate poverty in the country: National Social Action Plan Toward Strengthening Social Safety Nets and Access to Basic Social Services (2007), and National Social Development Strategy (NSDSL) in 2010 (Bastagli et al., 2019). A decade later, the GOL launched the Roads and Employment Project (REP) to rehabilitate roads in different regions of the country and create employment opportunities. The REP followed the population growth and the increase in unemployment rates in the country. In 2021, an amount of US\$ 10 million was reallocated to create a new component to support small farmers in rural areas. In addition, GOL developed and launched in 2011 the Emergency National Poverty Targeting Program (NPTP) Project to alleviate poverty rates in the country. Lately, MOSA launched the Daem Network for Social Protection. The DAEM platform has initiated the development of an integrated National Social Registry that will enable Lebanon to address future shocks rapidly, transparently, and equitably. The network comprises two programmes: safety programme, and an e-finance card programme (MOSA, 2022). Managed by IMPACT under the supervision of the Central Inspection, the platform has allowed the registration and

screening of household applications along the highest standards of transparency and efficiency.

Despite the consecutive attempts of GOL represented by MOSA in those programmes, as of September 2021, the UN estimates that roughly 75% of the total population lives in poverty (UN, 2021).

The lack of social security basics and the cumulative effects of the consecutive crises have drowned most of the Lebanese population into poverty, leading them to have limited to no access to proper services, including medical, educational, and transportation among others. The following sections provide an overview of the main programs aiming at alleviating poverty.

#### *i. National Poverty Targeting Program*

The National Poverty Targeting Program (NPTP) in Lebanon, launched in 2011, is managed by the Ministry of Social Affairs (MOSA) and the Presidency of the Council of Ministers (PCM). The rationale behind this program is to "provide social assistance to the poorest and most vulnerable Lebanese households based on transparent criteria that assess each household's eligibility to receive assistance, given available public resources" in Lebanon and improve the lives of 237,958 beneficiaries, or 42,935 households (PCM, no date).

NPTP is supported and funded by international organizations including the World Bank (WB), The World Food Programme of the United Nations (WFP), the UNHCR and the German Cooperation.

Based on the "Implementation Completion Result" report issued by the World Bank in 2021, while it was not possible to measure the Project's impact on poverty rates, it is likely to have had a significant impact on both monetary and non-monetary poverty. The certification of NPTP beneficiaries is expected to reduce monetary poverty of 261,000 individuals from extremely poor households that had access to health and school subsidies, while the e-card Food Vouchers improved food security of over 105,500 individuals. It is also expected to have decreased non-monetary poverty by improving access of poor and vulnerable people to education and health services, diversified dietary intake, and reduced negative coping strategies. The NPTP platform was used to target over 225,000 beneficiaries for restoring their access to essential healthcare services at MOHP Primary Health Care Clinics, and for the provision of UNICEF's ATM cash cards to support children through its winterization program during 2016 (US\$3 million) and 2020 (US\$3.5 million). These benefits helped to alleviate monetary poverty and free up household resources for other essentials.

#### *ii. Roads and Employment Project*

As part of the efforts to create job opportunities for residents in Lebanon as well as Syrian displaced populations, and to improve the economic situation of households, the Roads and Employment Project (REP) was launched in 2017 with the financial support of a loan accredited from the WB to the GOL. The components of the project were amended in 2021, following the economic collapse and the devaluation of the Lebanese Pound, and the COVID-19 pandemic. Both crises severely affected the living conditions of the Lebanese population, bringing roughly 75% of the total population to live below the poverty line, with 36% of them living in extreme poverty.

An additional component (component 4- Support to farmers engaged in crop and livestock production) was added to the project based on the request of MOA. The project would provide support to approximately 26,700 smaller crop and animal producers in Lebanon (whereby at least 10% of the beneficiaries shall be women) by providing them with vouchers for the

procurement of essential inputs to enable continued agricultural production following COVID-19-related planting and harvesting delays. Two types of paper-based vouchers would be offered: one for crop production inputs, and another for animal production inputs, mostly feed. On the other hand, the vouchers would not finance the purchase of pesticides. The component would also support the annual animal vaccination program of the Directorate of Animal Resources under the MOA by procuring vaccines for animal diseases.

iii. *Emergency Social Safety Network (ESSN)*

The ESSN also known as AMAN is a US\$246 million 3-year project launched in March 2022, that provided cash transfers and access to social services to extremely poor and vulnerable Lebanese populations affected by the economic and COVID-19 crises. The ESSN's purpose is to arrest the increase in extreme poverty and to preserve the human capital of 13 – 18 year-old children enrolled in public schools. It also aims to scale-up and enhance the National Poverty Targeting Program (NPTP): Lebanon's main poverty-targeting social assistance program launched in 2011 with financial and technical assistance from the World Bank.

**(e) OVERVIEW OF CULTURAL HERITAGE AREAS**

Lebanon is a host country to many archaeological and cultural sites. Five properties are inscribed on the World Heritage List of UNESCO: Anjar, Baalbek, Byblos, Ouadi Qadisha and the Forest of the Cedars of God, and Tyre (UNESCO, no date).

Many other sites are on the tentative list of UNESCO. These sites are:

- The historical center of Batroun (Le Centre Historique de la Ville de Batroun);
- Echmoun Temple;
- Set of Historical Monuments and Natural Sites of the Village of Menjez;
- Sacred Mount Hermon and its associated cultural monuments;
- Nahr el-Kalb Archaeological Site;
- Saida Historical Center;
- The castles of Mount Amel: Qalaat Al Chakif (Beaufort Castle), Qalaat Tibnin (Toron Castle), Qalaat Chakra (Dubieh Castle), Qalaat Deir Kifa (Maron Castle), Burj Al Naoqoura (Naqoura Tower);
- The Ancient City of Tripoli;
- Ras al-Qalaat promontory / Ras Al Natour promontory / Ras el-Mleih Promontory; and
- The Rachid Karamah International Fair in Tripoli-Lebanon;