

Climate Change

12 TERRESTRIAL ECOSYSTEMS, NATURAL HABITATS AND WILDLIFE

12.1. GOALS OF THE ASSESSMENT

The main goals of this study are to identify terrestrial species and ecosystems that may be particularly sensitive to climate change, assessing the degree of vulnerability to climate change and the main aspects that may be impacted. These are spatial distribution, determined by vegetation and bioclimatic zones, species composition and community structure. This assessment includes an overview of the status of the species that are endemic, endangered, under the threat of extinction, and/or at the edge of their geographic distribution. Scenarios for baseline tendencies and climate change impacts are constructed for natural areas and wildlife and adaptation measures are accordingly proposed.

12.2. SCOPE OF ASSESSMENT

The exposure units in this study are basically natural habitats and wildlife species. The natural areas considered are those that are representative of major types of ecosystems in addition to categories of particular or special interest. The latter include wetlands, islands and sandy beaches. Study areas are chosen as the ones identified as the most vulnerable under the baseline and climatic change scenarios.

The time frame for baseline scenario and for climate-change scenario milestone-years is the one that has been defined for the assessment of the bioclimatic changes and vulnerability.

The general data bioclimatic, habitat distribution and vegetation maps. Further data is required from other sectors in order to conduct a more comprehensive analysis of our sector.

12.3. METHODS, MAJOR ASSUMPTIONS AND UNCERTAINTIES

Simulation models as a means of constructing baseline and climate change impact scenarios were not used due to the limitations of the available data. The methods used were mostly based on empirical-statistical methods, analogues and expert judgment. However, the use of GIS tools for drawing and overlaying different maps (Bioclimatic zones, vegetation zones and ecosystems/natural habitats) facilitated the judgment in identifying the most vulnerable areas.

Protected areas were examined in terms of their latitude and altitude ranges, their presence in various bioclimatic and vegetation zones, their species composition, especially the presence of sensitive species and the vulnerability to sea level rise. Lists of various animal and plant species were compiled detailing, whenever available, their current status i.e. endemic, rare, endangered and presence at the edge of their

geographic distribution (e.g. southernmost).

12.4 CLIMATE CHANGE VULNERABILITY IMPACT ASSESSEMENT:

The main baseline disturbances that are currently affecting natural habitats are:

- a. Chaotic urbanization at the expense of forests and woodlands.
- b. Pollution of various sources, air, water and soil.
- c. Fires that seem to be increasing in frequency with the lengthening of the dry season.
- d. Changes in the water table due to excessive water exploitation for domestic and agricultural use.
- e. Quarrying activity which is also affecting the water table.
- f. Overgrazing.
- g. Fragmentation by one or more of the above factors.

Any intensive or extensive increase in any of these factors will lead to a degradation of the natural habitats that will be further exasperated by climatic changes.

The expected changes in the distribution of vegetation communities may lead to the disappearance of certain vegetation associations and their replacement by others. For example, a forest may regress into a shrubland or even grassland depending on the intensity of the modification.

Two forests in protected areas, namely Horj Ehden in the North and Arz Al-Shouf in the Barouk Mountain are characterized by great floral diversity of herbaceous and arborescent plants containing many endemic, rare and endangered species some of which are at the southernmost edge of their distribution. The distribution of *Cedrus libani libani* which normally falls within the precipitation range of 500-1300 mm with mean winter temperatures between -2 and -5°C may become increasingly under stress with the upward shift in bioclimatic zones. For a 3°C temperature increase, for example, an upward shift in vegetation belts of around 545m would be expected. Climatic factors, however, are not the only factors that may affect the success of cedars but there is a clear preference for humid atmospheres and moist well-drained soil.

According to the climatic scenario used here, there may be a 300m upward shift in the year 2020, 486m in 2050 and more than 700 meters in the year 2080. This would push the tree line in the year 2080 in both reserves to around 2500m. Considerable stress will begin to be felt as early as the year 2020. This makes both protected areas highly vulnerable. Furthermore, the rate of change may be faster than the species ability to adapt. Mountain vegetation as found in the two above-mentioned reserves may face considerable threat of serious decline and even disappearance.

Other factors, however, such as the increased water efficiency due to CO_2 increase may enhance its ability to withstand the new drought conditions. It is also uncertain to what extent and how soon there may be a change in soil characteristics affecting the vegetation.

In the main wetland area in Lebanon, the Ammiq ephemeral marshes intensive water pumping for the irrigation of several cultivated lands in the surrounding areas has reduced the area and shortened its seasonal span. It is expected that, in the absence of climate change and due to the lack of management plans, these marshes will be affected by:

- Change in land use in the surrounding areas, where more land will be reclaimed for cultivation,
- Increased water demand for the irrigation of these and other nearby cultivated lands.

The effect of climate change on the marshes may take two forms:

1. Spatial: leading to reduction in the total area of the marshes
2. Temporal: shortening of the duration in which the marshes exist during each year. This may mean, for example, that there may be no marshland left for the birds in their autumn return migration.

It is estimated that the total area of the marshes may undergo a decline at the rate of about 6% per year. At this rate, without climate change, the marshes may practically disappear in less than two decades and without climate change. This will be obviously exasperated under climate change.

Rivers and Riparian habitats would be vulnerable to precipitation changes. Some pass through more than one bioclimatic zone. Their fragility has increased during last 20 years by reduced water supply, reduced precipitation., population increase, excessive exploitation of water resources, pollution, quarrying, agricultural side-effects including soil erosion, pesticides and fertilizer runoff. Due to climate change, the reduced flow and increased water temperature (which is uncertain in magnitude) may lead to a reduction in the riparian (riverbank) vegetation. Altitudinal and latitudinal shifts in these zones may influence the pattern of vegetation

The Tyr sandy beach, the only remaining significant sand dune habitat in Lebanon for many plants and animals that are unable to thrive except on sandy substrates. The main pressures on the sandy beach in the foreseeable future, without climate change, are land reclamation and tourist development. Increased population density and the demand for more agricultural land will place more pressure on the whole zone. It is considered to be highly vulnerable to sea level rise and is classified as “critical”. This implies high vulnerability to erosion and flooding. The establishment of a nature reserve in the Ras El-Ain area may not be enough to protect sufficient sandy areas. There is a risk that the sandy beach narrow or even disappear with its indigenous fauna and flora.

The Palm Islands Nature Reserve, composed of three islets, will be subjected to inundation under a climate-change scenario.

The main problems facing the Lebanese wildlife today are the same as those listed above for natural areas. Populations of many species may be subjected to extirpation (local extinction) due to the great fragmentation affecting their habitats. This fragmentation is likely to continue and perhaps accelerate due to increased urbanization.

The species most vulnerable to climate change may be those that are endemic, endangered, at the edge of their geographic distribution, mountain, coastal and those which may be replaced by potential competitors from other zones. Some such species have been named in this report as facing decline or extinction.

In Lebanon, the known endangered forest tree species are found in degraded, heavily grazed areas. The extent to which they face threat is directly related to the continuing human pressures through felling and grazing. No study has quantified these two aspects. Under climate change, some areas of distribution may shift bioclimatically putting more stresses on these species.

12.5.ADAPTATION

Adaptations that may reduce the climate change impact may include the following:

1. Natural adaptation where the vegetation and wildlife may acclimatize where the climate change being still within their tolerance range. Some may adapt (in the evolutionary sense) if containing enough genetic diversity. T
2. Natural adaptation may have to be assisted by exploring and cultivating certain drought-tolerant ecotypes. It may be also be enhanced by reducing habitat fragmentation and thus allowing the natural genetic variation to lead to suitable adaptations.
3. Habitat fragmentation can be reduced by establishing corridors and connections between the isolated habitat types.
4. Intensive studies on species and ecosystems have to be devoted to assess the degree of vulnerability an to discern the above aspects.
5. Water use and change in land use have to be rationalized to protect wetlands and riparian habitats.
6. The area and the number of protected areas need to be expanded to include more of the sensitive habitat types and/or more vegetation and bioclimatic zones.
7. Buffer zones need to be established around protected areas to reduce the human impacts and those of climate change.
8. Adaptation measures have to be adopted within the next two decades.
9. Because of the international importance of some protected area it may be possible to seek international assistance especially in schemes such as “debt swapping” which involves trading foreign debts for financing the establishment and maintenance of protected areas and nature reserves.