Irrigation pond in Ehmej. (Photo by PMSPL II staff)

LEBANON CLIMATE RISK ANALYSIS

Performance Management and Support Program for Lebanon (PMSPL II)

December 2019

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A printed version of this document can be obtained through:

Social Impact, Inc. Corporate Office
2300 Clarendon Boulevard
Arlington, VA 22201
Tel: (703) 465-1884
Fax: (703) 465-1888
info@socialimpact.com

Or

Social Impact, Inc. Lebanon Office
Arz Street
Librex Bldg. Bloc B – 3rd Floor
Zalka, Metn, Lebanon
Tel: +961-1-879260

ACRONYMS

°C	Degrees Celsius
ADS	Automated Directives System
BALADI	Building Alliances for Local Advancement, Development, and Investment
CDCS	Country Development Cooperation Strategy
CO2	Carbon Dioxide
CO2eq	Carbon Dioxide Equivalent
CSO	Civil Society Organization
CSP	Community Support Porgram
DO	Development Objective
EDL	*Electricité du Liban*
FAO	Food and Agriculture Organization
FFP	Food for Peace
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
ICZM	Integrated Coastal Zone Management
IP	Implementing Partner
IPP	Independent Power Producers
IR	Intermediate Result
LiF	Livelihoods in Forestry
LWP	Lebanon Water Project
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
NCE	National Council for the Environment
NCCCU	National Climate Change Coordination Unit
NGO	Non-Governmental Organization
PMSPL II	Performance Management and Support Program for Lebanon II
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USFS	United States Forest Service

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I   INTRODUCTION

I.1   PURPOSE OF THE ASSESSMENT

USAID/Lebanon has requested a climate risk analysis be conducted to feed into the development of its 2020-2024 Country Development Cooperation Strategy (CDCS). This analysis will help determine the sectors where the risks posed by Lebanon's climate are highest in order to allow the Mission to properly address them at the project and activity levels and adaptively manage its interventions.

I.2   METHODOLGY

This climate risk analysis was conducted by the Performance Management and Support Program for Lebanon (PMSPL II) project. It relies on USAID's 2016 Lebanon Climate Risk Profile / Factsheet and adds to it updated information from different sources, mainly reports produced by the Lebanese Government, such as: Lebanon's Second National Communication to The UNFCCC (2011); Lebanon's Intended Nationally Determined Contribution under the United Nations Framework Convention on Climate Change (2015); Lebanon's Third National Communication to the UN Framework Convention on Climate Change (2016); and Lebanon's Second Biennial Update Report to the UNFCCC (2017).

As per the Mandatory Reference for ADS 201 "Climate Change in USAID Country/Regional Strategies" guidance, PMSPL II's team first conducted a climate risk screening that provided us with the necessary information to categorize as low[1], moderate, or high the risks that Lebanon's climate poses to the Mission's objectives (*Refer to Annex 1*) for each sector (*detailed in section III and summarized in Table 1*), development objective (DO), and/or intermediate result (IR).

The findings of this assessment will help inform the development of the CDCS 2020-2025.

I.3   STRUCTURE

This report first provides an introduction in **Section 1** that details the purpose and methods used to complete the analysis. **Section II** then presents an overview of Lebanon and a summary of its climate, and **Section III** describes the climate's impacts by sector and offers a screening of vulnerabilities. A summary of the main stressors, risks, and mitigation actions per sector is then presented in **Table 1**.

Section IV presents the policy context governing the climate risks and actions in Lebanon, as well as the national strategies and plans. **Sections V and VI** present selected ongoing experiences and key resources respectively.

The climate risk screening and management as it relates to the proposed CDCS DOs and IRs is presented in **Annex 1.** A greenhouse-gas (GHG) mitigation table is presented in **Annex 2.**

II   LEBANON CLIMATE RISK PROFILE

II.1   COUNTRY OVERVIEW

With a surface area of 10,452 km², Lebanon is the smallest country in continental Asia. It is located on the eastern basin of the Mediterranean Sea, bordered by Syria to the north and east and Israel to the south. Two parallel mountain ranges cut across its land mass: the Lebanon and the Anti Lebanon. Lebanon is characterized by mostly mountainous areas with narrow coastal plains stretching from north to south along the Mediterranean coast and a relatively vast plain in the Bekaa valley between the two mountain ranges. Altitude in these ranges varies between 400 and 3,088 meters. Irrigated agricultural land spreads over 1,040 Km2 and consumes around 70% of Lebanon's water, thus drier conditions due to climate change are likely to have adverse effects on agriculture. Moreover, the anticipated climate changes are expected to reduce the exploitable water supplies by about 1% by 2020, 8% by 2040, and 29% by 2080 and accelerate the depletion of groundwater supplies that are already under pressure from extraction for agriculture. Lebanon offers a significant number of natural and touristic attractions. The travel and tourism sector's total contribution to the GDP was 18.4% in 2017, at $9,345million, and is forecast to rise by 5.2% per annuum to 23.7% of GDP in 2028.

Figure 1: Lebanon Topography

However, climate changes such as increasing temperatures, rising sea levels, declining rainfall, and an accumulation of extreme weather events leading to the erosion and degradation of beaches, desertification, and an increasing risk of fire, drought, and loss of ecological habitats will adversely affect the tourism sector. Since 2011, traditional drivers of the economy such as real estate and construction have started suffering, and the real GDP which grew on average by an estimated 5.6% annually from 1993 to 2010, started to fall by an average of 4% annually from 2013 to 2015 and by 1.6% in 2018 and is forecast to continue dropping at almost the same rate through 2020.

Lebanon has signed several conventions, such as the Paris Climate Change Agreement, and established several institutions dedicated to the protection of the environment.

II.2   CLIMATE SUMMARY

Historical Climate

Lebanon has a Mediterranean-type climate characterized by hot and dry summers (June to September) and cool and rainy winters (December to mid-March). Spring and autumn are warm and pleasant. The average annual temperature is 15°C.

Along the coast, summers are hot and humid with temperatures surpassing 35°C in August, and due to the moderating effect of the Mediterranean, the temperature range during the day is narrower there than it is inland. January is the coldest month, with temperatures dropping to 5°C on the coast on some days. During the previous century, temperatures in Lebanon fluctuated between 23°C and 25°C without any discernible trend.
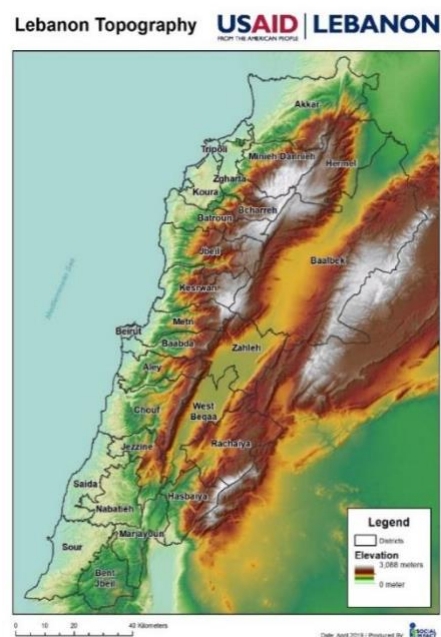
The mean annual rainfall along Lebanon's coast ranges between 700 and 1,000 mm.

CLIMATE PROJECTIONS

3-5°C jump in temperatures by 2090.

5-10 mm/year rise in the sea level thus Increase of about 88 cm between 1990 and 2090.

Rainfall decrease by 50 percent by 2090.

KEY CLIMATE IMPACTS

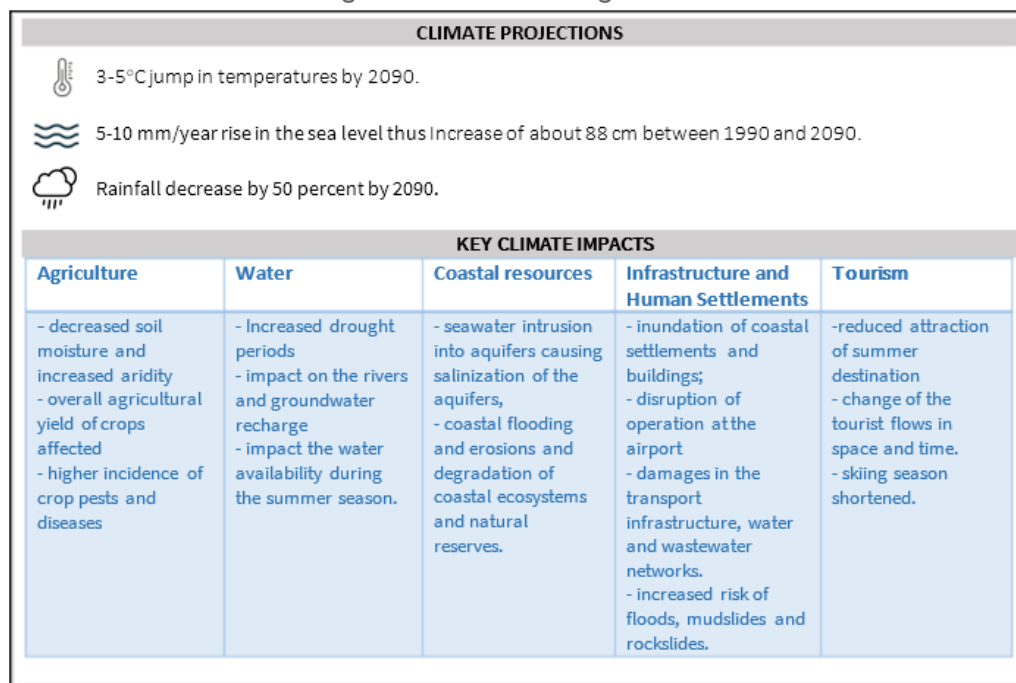| Agriculture	Water	Coastal resources	Infrastructure and Human Settlements	Tourism
- decreased soil moisture and increased aridity - overall agricultural yield of crops affected - higher incidence of crop pests and diseases	- Increased drought periods - impact on the rivers and groundwater recharge - impact the water availability during the summer season.	- seawater intrusion into aquifers causing salinization of the aquifers, - coastal flooding and erosions and degradation of coastal ecosystems and natural reserves.	- inundation of coastal settlements and buildings; - disruption of operation at the airport - damages in the transport infrastructure, water and wastewater networks. - increased risk of floods, mudslides and rockslides.	-reduced attraction of summer destination - change of the tourist flows in space and time. - skiing season shortened.

Figure 2: Climate Projections

About 70% of the average rainfall in the country happens between November and March. Rain usually falls during a few scattered days in the rainy season, often pouring down in heavy cloudbursts or violent storms. Precipitation in inland Lebanon is higher than it is along the coast. Snow usually falls at an altitude of 1,000 meters and above.

On average, there are 80 days per year with more than 0.1 mm of rainfall or 6.7 days with a quantity of rain, sleet, snow etc. per month. The driest weather is in July when an average of 0.3 mm of rainfall occurs. The wettest weather occurs in January with an average of 190.9 mm of rainfall.

Future Climate

By 2040, maximum temperatures are predicted to increase by up to 1°C along the coast and up to 2°C in the mountainous inland. This upward trend is expected to continue throughout the century reaching 3°C and 5°C respectively. Minimum temperatures will evolve similarly.

Significant reductions are projected for rainfall, with a drop of 10% to 20% in yearly precipitation for coastal and inland areas respectively by 2040 and 25% to 45% by 2090.

The annual average relative humidity is not expected to change much by 2040, but it is foreseen to drop by 10% in the eastern parts of the country by 2080. Wind speed and cloud fraction are not projected to change significantly in the two future periods studied. Annual average wind speeds do not currently exceed 4 m/s, and projected changes in the future are less than ±0.3 m/s. The cloud cover over Lebanon is expected to decrease by about 5%.

II.3   LEBANON'S GHG EMISSIONS

The most recent data were produced in 2013 and submitted as part of the Lebanon's Second Biennial Update Report to the UNFCCC (2017). According to this report, Lebanon emitted 26,285 Gg CO$_2$eq. with the most significant greenhouse gas (GHG) being carbon dioxide, resulting primarily from the combustion of fossil fuels. The main contributor to GHG emissions is the energy sector with 79% (including transport), followed by industry (10%), waste management (7%), and agriculture (3.5%). Lebanon's GHG emissions are increasing at an average rate of 3.4% every year, which led to a doubling of emissions since 1994. CO2 removals from the land use, land use change, and forestry categories amounted to 3,518.80 Gg CO2, bringing Lebanon's net emissions down to 22,766 Gg CO$_2$eq. In accordance with the Paris Agreement, the Government of Lebanon has declared in its Intended Nationally Determined Contribution (INDC, 2015) its intention to reduce greenhouse gas emissions by 15% by 2030 as an unconditional target and by 30% as a conditional one.
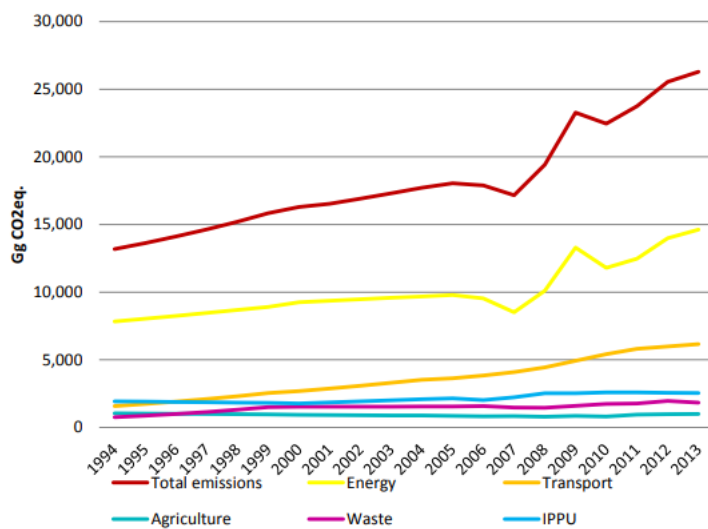

Figure 3: Trend of GHG emissions per sector (UNFCCC 2017)

III   SECTOR IMPACTS AND VULNERABILITIES

III.1   AGRICULTURAL PRODUCTION

With food security being at high risk, agriculture in Lebanon is one of the most vulnerable sectors to climate change due to the limited availability of water and land resources and the pressure exerted by population growth and urbanization. In Lebanon, agriculture uses 60-70% of the country's available water. Lower precipitation combined with higher temperatures will sharply decrease water runoff, which is expected to decline by up to 30%. Higher temperatures will significantly increase demand for irrigation water, while overall water availability will sharply drop. Moreover, the smaller water runoff is expected to significantly reduce groundwater recharge, further exacerbating the already very serious problem of rapidly declining groundwater levels in many parts of the country as well as the flow of rivers and streams.

Extreme temperatures during spring and summer can cause significant harm to many crops grown in Lebanon. Warmer winter temperatures can also affect some fruit trees, particularly those that require prolonged chilling time. Another indirect effect of climate change is the increased incidence of crop pests and diseases. Higher temperature, reduced precipitation, and high evapotranspiration will decrease soil moisture and increase aridity, thus affecting the overall agricultural yield of crops. Lebanon's agriculture may experience a decrease in productivity for most crops and fruit trees.

III.2   WATER RESOURCES

The expected decrease in precipitation, change in rainfall patterns, and increase in evapotranspiration will lead to earlier drought occurrence (15-30 days sooner than normal), which will exacerbate the existing water shortage that is already under pressure from urbanization and population growth. Changes in weather patterns will reduce the total volume of water by 6-8%, shrink the snow cover by 40%, and prolong drought periods. With temperature rising by 1°C, a 6-8% reduction in the total volume of water resources will occur.

In addition, climate change will induce a reduction of 40% to 70% of the snow cover, a shift of snowfall elevation from 1,500m to 1,900m, and a shortening of snow residence time from 110 days to 45 days. This will impact rivers and groundwater recharge, thus decreasing water availability during the summer. The main adaptation measures suggested for Lebanon's water sector include the protection of groundwater from salinization in coastal areas; the implementation of water management strategies to reduce water consumption in the domestic, industrial, and agriculture sectors; and the development of watershed management plans.

III.3   TOURISM

Many tourist attractions and activities in Lebanon are highly dependent on weather conditions. Climate change affects the tourism sector by inflicting damage on a wide range of environmental resources that are critical attractions for tourism. Temperatures rising by 2°C along with reduced precipitation are expected to lead to a decrease in the intensity, residence time, and thickness of the snow cover. Therefore, winter outdoor tourism is expected to diminish and the skiing season, which is the key tourist attraction during winter, will be affected. The expected loss of natural attractions and increase in sea levels will also inflict damage on public beaches and reduce ecotourism activities.

Rising temperatures and extreme heat waves will reduce the attraction of summer destinations. The drought caused by the heat will also lead to a higher risk of forest fires. Protected areas such as those in the Chouf will be affected, including the already endangered cedar forest. As a result of the above, tourist flow will change in both space and time.

III.4   COASTAL RESOURCES

Sea levels in Lebanon's coastal areas have been continuously rising and are expected to rise by 30 to 60 cm in 30 years. This means that large coastal strips will erode or even disappear completely into the sea. Seventy percent of Lebanon's 4-million population live on the coast where several industrial facilities and tourist facilities, including hotels and beach resorts, are also located. In addition, there are sandy beaches and coastal natural reserves in the north and south, such as Palm Island and the Tyre nature reserve. All these people and locations will be affected, as parts of coastal Lebanon become submerged under water due to the continuous rise of sea level as a direct effect of global warming. Rising sea levels will cause a considerable disruption of socio-economic activities taking place on the coast, such as fishing, agriculture, industry, and tourism. Also, the risk of seawater intrusion into aquifers will increase, causing their salinization. In addition, coastal flooding and erosions will lead to the degradation of coastal ecosystems and natural reserves.

Possible technical measures to be applied in this area include installing tetrapods or groynes, heaping up sand, and constructing dykes. An Integrated Coastal Zone Management (ICZM) or controlled urban and regional planning are required to counter the effect of surface sealing by new buildings and the consequent pollution of water and the coastal strip of land.

III.5   INFRASTRUCTURE AND HUMAN SETTLEMENTS

The impacts of climate change on infrastructure and human settlements are caused by the changing patterns of precipitation, the rising sea level, and the increasing frequency and intensity of storms. These impacts can cause the inundation of coastal settlements and buildings, disrupt Beirut airport's operation, and damage the transport infrastructure and water and wastewater networks along the coast. They can also increase the risk of floods, mudslides, and rockslides. Heavy winds and rains can inflict immense damage on infrastructure all along the coast and in mountainous areas. Storms and rains of such dimensions could bring the economy to a standstill. In June 2018, unseasonal torrential rains in the Ras-Baalbek village caused heavy flooding in over 40 houses, knocking down several walls and ruining indoor furniture. A dozen cars were damaged as well. Similar flooding occurred in the nearby towns of Al-Qaa and Arsal in the same period. Six months later, in January 2019, the Akkar, Baalbek-Hermel, and Bekaa governorates were hit by heavy snowfall and flooding, which severely affected over 11,300 Syrian refugees, including 6,000 children, in more than 360 settlement sites.

III.6   FOREST AND LAND USE

During the past 50 years, Lebanon's forest cover regressed by 17%. Lebanon loses approximately 1,500 to 2,000 hectares of its forests annually to wildfire and deforestation. These forests provide economic opportunities for many Lebanese and support ecological stability including the water cycle. Natural springs and mountain water sources also play a key role in Lebanon's environment and the protection of its forests. More than 2,000 springs, however, are threatened by rapid population growth, unplanned development, misuse, and pollution. Land use, land use change, and forestry in Lebanon act as a sink for carbon dioxide emissions. The main sources of emissions are logging, fuelwood extraction, biomass burning, and clear-cutting, in addition to the CO_2 that emanates from natural and man-made forest fires. Forest stands suffer from fragmentation, pest outbreaks, forest fires, and unsuitable practices, all of

which are affecting the sector's capacity to survive and develop. Temperature increase is another important factor affecting forest growth and survival in Lebanon. Water availability resulting from rainfall, snowfall in mountains, and the soil's capacity to store water are the essential relevant parameters to this sector. Forest fires constitute a serious threat to the vegetation cover and accelerate the decline of Lebanese forests. The most fire-prone areas in Lebanon are usually situated near urban complexes, below 1,200m of altitude. Three main tree types grow there: broadleaved trees, Pinus Pinea, and Pinus Brutia.

III.7 ECONOMY

The Lebanese economy loses about $800 million per year in agricultural and food costs that can be traced to direct or indirect climate change-related causes. This happens as higher temperatures, precipitation changes, and extreme weather events (e.g. storms) reduce agricultural productivity, cause flooding, and damage infrastructures. Such misfortunes are expected to cost Lebanon around $23,200 million in 2080. The total estimated cost from direct damage and forgone GDP will be borne by the government, at a cost of $610 million in 2020 and $44,300 million in 2080, and by households at an average annual cost of $1,500 in 2020 and $107,200 in 2080. Rural households would generally experience larger percentage reductions than urban households would.

Table 1: Summary of Main Stressors, Risks, and Mitigation Actions per Sector

Sector	Climate Stressors	Risks	Mitigation actions*
Agriculture	- Higher temperature. - Reduced precipitation. - Increased evapotranspiration. - Limited availability of water.	- Decreased soil moisture and increased aridity. - Overall agricultural yield of crops affected. - Higher incidence of crop pests and diseases.	- Adopt more drought- and heat-resistant species and change planting dates and cropping patterns. - Adopt good agricultural practices and select adapted varieties and rootstocks. - Expand modern irrigation techniques that are less water intensive. - Rehabilitate and modernize irrigation canals. - Use treated sewage water in irrigation. - Construct hill lakes and other water-harvesting methods. - Construct terraces for better soil and water management. - Better manage farm manure.
Forests and land use	- Temperature increase. - Drought of natural springs.	- Native species (Cedrus Libani, Juniperus Excels, Abies Cilicia) most susceptible to climate change are affected. - Extinction of insects that improve soil condition. - Increased risk of wildfires.	- Strengthen the legal and institutional framework for forest and land use management. - Integrate landscape levels planning in local/regional development plans. - Strengthen awareness, education, and support research. - Develop forest management plans for most vulnerable ecosystems. - Maintain and conserve existing forest carbon sinks. - Conduct reforestation and afforestation activities in new and degraded lands
Water	- Decrease in precipitation. - Changes in rainfall patterns. - Increase in evapotranspiration. - Reduction of total water volume by 6-8%. - Shrinkage of snow cover by 40%.	- Increased drought periods. - Less water in rivers and decreased groundwater recharge. - Decreased water availability in the summer.	- Improve water-use efficiency in households, industry, and agriculture. - Develop watershed-managed plans appropriate for expected climate changes. - Investigate the feasibility of alternative sources of water supply. - Improve the available information about Lebanon's water resources and water systems. - Protect groundwater from salinization in coastal areas. - Implement water demand side management strategies to reduce water consumption in

			households, industry, and agriculture.
Tourism	- Decrease in the intensity, residence time, and thickness of the snow cover. - Rising sea levels. - Rising temperatures and extreme heat waves.	- Skiing season is affected. - Damaged public beaches. - Reduced attraction of summer destinations.	- Identify alternative sustainable tourism products that have as little adverse climatic effects and that are as independent of climate related factors as possible. - Establish thematic walking tours or biking on fixed routes.
Coastal resources	- Continuous rise of sea level. - Increase of sea surface temperatures.	- Parts of coastal Lebanon might become submerged under water. - Disruption of socio-economic activities such as fishing, agriculture, industry, tourism, and leisure. - Seawater intrusion into aquifers causing their salinization. - Coastal flooding and erosions and degradation of coastal ecosystems and natural reserves.	- Install tetrapods or groynes. - Heap up sand. - Construct dykes. - Adopt Integrated Coastal Zone Management (ICZM) or controlled urban and regional planning.
Infrastructure and Human Settlements	- Heavy winds. - Changing precipitation patterns. - Rising sea levels. - Increased frequency and intensity of storms.	- Inundation of coastal settlements and buildings. - Disruption of operations at Beirut airport. - Damage to transport infrastructure and water and wastewater networks. - Increased risk of floods, mudslides, and rockslides.	- Adopt mitigation measures and compensatory investments designed to alleviate economic losses. - Dig evacuation canals to divert floodwater. - Construct concrete embankments to avoid mudslides.

*Definition: implementing policies to reduce greenhouse gases and enhance sinks

IV   POLICY CONTEXT

IV.I INSTITUTIONAL CONTEXT

Lebanon's **Council of Ministers** enacts all regulations in the form of decisions and decrees. **The Ministry of Environment (MoE),** which was established by law 216/1993 and amended by law 690/2005, coordinates closely with other ministries and various public- and private-sector groups on matters related to environmental inspection and enforcement, climate change adaptation, sustainable management of natural resources, continuous monitoring of air quality, promotion of hazardous and non-hazardous waste management, etc. The MoE is a member of the **National Council for the Environment (NCE),** which is composed of representatives of seven ministries and seven non-public entities. NCE's main role, as stipulated by decree 8157/2012, is to provide policy and planning suggestions in all environment and climate-related areas. The **National Climate Change Coordination Unit (CCCU)** is composed of 40 representatives from government agencies, NGOs, academic institutions, and regional and international organizations that deal directly or indirectly with climate change. Its main role is to strategically align all national mitigation and adaptation activities by coordinating and bringing them under the NCE.

IV. II NATIONAL STRATEGIES AND PLANS

The most recent national strategies and plans that relate to climate risk are listed below and can be found on the following links:

Nationally Appropriate Mitigation Action in Lebanon's Private Road Transport Sector (2017).

Nationally Appropriate Mitigation Action in Lebanon's Municipal Solid Waste Sector (2017).

Lebanon's Second Biennial Update Report to the UNFCCC (2017)

Lebanon's Third National Communication to the UN Framework Convention on Climate Change (2016)

Lebanon's Intended Nationally Determined Contribution under the UNFCCC (2015).

V   SELECTED ONGOING EXPERIENCES

The below table highlights an extended selection of on-going projects and initiatives that implement activities to mitigate climate change risks:

Selected program	Amount	Donor	Year	Implementer
Sustainable Agricultural Livelihoods in Marginal Areas (SALMA)	[redacted]	GEF, FAO	2012-2017	Ministry of Agriculture
Land Degradation Neutrality of Mountain Landscapes in Lebanon	[redacted]	GEF	2016-2022	UNDP and MOE
Sustainable Land Management in the Qaraoun Catchment	[redacted]	GEF	2016-2019	UNDP and Ministry of Environment
Sustainable Oil and Gas Development in Lebanon	[redacted]	MOEW	2012-2019	UNDP
Support to the Lebanon Environmental Pollution Abatement Project (LEPAP)	[redacted]	Italian Cooperation	2014-2019	Ministry of Environment
Small Decentralized Renewable Energy Power Generation	[redacted]	GEF	2014-2019	UNDP and MOEW with the Lebanese Center for Energy Conservation
Machrek Energy Development – Solar	[redacted]	European Union	2013-2019	UNDP

VI   KEY RESOURCES

1. Lebanon's Second National Communication to The UNFCCC (2011); Ministry of Environment, Beirut, Lebanon.
2. State and Trends of the Lebanese Environment (2011), UNDP/ECODIT/); Ministry of Environment, Beirut, Lebanon.
3. Lebanon Technology Needs Assessment Report for Climate Change (2012). Ministry of Environment, Beirut, Lebanon.
4. Climate change in Lebanon: Higher-order regional impacts from agriculture (2014); EA Haddad, N Farajalla, M Camargo, RL Lopes, F VVieira. REGION: Volume 1, Number 1.
5. Lebanon's Intended Nationally Determined Contribution under the United Nations Framework Convention on Climate Change (2015). Republic of Lebanon.
6. Lebanon's Third National Communication to the UN Framework Convention on Climate Change (2016); Ministry of Environment, Beirut, Lebanon.
7. Lebanon's Second Biennial Update Report to the UNFCCC (2017); Ministry of Environment, Beirut, Lebanon.

ANNEX 1 - CLIMATE RISK SCREENING AND MANAGEMENT

[redacted]

ANNEX 2 - GREENHOUSE GAS MITIGATION TABLE

What are the major sources of GHG emissions (e.g., personal cars, power plants, landfills, industry, agriculture sector, deforestation, etc.)? How has the distribution and composition of the GHG emissions profile changed over time historically and how is the profile expected to change in the future considering the major emitting sectors and/or sources? How are the sectors and sources that contribute to GHG emissions contributing to the growth and development of the economy and to meeting development objectives? What climate change mitigation or low emissions development plans, targets, commitments, and priorities has the government (national, state and local) articulated?	The main contributor to greenhouse-gas (GHG) emissions in Lebanon is the energy sector at 79%, followed by industry at 10%, waste management at 7%, and agriculture at 3.5%. Lebanon's GHG emissions are increasing at an average rate of 3.4% per year. CO_2 removals from the land use, land use change, and forestry categories amounted to 3,518.80 Gg CO_2, bringing Lebanon's net emissions down to 22,766 Gg CO2eq. The most recent data were produced in 2013 and submitted as part of Lebanon's Second Biennial Update Report to the UNFCCC (2017). The report states that Lebanon emitted 26,285 Gg CO2eq. in 2013 with the most significant greenhouse gas being carbon dioxide, resulting primarily from the combustion of fossil fuels. During the past decade, the agricultural and industrial sectors stagnated while construction and real estate, along with banking, boomed. Industrial exports, which averaged over $3 billion annually from 2008 to 2015 and peaked at $3.57 billion in 2012, had by 2016 dropped to some $2.5 billion and fell further in 2017. The service, industry, and agricultural sectors constituted 72 percent, 14 percent, and 4 percent, respectively, of real GDP from 2004 to 2016. The agriculture and agri-business sector - including crops, livestock, fisheries, forestry production, and food processing - accounts for around 3.5% of Lebanon's GDP and employs roughly 9% of the Lebanese labor force. The country is endowed with the highest proportion of agricultural land (64.3%) in the Middle East as a percentage of total land area. In 2015, the agro-industrial sector generated an estimated 32.03% of the industrial sector output and approximately 2.66% of the country's GDP, with an estimated market size of $1.98 billion. In addition to its significant employment-generating potential, the sector benefits from a well-trained labor base.

	Energy and waste management provide significant grounds for disputes and divisions. They constitute major challenges that are in dire need of being addressed. EDL's end-user tariffs are not cost-reflective, with EDL requiring a large annual subsidy, estimated at close to $2 billion in 2013, or 4.5% of GDP. Annual electricity demand is projected to grow at around 5% per year. In the environment and clean/renewable energy sector, the private sector requires skilled employees with practical or professional experience. This combination is perceived to be lacking in the Lebanese market. Solid waste management has been noted as a major need within the Lebanese economy, raising the prospects for activities that focus on recycling as an economically productive activity. Employment in solid waste management is not filled primarily by the Lebanese workforce under the current conditions, but this could change if higher-technology waste management practices were adopted. In accordance with the Paris Agreement, the Government of Lebanon has declared in its Intended Nationally Determined Contribution (INDC) its intention to reduce greenhouse gas emissions by 15% by 2030 as an unconditional target, and by 30% as a conditional one. Mitigation measures are mainly achieved in the power (covering both energy efficiency and renewable energy) and forestry sectors. Emission reduction initiatives in the industrial, transport, agriculture, and waste management sectors are few and not well documented.
Which of these sectors is USAID planning to program in? What opportunities exist to reduce emissions in those sectors? What opportunities exist to reduce emissions associated with USAID activities?	Collaboration between USAID/Lebanon and United States Forest Service (USFS) has already resulted in 333,141.88 metric tons of CO_2eq reduced and/or avoided through reforestation activities. USAID/Lebanon will continue to support reforestation activities under the new CDCS through the implementing mechanism, Livelihoods in Forestry (LiF), and thus efforts to further reduce CO_2 emissions will be ongoing throughout the new CDCS. Although USAID/Lebanon does not work in the energy and transportation sectors, which are the main sources of CO_2 emissions,

	DO3 of the new CDCS will support small initiatives with local governments to install renewable energy systems.
Does the strategy incorporate ways to reduce GHG? Reference the page number in the strategy. Note in particular if a Goal, the DO, or an IR or sub-IR specifically incorporates mitigation.	The forestry and wildfires prevention activities will continue under DO1 of the new CDCS. Although DO1 focuses on enhancing the economic opportunities for private sector engagement, the forestry activity will result in the reduction of GHG emissions.
What are the next steps at the project and/or activity levels to reduce greenhouse gases?	Any future design of projects and activities under DO1 and DO3 will take into consideration GHG emissions and their impact on the climate. Assessments and screening prior to the design, award, and implementation will be conducted to identify potential areas that would mitigate the effects of climate change. Reforestation activities implemented under DO1 would mitigate the greenhouse gases resulting from the industrial activities. Under DO3, collaboration with local governments to introduce solar/renewable energy will contribute to lowering gas emissions resulting from generators.

Social Impact, Inc.
2300 Clarendon Boulevard
Arlington, VA 22201
Suite 1000
Tel: (703) 465-1884
Fax: (703) 465-1888
www.socialimpact.com