Ministry of Foreign Affairs

Climate Change Profile
Lebanon

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Introduction

This climate change profile is designed to help integrate climate actions into development activities. It complements the publication 'Climate-smart = Future-Proof! – Guidelines for Integrating climate-smart actions into development policies and activities' and provides answers to some of the questions that are raised in the step-by-step approach in these guidelines.

The current and expected effects of climate change differ locally, nationally and regionally. The impacts of climate change effects on livelihoods, food and water security, ecosystems, infrastructure etc. differ per country and region as well as community and individual, with gender a particularly important vulnerability factor. This profile aims to give insight in the climate change effects and impacts in Lebanon, with particular attention for food security and water. It also sheds light on the policies, priorities and commitments of the government in responding to climate change and important climate-relevant activities that are being implemented, including activities being internationally financed.

Summary

Lebanon is a highly urbanized, middle income country with most of its population in coastline cities that are vulnerable to climate-related sea level rise. Saltwater intrusion into coastal aquifers is already occurring and will continue with rising seas. Reduced rainfall and increased temperature will result in a decrease in snow level, a vital water source, which will negatively impact on Lebanon's water supply, particularly during the period for high demand of water for irrigation. The Syrian crisis has resulted in an estimated 1.5 million refugees, increasing Lebanon's population by 30% in just over two years and adding stress to the already-stretched economy and natural resources and hindering the country's efforts to build a climate-resilient low carbon economy[1].

Overall ranking

Lebanon has an emissions ranking of 82 out of 220 countries and regions2 contributing about 0.06% of global GHG emission[3] . For climate vulnerability Lebanon has a ranking of 106 out of 181 countries in the ND-Gain Index (ranking 1 being the least vulnerable)[4]. Lebanon is the 78th least vulnerable country and the 59th least ready country. *Vulnerability* measures the exposure, sensitivity, and ability to cope with climate related hazards by accounting for the overall status of food, water, environment, health, and infrastructure within a country. *Readiness* measures a country's ability to leverage investments and convert them to adaptation actions by looking at the country's economic, governance and social readiness. Globally, relative to other countries its current vulnerabilities are manageable but improvements in readiness will help it better adapt to future climate challenges.

Biophysical Vulnerability

Lebanon is located on the eastern basin of the Mediterranean Sea, with a surface area of 10,452 km2, a coastline extending on 225 km and a landscape characterized by mostly mountainous areas . Lebanon is divided into four topographic systems[5] [6] (see Map 1):

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

Lebanon has a diverse natural environment including coastal, agricultural, forest and mountainous areas many of which have unique biodiversity and ecosystems that are sensitive to climate change[7]. The land structure consists of high sloping and steep lands, which are prone to water erosion causing loss of top-soil and the capacity to retain water. Degraded sandy soils contribute to dust and sand

1 Republic of Lebanon's Intended Nationally Determined Contribution (INDC) (2015) available at http://www4.unfccc.int/submissions/INDC/Published%20Documents/Lebanon/1/Republic%20of%20Lebanon%20-%20INDC%20-%20September%202015.pdf

2 Global Carbon Atlas (2016). Available at http://www.globalcarbonatlas.org/en/CO2-emissions

3 "Climate Analysis Indicators Tool (CAIT) Version 2.0. (Washington, DC: World Resources Institute, 2014)". *World Resources Institute*. Retrieved 2017-06-12.

4 GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. http://gain.nd.edu/our-work/country-index/rankings/

5 World Bank Climate Change Knowledge Portal (2018). Available at http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=LBN

6 Third National Communication to the UNFCCC (2016) Prepared by the Ministry of Environment (2016) available at http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php

7 INDC (2015)

storms, which are hazardous to humans and livestock[8]. Of the surface area of Lebanon, an estimated 39% is in pastures and meadows, 12% in permanent crops (olives, fruit trees, citrus, and grapes),11% arable land, and 13% is in forests[9].

Lebanon has a Mediterranean-type climate characterized by hot and dry summers and cool and rainy winters, with an average annual temperature of 15°C. Along the coast, summers are hot and humid with temperatures crossing 35°C in August. But due to the moderating effect of the sea, the daily temperature range is narrower than it is inland. January is the coldest month, with temperatures around 5 to 10°C. The mean annual rainfall on the coast ranges between 700 and 1,000 mm. About 70% of the average rainfall in the country falls between November and March and is concentrated during only a few days of the rainy season, falling in heavy cloudbursts or violent storms. Rainfall in inland Lebanon is higher with snow in the mountains than along the coast[10] [11].

Climate trends

Since 1960 climate trends include[12](see Maps 2 and 3):

- Increase in annual mean temperature of 0.11°C per decade, more in spring and summer;
- Increase in the number of hot nights by 7 percent (mostly in summer);
- Decrease in precipitation of 11 mm per month on average (since 1950);
- Increase in the amount of rainfall received during one-day extreme rainfall events;
- Rising Mediterranean Sea levels of roughly 20 mm per year;
- Increase of 1.3°C in Mediterranean Sea surface water temperature (since 1982).

Climate change projections

Analysis of historical climatic records of Lebanon from the early 20th century with future emissions trajectories indicates that the expected warming in Lebanon has no precedent[13].

Climate projections[14] suggest:

- an increase in temperature of 1.2°C by mid-century and over 2°C by 2100. Water will face a reduction of 6 - 8% of the total volume of water resources with the increase in 1°C and 12 -16% with a 2°C rise in temperature[15];
- a decrease in precipitation of 4 -11% with drier conditions by the end of the century (up to 5 mm decrease in average monthly precipitation);
- increased trend of warming, reaching up to 15 additional days with maximum daily temperature higher than 35°C and an increase in number of consecutive dry days when precipitation is less than 1.0 mm by the end of the century;
- Increased incidence of drought conditions due to longer and geographical expansion of drought periods resulting in a hotter and drier climate;
- Continued sea level rise, rising by a total of 30-60 cm between 2020 and 2050;
- Decrease in forest productivity and shifts in species composition.[16]

Anticipated impact on Lebanon includes adverse effects on agriculture, water resources, coastal resources, energy and tourism (see Table 1 below) as well as public health and infrastructure. For water resources, drier conditions are likely to further accelerate the depletion of groundwater supplies that are currently under pressure from extraction for agriculture and are also being polluted by industry[17]. Anticipated changes in climate would reduce exploitable supplies of water by about 1% in 2020, 8% in 2040, and 29% in 2080[18]. Lebanon's arid/semi-arid climate makes it poor in water resources availability and vulnerable to the impacts of climate change; the projected changes in rainfall will put additional pressure on national water security and impact sectors such as agriculture, where around 70% of the available water is being used for irrigation. The supply of hydroelectricity will diminish with anticipated declining precipitation and rising temperatures reduce the water in rivers available for hydropower plants[19].

8 World Bank Climate Change Knowledge Portal (2018). Available at http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=LBNWB (2018)

9 World Bank Climate Change Knowledge Portal (2018).

10 Second Biennial Update Report (BUR) (2017). Prepared by the Ministry of Environment with support of GEF and UNDP. Available at http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php

11 TNC (2016).

12 USAID (2016). Fact Sheet. Climate Change Risk Profile Lebanon. Available at https://www.climatelinks.org/resources/climate-change-risk-profile-lebanon

13 TNC (2016.

14 These projections were made by the Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources in the Arab Region (RICCAR) which was led by the United National Economic and Social commission for Western Asia (ESCWA). RICCAR combined climate change impact assessment with socio-economic and environmental vulnerability assessment, based on the generation of downscaled regional climate modeling projection covering the Arab/Middle East North Africa (MENA) domain. For this climate profile the moderate Representative Concentration Pathway (RP4.5) developed by the IPCC which is based on a peaking of global emissions around 2030.

15 Second National Communication (SNC). 2011

16 RICCAR (2017)

17 World Bank (2018)

18 TNC (2016)

19 INDC (2015)

Socio-economic Vulnerability

GDP (PPP) per capita (2016)[20]:	USD 14,316.5
Population (est. July 2018)[21]:	6,093,509
Projected population (2050)[22]:	5,412,000
Population density per km² (2016)[23]:	587
Human Development Index (2016)[24]:	76 out of 188 countries
Corruption Perceptions Index (2016)[25]:	136 out of 176 countries
Fragile State Index (2017)[26]:	43 out of 178 countries
Gender Inequality Index (2016)[27]:	83 out of 188 countries
Adult literacy (2015)[28]:	91% (male 94%; female 88%)

Lebanon Is a highly urbanized, middle-income country with an economically important tourist industry[29]. Almost 90% of the population resides in the cities along the coastline that, as noted above, is vulnerable to projected sea level rise. Lebanon's economic growth record is volatile. During the period 2006-2010, real GDP growth averaged 7.7% before falling to 1.9% in 2011-2015 because of geopolitical developments[30]. Conflicts over the years have damaged infrastructure, which suffers from underinvestment and inefficient management.

On a per capita basis, Lebanon currently hosts the largest number of **refugees** in the world, with the *registered* Syrian refugees accounting for more than 20% of the total population[31].The inclusion of *non-registered* Syrian refugees and refugees from other countries (e.g. Iraq, Palestine) brings the number of refugees to an estimated 1.5 million. The large influx of refugees, a large percentage of which are in the main agricultural areas of the North and the Bekaa, is putting significant pressure on natural resources (farmlands, rangelands, groundwater and forest resources) and directly impacting energy demand and consumption, solid waste and wastewater generation and management, air quality, food consumption and land use[32] [33]. The Syrian crisis is expected to worsen poverty incidence among Lebanese as well as widen income inequality. It has set back development and heavily weighed on the national economy, generating a cumulative and compounded cost of about one-third of the national GDP since the start of the crisis[34]. It is estimated that because of the crisis, some 200,000 additional Lebanese have been pushed into poverty, adding to the previously estimated 1 million poor. An additional 250,000 to 300,000 Lebanese citizens are estimated to have become unemployed, most of them unskilled youth[35].

Lebanon imports more than it exports and is largely dependent on imports for food and fuel. Due to the dependence on imports and services (including banking and tourism), economic productivity is highly influenced by regional and international shocks. The conflict in Syria is disrupting trade routes and having a drastic impact on the country's export of agricultural products to markets, particularly exports of fresh produce. The collapse of the animal health system in Syria has resulted in higher incidence of outbreaks of animal diseases in Lebanon as a result of seasonal trans-boundary movements of livestock (mainly sheep) from Syria[36].

The tourism industry is one of the most important economic sectors in Lebanon. It contributes 7.6% (20 % when indirect investments are considered) to the country's GDP and employs 38% of the country's workforce[37]. The country's popular attractions of both sun and snow (e.g. ski resorts) are highly weather dependent and vulnerable to the projected climate change impact of higher temperatures and changes in precipitation.

The sector with the lowest contributing share to the GDP (4%) is the agriculture, forestry & fishing sector. However, agriculture employs 20-30% of the active work force and constitutes 17% of the total exports. In rural areas agriculture is reported to contribute up to 80% of the local GDP and represents the major income- earning and employment

20 World Bank Data – GDP per capita, PPP. http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD

21 Lebanon Population. (2017-12-21). This includes the estimated 1.5 million refugees currently residing in Lebanon. Retrieved 2018-02-13, from http://worldpopulationreview.com/countries/lebanon-population/

22 UNDESA (2017): World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248. https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf [estimates anticipate a return to current refugees to home country].

23 World Bank Data – Population density, https://data.worldbank.org/indicator/EN.POP.DNST

24 UNDP (2017) Human Development Report 2016: Human Development for Everyone. Table 1. http://hdr.undp.org/en/content/human-development-index-hdi

25 Transparency International (2017) Corruption Perceptions Index. https://www.transparency.org/whatwedo/publication/corruption_perceptions_index_2016

26 Fragile State Index (Fund for Peace) (2017) available at http://fundforpeace.org/fsi/

27 UNDP (2017) Human Development Report 2016. Table 5. http://hdr.undp.org/en/content/human-development-index-hdi

28 World Bank Date- adult literacy (data used, 2007;2009) https://data.worldbank.org/indicator/SE.ADT.LITR.MA.ZS?locations=LB

29 USAID (2016). Fact sheet: Climate Change Risk Profile Lebanon.

30 Lebanon's Second Biennial Update Report to the UNFCCC (2017) available at https://unfccc.int/files/national_reports/non-annex_i_parties/biennial_update_reports/application/pdf/3490185_lebanon-bur2-1-lebanon_burii_2017.pdf

31 FAO (2018) available at climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.en

32 Second Biennial Update Report (2017).

33 FAO (2018)

34 TNC (2016)

35 http://www.worldbank.org/en/country/lebanon/overview

36 FAO (2018)

37 USAID (2016)

opportunity [38]. Rural populations accounts for only an estimated 12% of Lebanon's population and are relatively poorer than urban populations. Farm households typically engage in non-agricultural economic activities as well as in agriculture (poorer rural households tend to rely more heavily on agriculture than better-off households). About 9% of the total farmers are women, among whom there is an increased incidence of poverty when compared to male farmers. Women are mainly engaged in the production of dairy products, food preserves and subsistence farming[39].

Agricultural production reflects Lebanon's range of temperature and precipitation regimes:

- **The Bekaa:** is the most important production area and accounts for the highest percentage of seasonal crops (60%) - cereals, potatoes, and vegetables- and in stone fruits, and grapevine. It also contains the highest percentage of cattle population (43%), sheep (72%), goats (51%) and poultry layers (60%).
- **The north and Akkar Plain:** Olives, cereals, potatoes, vegetables, cattle and poultry broilers production.
- **South and Nabatieh:** Olives, cereals, vegetables, and tobacco production.
- **Mount Lebanon:** Fruits, vegetables, poultry broilers, and swine production.
- **Coastal:** intensive vegetable greenhouse production, citrus fruits, and bananas.

Agriculture is characterized by a focus on higher value fruits and vegetables. The most important cereals cultivated are wheat and barley, with some production of forage crops such as alfalfa, vetch, corn, oats, and sorghum. Most of the barley grown in the arid parts of Bekaa (Hermel and El Qaa) is left as pasture for grazing animals[40]. Of the total utilized agricultural land, approximately half is irrigated: 50% in flood and furrow irrigation; 30% in drip and 20% through sprinkler irrigation.

Livestock contributes to around 30% of the total value of production. The poultry sector is the only agriculture sector that satisfies domestic demand and is dominated by few companies utilizing closed systems producing quality broilers and egg products. Cattle are mainly raised for milk production with the majority of stocks raised in large farms as well as small-sized holdings[41]. The size of sheep and goat herds has decreased in recent years mainly due to decrease in the number of shepherds as well as competition from imported meat from Australia, Turkey and Syria. The crisis in Syria has caused the influx of goat and sheep herders to Lebanese rangelands with their flocks[42].

Impact of climate change

An assessment of the impact of climate change on important economic and health sectors was presented in the Third National Communication (TNC) in 2016.

Table 1: Impact of Climate Change [43]

Less snow	• Less precipitation will fall as snow, with snow that currently falls at 1,500 m shifting to 1,700 m by 2050, and to 1,900 m by 2090. • Decrease in snow residence time from 110 days to 45 days. • Loss of ski season as a reduction of 40% of the snow cover of Lebanon with an increase of 2°C in temperature is projected, reaching 70% decrease in snow cover with an increase of 4°C.
Less water availability	• Snow will melt earlier in the spring, affecting the recharge of most springs, reducing the supply of water available for irrigation during the summer, and increasing winter floods by up to 30%. • The declines in precipitation will exacerbate existing challenges to water availability for agriculture, commercial and residential uses and adversely impact on rivers and groundwater recharge, and water availability during the summer season and in drought periods.
Increase drought period	• Droughts will occur 15 days to 1 month earlier; countrywide drought periods will extend 9 days longer by 2040 and 18 days longer by 2090. The already dry regions, such as the Bekaa, Hermel, and the South, will experience the sharpest effects. • Cost impacts will be added to irrigation needs, as more pumping hours will be required, therefore consuming more energy.
Less agriculture productivity	• Soil moisture will decline in response to higher temperatures, reduced precipitation, and higher evapotranspiration. • Changes in temperature and rainfall will decrease productivity of lands currently used to produce most crops and fruit trees, especially wheat, cherries, tomatoes, apples, and olives, and may affect the quality of grapes, despite some transient benefits from the expansion of the coastal plantations such as banana and tomatoes. • Most crops also will face increased infestation of fungi and bacterial diseases.

[38] Verner, D., David R., Maximillian A. and Wilby R. (2013). Increasing Resilience to Climate Change in the Agricultural Sector of the Middle East: The Cases of Jordan and Lebanon. Washington, DC: World Bank. Available at https://openknowledge.worldbank.org/handle/10986/13123 cited in the Second Biennial Update Report (2017).

[39] FAO (2018).

[40] TNC (2016).

[41] TNC (2016) citing FAO statistics available at http://www.fao.org/faostat/en/#country/121

[42] TNC (2016)

[43] TNC (2016)

Higher energy demand	Higher temperatures will increase demand for cooling, with related consumption of electricity increasing 1.8% for a 1°C increase in temperature, and 5.8% for a 3°C increase in temperature.
Sea level rise	Sea levels will rise up to 30-60 cm in 30 years, if the recent rate of rise, approximately 20 mm/year, continues. The higher sea levels will lead to seawater intrusion into aquifers, increase the risk of coastal flooding and inundation, increase coastal erosion, cover sand beaches, and alter coastal ecosystems in natural reserves and elsewhere.
Forests at risk	Forests will be adversely affected, especially forest stands that already suffer from fragmentation, pest outbreaks, forest fires and unsuitable practices.
Increased mortality and morbidity	The effects of climate change on public health include the outbreak of infectious diseases from changing temperatures, increased morbidity and mortality from heat and other extreme weather events, malnutrition from droughts and floods and other water-borne, rodent-borne diseases and vector-borne diseases.
Weakened tourism	• Winter outdoor tourism will diminish as warmer temperatures and reduced precipitation shorten the skiing season. • Other impacts on tourism will occur in response to changes in ecosystems, loss of natural attractions, such as sandy public beaches, and structural damage to the nation's archaeological heritage.

Lebanon's water resources are increasingly stressed by climate change along with high population growth, increased demand from agriculture and industry, inadequate water storage capacity, increased water pollution and inefficient utilization. Since mountain snow cover is a vital water source, the projected decrease by 40% in snow levels will negatively impact on the water supply, particularly during the period of high demand for water for irrigation (April to June). Reduced precipitation is likely to increase the incidence of drought while higher temperature will increase the effects of drought. Bekaa, Hermel and the south will be the most affected by longer drought periods. Saltwater intrusion into coastal aquifers is already occurring and will continue with rising seas[44]. In coastal cities, such as Beirut, saltwater intrusion is already forcing residents to install desalinization equipment, purchase water from private tankers, and abandon wells[45].

Agriculture in Lebanon is highly vulnerable to climate change due to the country's limited water and land resources which are under increasing pressure from population growth and urbanization. Lebanon's agricultural productivity (ranging from semi-tropical produce in coastal areas to orchards in the high mountain) is already strained from higher temperatures, reduced precipitation and high evapotranspiration[46]. Current erosion and topsoil loss on its steep slope will be exacerbated by storms and high precipitation events (HPE). Crops particularly at risk are cherries, apples and grapes (which will impact on the wine industry)[47]. Also affected will be the grazing period and quality of pastures for livestock. The increased salinization of soil due to sea level rise will threaten economically important banana and tomato production in the coastal areas[48].

An assessment of the economic costs of climate change in Lebanon estimates that the total cost in 2020 would be equivalent to about USD 4,000 per household. This is around a third of the average household annual earnings, which currently is about USD 12,000, as a result, many households would become impoverished[49].

Proposed Climate Adaptation Actions[50]

- For the **water** *sector*: reducing saltwater intrusion in coastal freshwater aquifers as sea level rises; improving water-use efficiency ofdomestic,industrial,and agriculturalsectors; developing watershed-managed plans for expected changes in climate; investigating the feasibility of alternative sources of water supply; and improving the available information about Lebanon's water resources and water systems.
  A national adaptation framework for the water sector to restructure water governance, implement measures for water resources and infrastructure, improve surface and groundwater quality, improve equitable access to sustainable water supply and enhance knowledge and capacity for climate change adaptation.
- For **agriculture**, potential options cited in the NDC[51] and TNC[52] to increase climate resilience include: increasing the water-use efficiency of irrigation systems, developing species and hybrids more tolerant of high temperatures and drought, changing the timing of planting, irrigation, and harvesting, adopting sustainable agricultural practices and integrated pest management techniques, developing rangeland-management practices that

44 World Bank (2018).

45 M. Saadeh and E. Wakim (2017) Deteriorization of groundwater in Beirut due to saltwater intrusion. Journal of Geoscience and Environment Protection. Vol. 5 No. 11, November 2017. DOI: 10.4236/gep.2017.511011. Available at http://www.scirp.org/Journal/PaperInformation.aspx?PaperID=80384

46 USAID (2016)

47 USAID (2016) suggests a reduction in fruit tree yields of up to 50% and decreased crop quality, particularly for wine grapes).

48 USAID (2016)

49 TNC (2016) and BUR (2017)

50 Based on TNC (2016), Biennial Update (2017) and NDC (2015)

51 NDC (2015)

52 TNC (2016)

recognize the effects of climate change, and providing farmers with better, timely information about pending extreme weather events.
- For **coastal communities** and ecosystems vulnerability to climate change could be reduced by developing and implementing plans for pulling human activities back from coastal areas that will be exposed to expected rises in sea level, creating coastal marine reserves, developing and implementing a strategy for protecting capital and people unlikely to move and providing coastal residents with better, timely information about pending extreme weather events.
- For the **tourism** sector, potential options to increase climate resilience include developing better insurance and other short-run tools for managing risks to tourism, such as disruptions from coastal storms or lack of snowfall at mountain resorts, developing appropriate long-run plans for managing risks, such as moving coastal tourism facilities away from potential storm surges and winter facilities to higher altitudes, reducing the stress on climate-sensitive natural resources important to tourism from e.g., erosion and urban sprawl, and providing the tourism industry with better, timely information about pending extreme weather events.
- For **forests** and biodiversity: The national afforestation and reforestation programme and the national biodiversity strategy and action plan aim at increasing forests from 13% of Lebanon's total area to 20% over a period of 20 years and to develop and implement adaptation plans for ecosystems vulnerable to climate change.
- For **energy**: improving energy-use efficiency of buildings and transportation systems and developing energy-supply systems that are less vulnerable to the disruptions of extreme weather events, higher average temperatures, and other aspects of climate change.

National government strategies and policies

The Ministry of Environment (MoE) is the main national coordinator for climate change and the UNFCCC focal point. The MoE is responsible for the coordination, compilation and submission of national communications, Biennial Update Reports (BUR) and related GHG inventories. The Climate Change Coordinating Committee (CCCC), led by the MoE, in cooperation with the focal points located at the line ministries, government agencies, private sector and academic institutions, oversee the implementation of all climate change activities as well as climate mainstreaming[53]. The Ministry also chairs the National Council for the Environment (NCE) which is composed of official representatives from 7 ministries (the Ministry of Environment; and the ministries of Finance, Interior and Municipalities, Agriculture, Public Works and Transport, Energy and Water, and Industry) and 7 non-public entities (Order of Physicians, Order of Engineers and Architects, The Bar Association, Association of Banks, Association of Insurance Companies, representative of Non-Governmental Organizations (NGOs), representative of the academic sector). The NCE is mandated to approve environmental policies and strategies and integrate environmental concept, including climate change issues, into national development plans[54].

The Environmental Protection Law (law no. 444/2002) is the overarching legal instrument for environmental protection and management in Lebanon. With respect to climate change, apart from law 359/1994 and law 738/2006 relating to the ratification of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP), no major legislation (e.g. climate change policy) directly addresses climate change in Lebanon55. However, a number of regulations have addressed issues that could be linked to climate change, such as the reduction of air pollution from transport (law 341/2001), the reduction of energy import by developing local energy including renewable energies (Council of Ministers, decision no. 13/2004), energy efficiency standards and labels, tax incentives on green products as well as large scale renewable energy industries (decree 167 under Law 444) and other decisions relating to the ratification of conventions such as the United Nations (UN) Convention on Biodiversity or the UN Convention to Combat Desertification. Lebanon has set a target towards land neutrality by 2030 under the United Nations Convention to Combat Desertification.

The Paris Agreement was signed by Lebanon in April 2016; ratification is still awaiting approval by the Lebanese Parliament after having been approved by the relevant parliamentarian committees. Lebanon submitted its Intended Nationally Determined Contribution (NDC) in 2015 but has as yet not submitted its First NDC (see below). It has submitted First (1999), Second (2011) and Third National Communication (2016) and two Biennial Update reports (2015; 2017) to the UNFCCC[56].

Lebanon has already made progress in mainstreaming climate change adaptation into the biodiversity (draft National Biodiversity Strategy and Action Plan, NBSAP, 2015), water (National Water Sector Strategy, 2012), forestry and agriculture (National Forest Plan, NFP, 2015 and Ministry of Agriculture Strategy, 2015) sectors[57].

53 USAID (2016)

54 TNC 2016) Biennial Update (2017)
55 TNC (2016)
56 Biennial Update (2017)
57 Biennial Update (2017)

Intended National Determined Contributions (INDC)[58]

Lebanon's INDC was submitted to the UNFCCC in September 2015. To date (March 2018), no NDC has been submitted. The INDC Lebanon highlights adaptation as a priority for Lebanon.

Adaptation

The INDC notes that as a developing country with scarce water resources and high population density in the coastal areas, Lebanon is already facing and will continue to face, significant challenges as a result of climate change. The INDC reflects the objectives to both build resilience and improve adaptation as it lowers emissions, and therefore take advantage of the synergies between adaptation and mitigation. The proposed adaptation actions were based on existing sectoral plans and strategies (see above).

Table 2. Key adaptation measures in the forestry and agriculture, and water sectors

Forestry and agriculture	**Overarching objective:** Towards sustainably managed forest resources, safeguarded ecological integrity, and economic and social development for the benefit of present and future generations. This will be achieved through the implementation of the National Forest Programme including, among others: • Raising tree nurseries' productivity. • Planting of trees. • Implementing the forest fire fighting strategy. • Rehabilitating irrigation canals. • Promoting Good Agricultural Practices through the support of organic farming and obtaining quality certificates. • Applying forest integrated pest management. • Developing an early warning system for agricultural pests and climatic conditions.
Water	**Overarching objective:** Increase water availability and improve water usage to decrease the sector's vulnerability to climate change impacts by: • Improving water security such as through increasing artificial recharge of groundwater aquifers and increasing surface storage dams and hill lakes. • Optimizing the use of the current water resources through the rehabilitation of the existing network and the installation of water meters. • Increasing wastewater collection and treatment. • Increasing water reuse, especially after wastewater treatment. • Improving water efficiency and decrease water loss in irrigation.

Mitigation

For mitigation, Lebanon proposed contribution has two targets: the first representing the country's own contribution ('unconditional target'), the second offering a wider mitigation target conditional on receiving international support (conditional target').

In the INDC associated costs for adaptation and mitigation measures are not included.

Unconditional Target	• A GHG emission reduction of 15% compared to the Business- As-Usual (BAU) scenario in 2030. • 15% of the power and heat demand in 2030 is generated by renewable energy sources. • A 3% reduction in power demand through energy-efficiency measures in 2030 compared to the demand under the Business-As-Usual scenario. The unconditional mitigation scenario includes the impacts of mitigation actions which Lebanon can implement without additional international support.
Conditional Target	• A GHG emission reduction of 30% compared to the BAU scenario in 2030. • 20% of the power and heat demand in 2030 is generated by renewable energy sources. • A 10% reduction in power demand through energy-efficiency in 2030 compared to the demand under the BAU scenario. The conditional mitigation scenario covers the mitigation actions under the unconditional scenario, as well as further mitigation actions which can be implemented upon the provision of additional international support.

[58] Republic of Lebanon's Intended Nationally Determined Contribution (INDC) (2015) available at http://www4.unfccc.int/submissions/INDC/Published%20Documents/Lebanon/1/Republic%20of%20Lebanon%20-%20INDC%20-%20September%202015.pdf

Climate Finance

Lebanon recognizes that it will have to improve its institutional arrangements to allow accurate reporting of support received for climate change activities. Efforts are underway to define climate finance and devise a process to establish a system for MRV of support received (including capacity-building and technology transfer) and linkages to NDC goals. Lebanon presented in its most recent (2017) Biennial Update Report (BUR) available and trusted information, in a format that, if developed and improved, could inform the global stock take more easily[59].

Lebanon has prepared two Nationally Appropriate Mitigation Actions (NAMAs): Private Road Transport Sector (FEVs) and the Municipal Solid Waste Sector. The project proposals have been endorsed by the Council of Ministers (2017) will be submitted to the NAMA Registry.[60]

Climate Change Projects

International and bilateral funding for Lebanon is primarily focusing on refugee and humanitarian support. Lebanon has, however, been successful in obtaining finance for climate projects from international and multilateral (climate) funds.

During the 21st Conference of the Parties in Paris in December 2015, the Paris Pact on Water and Climate Change Adaptation was announced with a coalition of 290 nations, river basin organizations (including cross-border), business and civil society and funding agencies.

The objective of the pact is to make water systems more resilient to climate impacts. Lebanon is one of the countries that joined the initiative, which is led by the International Network of Basins Organisations (INBO). The project Lebanon is involved in under the Pact is the **Mediterranean Water Knowledge Platform**, a 7-year commitment to assess the state and trends of water resources. The European Commission supports the project. The project will be contributing to several **Sustainable Development Goals**, and currently it is financed by USD 3.9 million for implementation.

International and multilateral projects (since 2012) are listed in Table 3.

Table 3. International and multilateral climate projects.

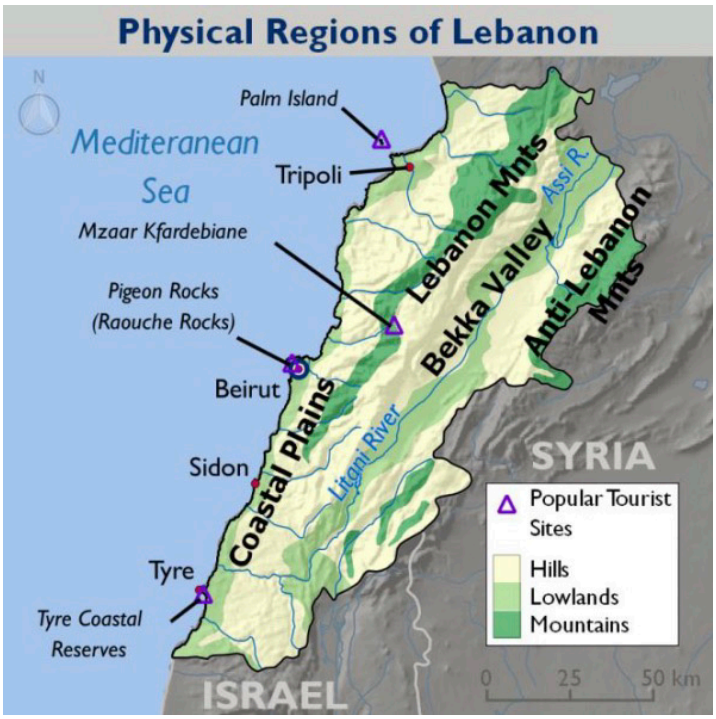
Main sources Climate Funds Update (2017)[61]

Name of Project	Fund	Amount of Funding Approved (USD millions)	Disbursed (USD millions)	Dates
Climate Smart Agriculture: Enhancing Adaptive Capacity of the Rural Communities in Lebanon	Adaptation Fund	7.68	1.59	2012-2021
First Biennial Report [submitted to UNFCCC]	GEF 5	.32	.32	2013
Second Biennial Report [submitted to UNFCCC}	GEF 6	.35	.35	2016
Smart Adaptation of forest Landscape in Mountain areas (SALMA)	Special Climate Change Fund (GEF 5) Implementing partner FAO	7.15		2016

[59] Second Biennial Update Report, MoE, 2017.
[60] Republic of Lebanon Ministry of Environment Climate Change Portal (hosted by UNDP). Available at http://climatechange.moe.gov.lb/nama
[61] http://www.climatefundsupdate.org/data

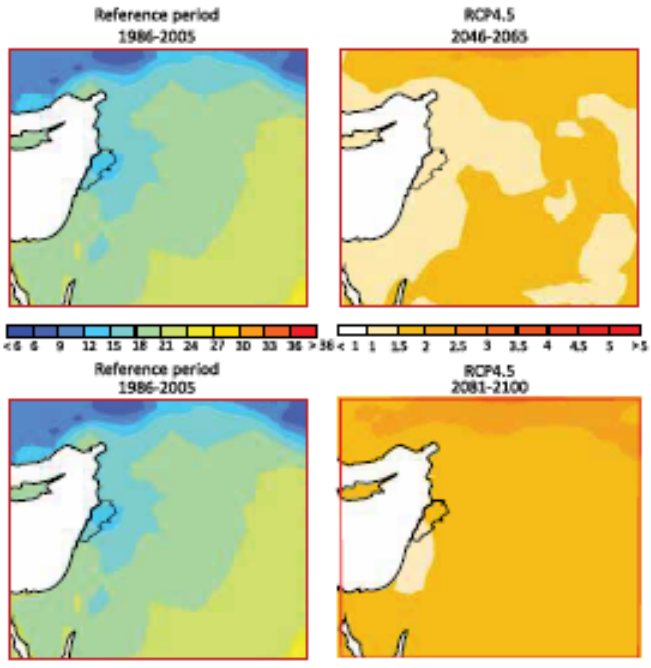
Maps

Map 1 Physical regions of Lebanon



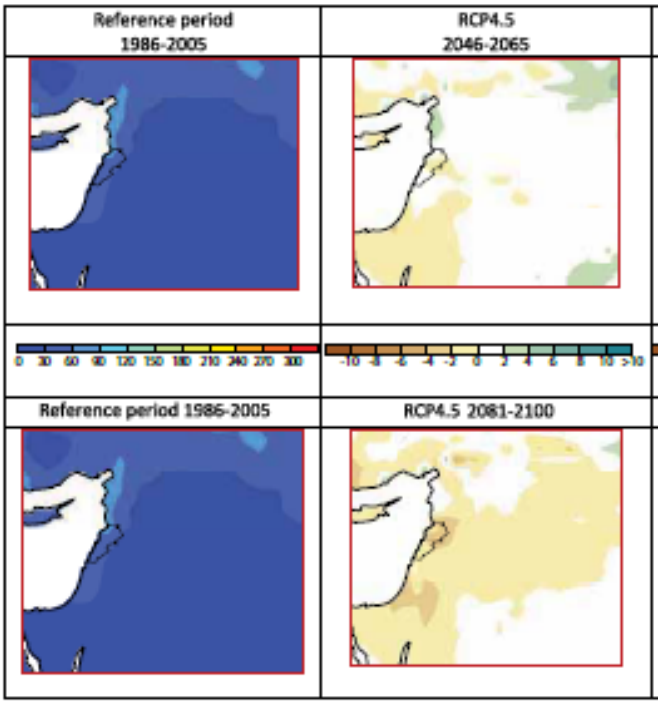
Source: USAID (2016)). Fact Sheet. Climate Change Risk Profile Lebanon. Available at https://www.climatelinks.org/resources/climate-change-risk-profile-lebanon

Map 2 Projected Changes in Temperature (Moderate Projection)



Source: Third National Communication to the UNFCCC (2016) Prepared by the Ministry of Environment (2016) available at http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php

Map 3 Projected Changes in Precipitation (Moderate Projection)



Source: Third National Communication to the UNFCCC (2016) Prepared by the Ministry of Environment (2016) available at http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php

Published by:

Ministry of Foreign Affairs of the Netherlands
P.O. Box 20061 | 2500 EB The Hague | The Netherlands

www.government.nl/foreign-policy-evaluations

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