CLIMATE CHANGE VULNERABILITY AND ADAPTATION

TOURISM

Lebanon's Second National Communication

Ministry of Environment/UNDP

2011

1. VULNERABILITY AND ADAPTATION OF THE TOURISM SECTOR

1.1. VULNERABILITY ASSESSMENT

1.1.1. Background

General Overview

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

A close linkage exists between climate and tourism. In fact, climate defines the length and quality of tourism seasons and plays a major role in destination choice and tourist spending. Climate also affects a wide range of environmental resources that are critical attractions for tourism, such as snow conditions, biodiversity, water levels and quality. Moreover, climate has an important influence over environmental conditions that can deter tourists including disease spread, and extreme events such as heat waves, floods and extreme storms (UNWTO & UNEP, 2008).

There are different forms of tourism and recreation that are influenced differently by climate and climatic change. The Lebanese Ministry of Tourism has classified tourism into three major categories and 11 groups (MoE, 2001):

- **Recreational tourism** which includes beach holidays, winter sports, summer holidays in the mountains, cultural tourism, religious tourism, adventure tourism and youth tourism.
- **Business tourism** which includes individual businessmen, and passenger movement for the purpose of exhibitions and congresses.
- **Other types of tourism**, mainly comprising of medical/health visits and travel for education and training.

Touristic activities and infrastructure in Lebanon are concentrated in three areas (MoE, 2005) (Figure 1-1):

- The high mountains where ski resorts and winter chalets are located;
- The hills overlooking Beirut and the coast where "country clubs" are found; and
- The coastline where beach resorts, public beaches and marinas are located, mainly on the northern coast.

In recent years, alternative types of tourism and recreational activities have grown in Lebanon. One of these types of tourism is ecotourism, or nature tourism, which has registered a significant increase in the number of ecotourism providers throughout the years since 1991 (MoE, 2001). Eco-tourism in nature reserves and protected areas has been growing. In 2004, 56,000 visitors entered Lebanon's nature reserves (MoE, 2008), a growth of around 56% from the year 2000.

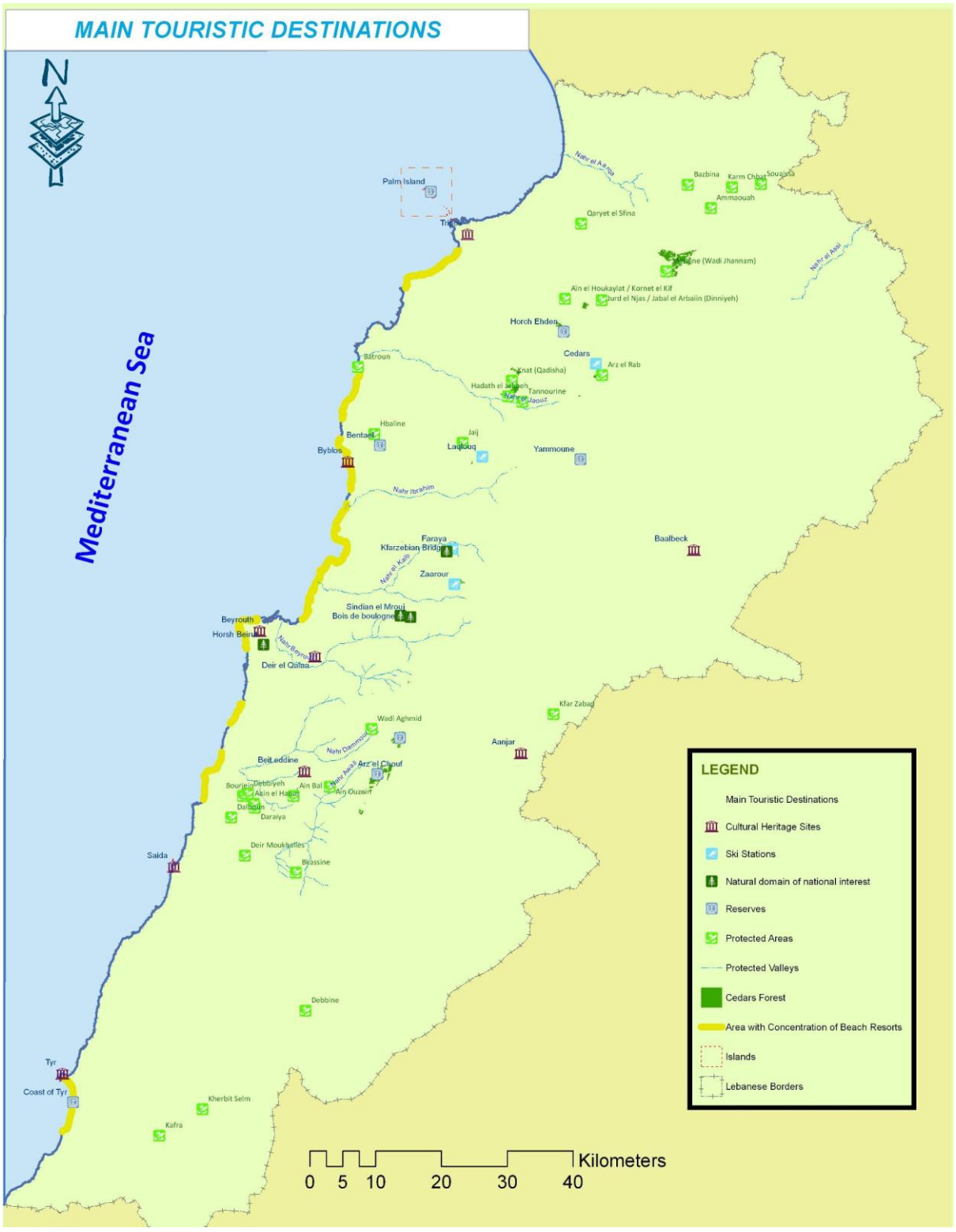

Figure 1-1 Map of the main touristic attractions and areas in Lebanon

Tourism and the local economy

Tourism is a driving force for the local economy, generating US$6,000 million in international receipts in 2004, up from US$742 million in 2000. In 2003, tourism accounted for 34.2 percent of GDP, compared to 27.6 percent in 2004 (WTO, 2009) (Figure 1-2).

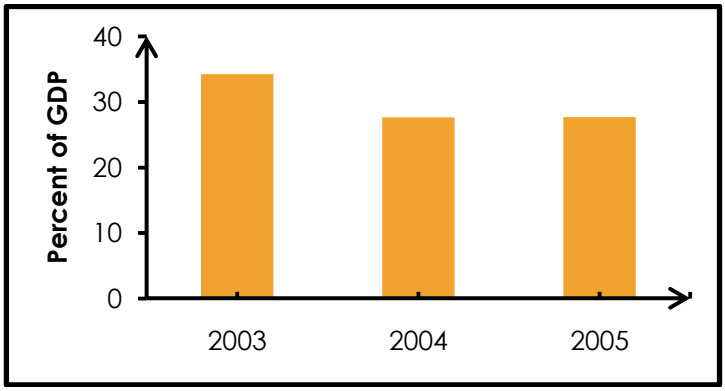

Figure 1-2 Share of tourism expenditure in GDP

Source: WTO, 2009

The number of international arrivals of non-resident tourists grew steadily between 2000 and 2004, but has been fluctuating since 2005, mainly due to the weak security situation that has prevailed in 2005 and 2006. In 2007, Lebanon witnessed a significant rise in international arrivals (Figure 1-3).

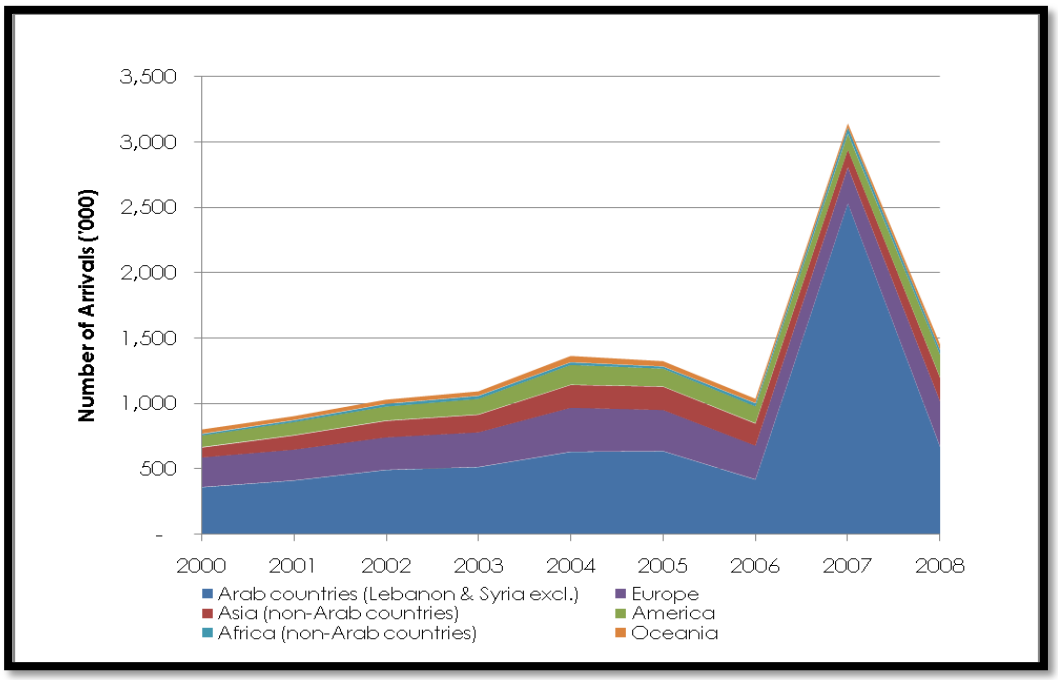

Figure 1-3 Distribution of annual tourist arrivals by region of origin

Source: CAS 2000-2008

International tourism receipts[1] have significantly risen since 2002 (Figure 1-4).

1 International tourism receipts are expenditures by international inbound visitors, including payments to national carriers for international transport. These receipts include any other prepayment made for goods or services

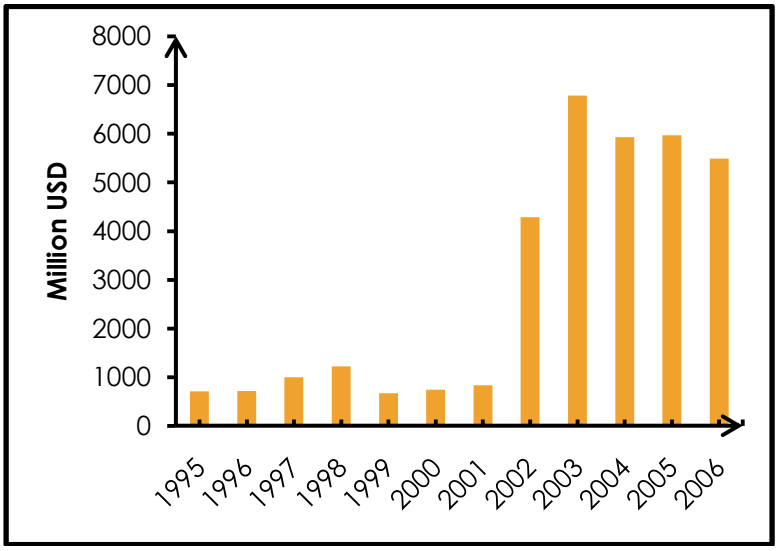

Figure 1-4 International tourism receipts between 1995 and 2006

Source: WRI, 2008

1.1.2. Methodology

1.1.2.1. Scope of Assessment

Unit of Study

The study focuses on the main tourism activities and touristic sites that might be affected by climate change as follows:

- Sea-level rise could damage some coastal archaeological sites (e.g. World Heritage sites of Tyre and the Fortress of Saïda) and coastal touristic infrastructure, such as beach resorts, public beaches and marinas. It may also threaten marine and coastal nature reserves which could suffer from inundation and rapid erosion.
- Winter season shortening and snow cover reduction may threaten the viability of winter sports at current altitudes.
- Higher temperatures could affect the attractiveness of mountainous summer resort areas.

Spatial Frame

The assessment covers all the touristic areas of Lebanon with focus on the sites and activities that are likely to be vulnerable to the projected changes in climatic conditions. The vulnerable areas are referred to as "hotspots".

Time Frame

The tourism sector in Lebanon is active throughout the year, but it reaches its peak during the summer months of July and August (Table 1-1). The impacts of climate change will be felt differently throughout the year according to the seasons in which tourism activities are held. While in summer touristic activity along the coastline is more sensitive to extreme temperatures, touristic activity in ski resorts would be affected by decreased snow fall in winter. Therefore, the assessment covers the whole year.

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received in the destination country. They also may include receipts from same-day visitors, except in cases where these are important enough to justify a separate classification (WRI, 2008).

The baseline year for this assessment is 2004, and projections were made until 2030, i.e., over a time frame of around 25 years.

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

PERCENTAGE OF ARRIVALS									
Season	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Winter	18	20	17	17	17	19	22	22	19
Spring	25	26	24	24	25	26	33	25	22
Summer	34	34	36	38	36	39	21	27	30
Autumn	22	20	22	21	21	35	24	26	29
Total Number of Arrivals* (Thousands)	2,707	2,867	3,349	3,505	4,016	3,610	2,024	5,567	6,518

Source: Central Administration of Statistics (CAS), Statistical Bulletins 2000-2008

* Figures include arrivals of Lebanese and Syrian nationals

1.1.2.2. Climate Factors

Tourism is sensitive to changes in temperature, rainfall, snowfall and extreme weather events, and is thus sensitive to climate change (UNWTO, 2009). Changes in these factors could lead to shifts in a variety of outdoor tourism and recreation opportunities in Lebanon, such as skiing in winter and beach activities in summer. Climate simulations for Lebanon show that warmer temperatures and less precipitation are likely to occur. This would result in warmer weather and water shortages in summer, and less snow in winter.

1.1.2.3. Methods of Assessment

The assessment consisted of:

- Developing two baseline socio-economic scenarios to illustrate the current situation and forecast the future variation in the demographic, socio-economic and technological driving forces for the tourism sector.
- Developing a climate change scenario that indicates how climatic and climate related factors could probably change.
- Identifying vulnerable hotspots to climate change based on their social and biophysical exposure, sensitivity and their adaptive capacity to climate change. In the tourism sector, the results of the assessment for the coastal zone, biodiversity (forestry), and water sectors, together with climatic simulations served as a basis for defining the vulnerable hotspots.
- Setting out socio-economic indicators to define the sensitivity, adaptive capacity and vulnerability of vulnerable hotspots under socio-economic and climate change scenarios.
- Determining the likely climate change impacts through a literature review and further analysis.

1.1.2.4. Data Sources and gaps

The main sources of data used in this chapter are:

- The Ministry of Environment (MoE).
- The Ministry of Tourism (MoT).
- World Tourism Organization (WTO).
- World Resources Institute (earthtrends.wri.org).

- Central Administration Statistics (CAS)

Gaps in data on the following parameters constituted an obstacle to conducting a detailed quantitative analysis:

- Ecotourism: number of visitors to nature reserves for the years 2000-2004
- Breakdown of the number of tourists by tourism category.
- The contribution to GDP of the different categories of tourism over the years.

1.1.3. Scenarios

1.1.3.1. Socio-economic Scenarios

In Lebanon, tourism growth and its sensitivity to climatic change are influenced by three main factors:

- Economic stability, whereby high prosperity levels in the country result in growth of the tourism sector;
- Security and political stability, whereby the absence of conflict and strife dispel uncertainties regarding investment in tourism and encourage potential tourists to visit the country;
- Resources' availability, especially forests and the availability of water supplies that could become a major constraint.

Based on the above-mentioned factors and other general factors (e.g. population growth), two baseline scenarios were developed to define the storylines of the tourism sector in Lebanon under business-as-usual conditions:

Scenario A Low population growth: Population will grow, however at a decreasing rate – average of 0.35%[2] between 2010 and 2030 GDP grows at an annual average rate of 4.2%[3] Total urbanized area will slightly increase Same standard of living ▪ Sustainable development ▪ Conservation of the limited natural resources available Progressive adoption of forest management policies Law enforcement Increased awareness of the recreational value of natural assets, and participation of civil society in its protection. Same standards of living.	Under this scenario, tourism will probably be among the main active economic sectors. Both mass tourism and ecotourism will be growing with greater emphasis on ecotourism due to better understanding of the recreational value of natural assets, and participation of civil society in its protection. Law enforcement and the adoption of forest management policies will lead to a higher interest in eco-tourism and nature-based activities. This would create alternative livelihoods, especially for populations in remote areas, which would in turn influence internal migration and local sustainable economic development. However, the low resources availability under this scenario might limit eco-tourism growth. The tourism sector overall is likely to have considerable growth, and would consequently have an important contribution to GDP.
Scenario B Liberal globalization Balanced economic development Considerable GDP growth - GDP is assumed to grow at an annual average rate of 8.6% between 2010 and 2030 High population growth - Population will grow at a modest increasing rate with an average of 0.96%[4] between 2010 and 2030 Total urbanized area will increase with population, growth of 284 km^2 of urbanized areas Better standards of living ~ 2.4 times higher ▪ Unsustainable development ▪ Degradation of the limited natural	This scenario assumes a liberal globalization with social and cultural interactions, along with high economic growth and improved competition for goods export. The industrial, agricultural and tourism sectors would all grow. This implies, on one hand, a moderate growth in the tourism sector which basically relies on mass tourism and thus entails a massive burden on environmental resources, and on the other hand a low growth of ecotourism due to the lack of awareness of recreational and other values of natural assets and the degradation of available natural resources. The sector will consequently have an unsustainable growth marked by a high pressure

2 This an average of the population growth rate in a **low-fertility scenario** as projected in the World Population Prospects: The 2008 Revision (UN, 2009).

3 This is an average of the actual GDP growth rate, at constant 1990 prices, between 2000 and 2004 (IMF, 2009).

4 This an average of the population growth rate in a **high-fertility scenario** as projected in the World Population Prospects: The 2008 Revision (UN, 2009).

resources available Lack of awareness of recreational and other values of natural assets	on the environment and natural resources.

In general, the tourism sector will flourish under both scenarios; however, its growth will be more regionally-balanced and sustainable under scenario A and less sustainable under scenario B.

It is worth mentioning that both scenario implications on the tourism sector would be less applicable in the absence of the three factors listed above: economic stability, security and political stability, and resources' availability.

1.1.3.2. Climatic Scenarios

As mentioned above, the climate factors that influence the touristic activities are mainly temperature and precipitation. Table 1-2 summarizes the projections of these factors for the Mediterranean region and for Lebanon as they figure in the IPCC Fourth Assessment Report and the EEWRC Climate simulations respectively.

Table 1-2 Projected change in climatic factors of significance to the tourism sector

CLIMATE FACTOR	PROJECTIONS FOR THE MEDITERRANEAN REGION[1]	PROJECTIONS FOR LEBANON[2]
Temperature	The annual mean warming from the period 1980-1999 to 2080-2099 varies from 2.2°C to 5.1°C. The warming in the Mediterranean area is likely to be largest in summer.	Increases in Tmax are projected to be between 1°C on the coast of Lebanon and 2°C inland by 2040, and between 3°C on the coast and 5°C inland by 2090.
Precipitation	The annual area-mean change from the period 1980-1999 to 2080- 2099 varies from –4% to –27% in the Mediterranean region.	Rainfall reduction is projected to be between –10 and –20% by 2040, and between –25% and –50% by 2090.

Sources:

1 Christensen et al., 2007

1.1.4. Vulnerability Assessment

The tourism sector is simultaneously very vulnerable to climate change and an important contributor to greenhouse gas (GHG) emissions (Khattabi, 2009). This duality refers on one hand to the mitigation challenge and on the other hand to vulnerability and adaptation issues (Khattabi, 2009). This section assesses the vulnerability of the tourism sector to the likely effects of climate change; it defines both the sensitivity of the sector to climatic factors and its adaptive capacity to cope with climate change impacts on tourism.

1.1.4.1. Sensitivity to Climatic Factors

The relationship between tourism and climate is very complex and remains difficult to define. Climate affects a wide range of the environmental resources that are critical to tourism. Changes in climatic factors such as higher temperatures and less precipitation may affect winter activities in high mountain areas by altering the snow conditions. It also affects biodiversity of natural areas by increasing risks of forest fires and changing plant-wildlife-insect populations and their distribution which may adversely impact nature-based tourism. The added effect of sea level rise may lead to coastal erosion, loss of

beach area, higher costs to protect and maintain seafront resorts and thus affect summer activities (UNWTO & UNEP, 2008).

It should be mentioned that the interest in the connection between tourism and climate change is relatively new in the literature, but has been receiving special attention in the last two decades (Khattabi, 2009). Some qualitative research (e.g., Perry, 2000) and simulation studies (e.g., Bigano et al., 2008) of the vulnerability of tourism in the Mediterranean basin to climate variability in addition to studies on the impacts of climate change on water in Lebanon (e.g., Najem, 2007) have been carried out.

1.1.4.2. Adaptive Capacity

Tourism is a continuously adapting industry, responding to changing demographic and economic conditions as well as to new demands and technologies. Climate change will present new challenges but also lead to opportunities for tourism investment to capitalize on the new environmental conditions (Perry, 2000).

The capacity of the tourism sector to adapt to climate change is thought to vary between the sub-sectors of the tourism industry (UNWTO & UNEP, 2008). Tourists have the greatest adaptive capacity (depending on three key resources: money, knowledge and time) with relative freedom to avoid destinations impacted by climate change or shifting the timing of travel to avoid unfavorable weather conditions. Suppliers of tourism services and tour operators at specific destinations have less adaptive capacity. Large tour operators, who do not own the infrastructure, are in a better position to adapt to changes at destinations because they can respond to clients' demands and provide information to influence clients' travel choices. Destination communities and tour operators with large investment in immobile capital assets (e.g., hotel, resort complex, marina or casino) have the least adaptive capacity (UNWTO & UNEP, 2008). The information requirements, policy changes and investments that are required for effective adaptation by tourism destinations require decades to implement in some cases, (Simpson et al., 2008).

Figure 1-5 illustrates the relative adaptive capacity of major sub-sectors.

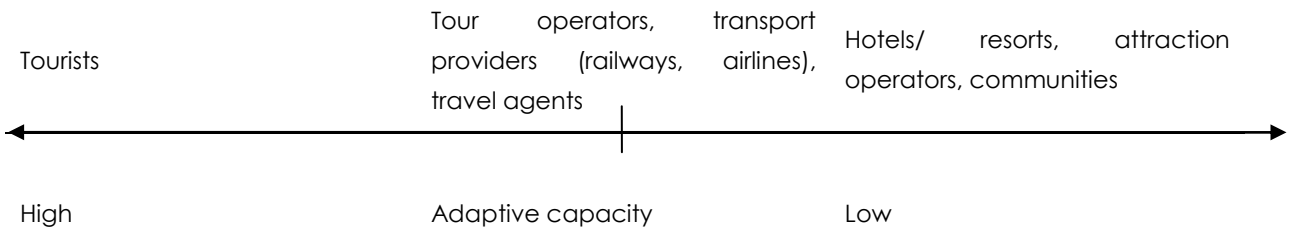

Figure 1-5 Relative adaptive capacity of major tourism sub-sectors

Source: Scott, D. and Jones, B. (2006)

1.1.4.3. Vulnerability Assessment Results

In this section the possibly vulnerable tourism destinations in Lebanon based on their sensitivity to climate change and their adaptive capacity are listed and explained. The tourism destinations and areas for which sensitivity and adaptive capacity are examined as per the climatic and future socio-economic conditions appear in Table 1-3. The intuition behind considering certain destinations as highly vulnerable to climate change – high mountain areas, coastal areas, and natural areas of national interest – is discussed hereafter.

Table 1-3 Vulnerability of tourism destinations

SYSTEM	SENSITIVITY TO CLIMATE CHANGE	ADAPTIVE CAPACITY		VULNERABILITY
High mountain areas – ski resorts and winter holiday destinations	High due to forecasted increase in Tmin and decrease in precipitation	Scenario A	Moderate	High
		Scenario B	Low	Very High
Coastal areas	High due to expected sea-level rise	Scenario A	Low	Very High
		Scenario B	Low	Very High
Natural Areas				
Inland Protected Areas and Nature Reserves	High due to forecasted increase in Tmin and forest fires	Scenario A	Moderate	High
		Scenario B	Low	Very High
Other natural areas of national interest (forests…)	Moderate	Scenario A	Moderate	Moderate
		Scenario B	Low	High
Inland archaeological sites	Low	Scenario A	Low	Low
		Scenario B	Moderate	Low
Mountainous summer resort areas	High due to forecasted increase in Tmin	Scenario A	High	Low
		Scenario B	High	Low

Three types of locations are considered to be highly vulnerable to climatic changes:

- The high-altitude Mountains where ski stations and winter resorts and chalets are located (Figure 1-6). Warmer temperatures and precipitation reduction are expected to lead to a decrease in the intensity, residence time and thickness of the snow cover in the mountains of Lebanon (as mentioned in the Water chapter), and thus shorten the skiing season. Studies have shown a 12%-16% decrease in the precipitation and the snow cover over the last four decades (Shaaban et al., 2008). Furthermore, the mountainous ecosystems have been depleted of their vegetation cover by several degradation factors of which are overgrazing and the use of vehicles operating on snow (quad, 4X4 and snowmobiles etc). As a result, the potential for self regeneration and reconstitution of the vegetation cover has been altered.

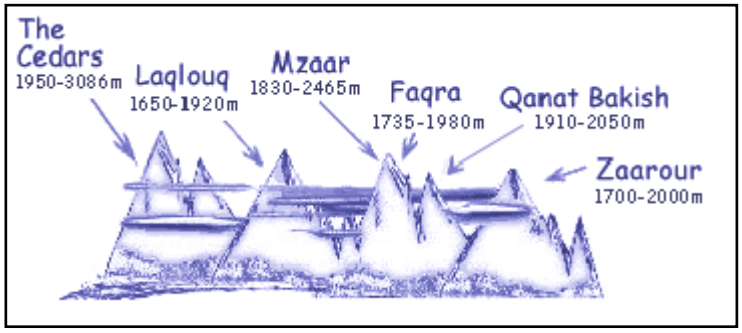

Figure 1-6 Ski resorts in Lebanon and their relative altitude

- The coastline where archaeological sites, beach resorts, marinas and public beaches (e.g. Ramlet el Bayda, Tyre etc.) are located could be exposed to sea-level rise that may predictably attain a 12 to 25 cm rise by 2030 in the Mediterranean Sea, as indicated in the coastal zone chapter. Such a rise may inflict damage on the mentioned touristic attractions due to their proximity to the shore if protective structures are not built. Sea-level rise may affect the attractiveness of public beaches that are used by a significant proportion of the population, and cause erosion and structural damage to the national archaeological heritage.
- Natural areas of national interest where eco-tourism takes place: Some of those areas are at risk due to their coastal location, therefore might be affected by the expected sea level rise (e.g., the Palm Islands and Tyre Coastal Nature Reserve), or due to projected warmer temperatures that may have significant impacts on the natural and social assets of these areas.
- Higher temperatures and lower precipitation resulting in longer drought periods may impact the natural areas of national interest such as the protected areas and the natural reserves by increasing the risk of forest fires and endangering some forest species (refer to the biodiversity chapter). For example, a shift in forest lines increases the risk of forest fires and the risk of forest pest infestation which may ultimately affect ecotourism in mountainous areas, and consequently impinge on the livelihoods of the communities there (guesthouses, restaurants, souvenirs shops, etc.).
- Higher temperatures may also affect the mountainous summer resort areas as they offer a cooler climate compared to urban coastal cities. Given that this can be rather easily mitigated by increasing cooling intensity in areas with hotter temperatures or by the gradual and autonomous shift of mountainous summer resort areas to higher altitudes, the vulnerability of those areas were deemed to be relatively low. The adaptive capacity of residents and seasonal tourists in the mountainous summer resort areas is considered to be high, especially that many of the residences are second-homes.
- The vulnerability of inland archaeological sites was considered to be low due to the low overall sensitivity of those sites, such as Baalback and Anjar which are located in semi-arid climates, to higher temperatures and lower precipitation.

1.1.5. Impact Assessment

1.1.5.1. Selected Impact Indicators

Socio-economic indicators (Table 1-4) for the most vulnerable systems identified in Table 1-3 were selected and used in the impact assessment under the climate change scenario and each of the two socio-economic scenarios.

Table 1-4 Indicators for analysis of climate change impacts on vulnerable systems in Tourism

VULNERABLE SYSTEM	INDICATOR	RELEVANCE
High mountain areas - ski resorts and winter holiday destinations	Receipts from winter activities	Receipts from winter activities are closely related to changes in precipitation

VULNERABLE SYSTEM	INDICATOR	RELEVANCE
Coastal areas	Receipts from coastal summer activities (mainly beaches) and entrances to coastal archaeological sites	Receipts from coastal summer activities would be affected by the damage caused by sea-level rise
Natural areas	Number of ecotourists	Number of ecotourists is closely related to attractiveness and biodiversity of natural areas which are threatened by high temperatures and forest fires

1.1.5.2. Impacts from climatic and non-climatic factors

According to the UNWTO, there are four broad categories of climate change impacts that could affect tourism destinations, their competitiveness and sustainability, three of which will be covered in this Chapter (UNWTO & UNEP, 2008).

Direct climatic impacts, including geographic and seasonal redistribution of climate resources for tourism, and changes in operating costs (heating-cooling degree days, insurance premiums).

Indirect environmental change impacts, including climate-induced environmental changes such as water shortages, biodiversity loss, decline of landscape aesthetic, increase in vector-borne disease, damage to infrastructure.

Indirect societal change impacts, including the consequences of the broader impacts of climate change on societies, such as changes in economic growth, development patterns, socio-political stability and personal safety. These will have 'knock-on' effects on operations, employment and security issues in tourism and related sectors.

Impacts of mitigation policies on tourist mobility,including changes in tourist flow due to increased prices; alterations to aviation routes; changes in the proportions of short-haul and long haul flights. This aspect will not be included in the impact assessment since it is basically limited to the vulnerability and adaptation sections.

Direct impacts from a changed climate

Direct impacts include changes in climate-related push-pull factors[5], changes in operating costs as a result of climate change and change to patterns of extreme weather events (UNWTO & UNEP, 2008).

Changes in climate-related push-pull factors would result in the redistribution of climatic assets among tourism regions. Changes in the length and quality of climate-dependent tourism seasons (i.e., sun-and-sea or ski holidays) could have considerable implications for competitive relationships between destinations and therefore the profitability of tourism enterprises (UNWTO & UNEP, 2008). Due to the potential increase in temperature during the summer season and the decrease of snow cover during the winter season, tourism might shift to the spring and autumn seasons.

5 Push-pull factors are reflected in unfavorable climate conditions in country/place of origin of tourists and favorable conditions at destinations.

Changes in seasonal operating costs, such as cooling, snow-making (in case it is adopted), irrigation and water supply and annual insurance costs (UNWTO & UNEP, 2008) could make tourism in Lebanon more expensive.

Changes in climate weather extremes would affect the tourism industry through increased infrastructure damage, additional emergency preparedness planning, higher operating expenses (e.g., insurance, backup water and power systems, and evacuations), and business interruptions (UNWTO & UNEP, 2008). Given the low preparedness to climate emergencies, the impact could be serious.

Indirect impacts from environmental change

Because environmental and climatic conditions are such a critical resource for tourism, any subsequent changes will have an inescapable effect on the industry. Changes in water availability, snow cover, the loss in biodiversity at destination level, degradation of the aesthetics of destination landscapes, agricultural production, increase of natural hazards, coastal impacts, damage to infrastructure and the increasing incidence of vector-borne diseases all impact tourism in various ways (UNWTO & UNEP, 2008). Following are the main potential indirect impacts of climate change and its implications on vulnerable tourism destinations in Lebanon.

WARMER TEMPERATURES, LOWER PRECIPITATION AND EXTREME WEATHER EVENTS

In general, warmer temperatures may cause heat stress and health risks for tourists and entail additional cooling costs. Furthermore, expected lower precipitation and increased evaporation may lead to potential water scarcity, both shortages in water for basic needs as well as water distribution problems, relating to competition for water between different sectors (e.g., agriculture and tourism), or between different forms of use in tourism establishments (e.g., rooms, kitchen, housekeeping, swimming pools, maintenance of gardens, golf courses etc.) (UNWTO & UNEP, 2008).

Extreme weather events such as extreme storms may threaten tourism facilities (of various tourism destinations) which may require increased insurance costs due to loss of insurability and business interruption costs (UNWTO & UNEP, 2008).

- Implications on high-altitude Mountains

Forecasted higher temperatures and decrease in precipitation may lead to a decrease in the snow cover on mountains in Lebanon.

Lebanon, the country with about 60–65% of mountainous terrain, receives a considerable amount of snow that covers about 25% of its area (from January to March). Normally, snow covers the regions located at 1500 m of altitude (Najem, 2007), thus shaping the mountain chains of Lebanon. It is predicted that an increase of temperature of 2°C and 4 °C may change the altitude of regions covered by snow to 1900 m and 2000 m respectively (Najem, 2007).

One of the potential impacts of climate change consists of decreasing the snow-covered area and snow residence time, i.e. the time snow remains before melting. This may shorten the winter sports season, the key attraction for tourism during winter. A recent study that analyzed historical satellite images showed a noticeable decrease in the area of snow cover (Figure 1-7). This was accompanied by a decrease in the residence time of dense snow cover (Figure 1-8) as a reflection of the increase in temperature levels (Shaaban et al. 2008).

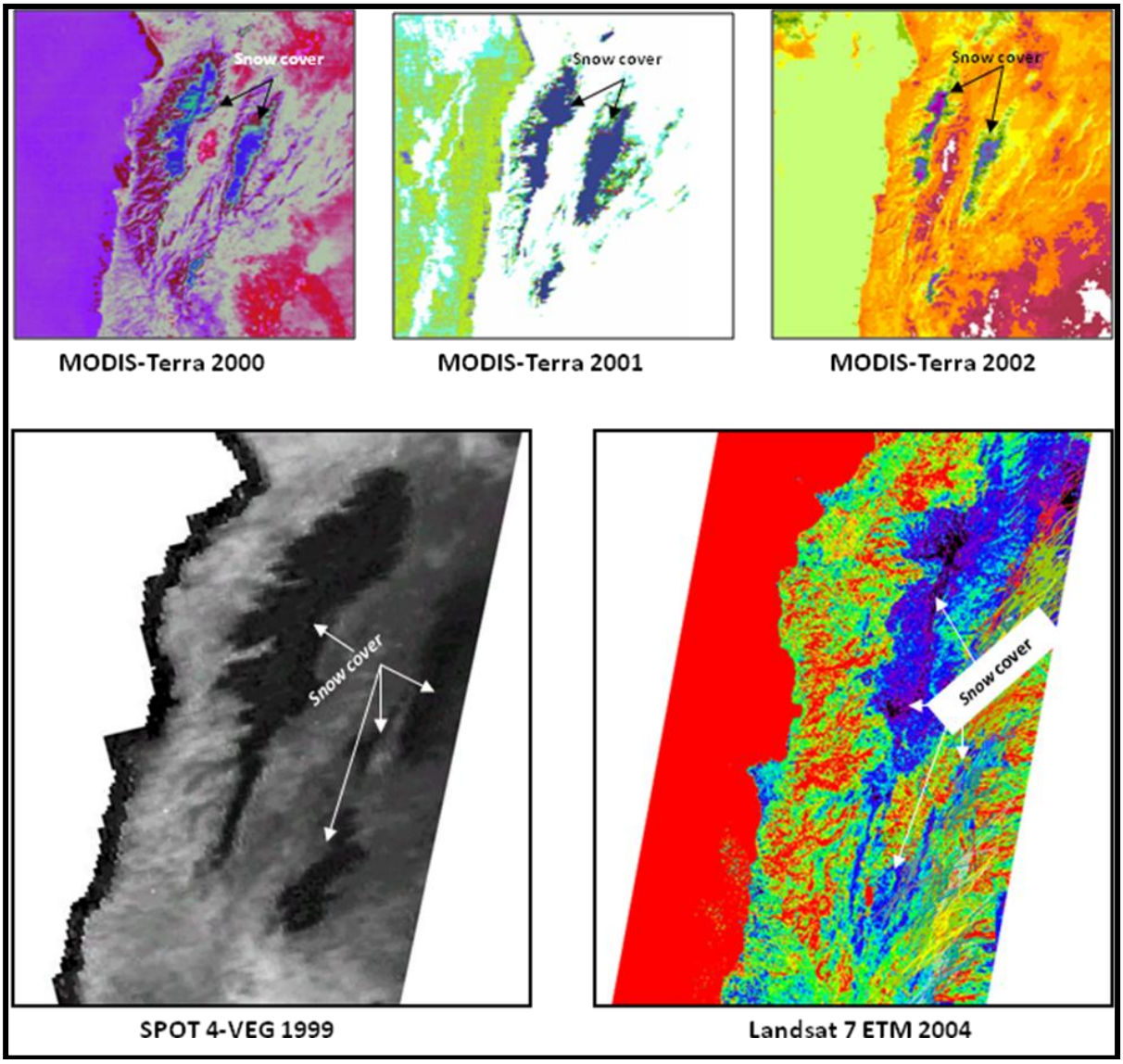

Figure 1-7 Different satellite images and dates showing the change in snow cover in Lebanon

Source: Shaaban et al., 2008

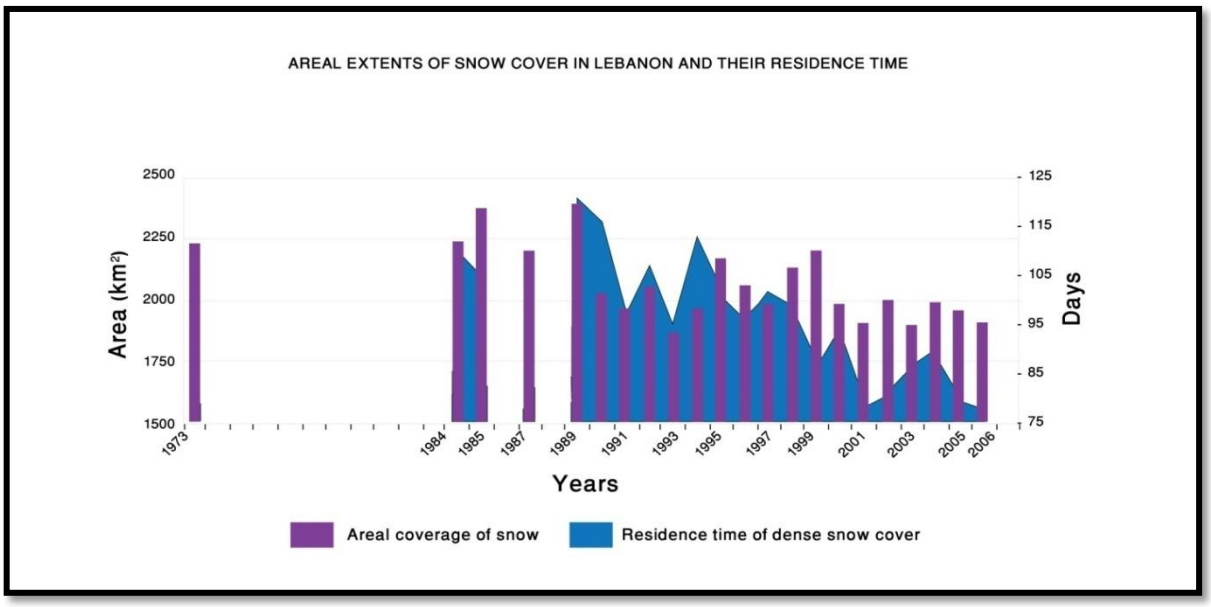

Figure 1-8 Area of snow cover in Lebanon and their residence time

Source: Shaaban et al., 2008

Even though the analyzed satellite images are not complete in terms of temporal coverage to show strong evidence of snow cover change, they still show a general changing trend. For instance, before the 1990s, dense snow often covered more than 2,000 km^2 of the Lebanese mountains and averaged about 2,280 km^2. Lately, it declined to less than 2,000 km^2 with an average area of about 1,925 km^2. In addition, the average time that dense snow remains on mountains before melting processes take place has also decreased from 110 days to less than 90 days (Shaban, 2008), and it is expected to decrease to 45 days with a warming of 2°C (Najem, 2007).

- Implications on coastline areas

Mediterranean Sea Surface Temperatures (SST) are expected to gradually increase due to climate change. Higher SST may lead to an extension of the swimming season, during which other water activities are also practiced. Given that for comfortable water activities SST should be around 20-21°C, current SST in winter are too cold for swimming in the Mediterranean Sea (Perry, 2000). In Lebanon, water activities are mostly practiced between May and October. The greatest benefit of a 2-3°C rise in SST would be the extension of the swimming season to the spring and autumn seasons. This analysis is based on a study conducted for the central and eastern part of the Mediterranean Basin (Perry, 2000).

- Implications on natural areas of national interest

The landscape as well as environmental assets and amenities are essential for the sustainable development of the tourism sector, and they are the prime movers of ecotourism. Climate change could affect natural ecosystems, worsening their state as a result of changes in temperature and precipitation which are expected to affect considerably the growth, strength, function and survival of these ecosystems (Laouina, 2008).

For instance, the forest sector will have to face the impact of increased frequency of fire events due to increased drought periods and the replacement of forest stands with fire prone shrub communities (refer to Forestry chapter).

This is likely to provoke the loss of natural attractions, increase soil erosion, and afflict potential damage to tourism infrastructure and natural assets. According to a recent study (AFDC, 2007), 129 forest fires were recorded in Lebanon in 2004 resulting in 585 ha of burned forest areas compared with 79 forest fires in 1996 that resulted in 468.5 ha of burned forest areas (FAO, 2001). The AFDC study notes that 5.6% of forests are at high risk of fires, and 25% are at medium risk.

Numbers of eco-tourists might be differently affected according to the scenarios; while scenario A would imply a slight increase in the number of eco-tourists, the number would moderately decrease under scenario B (Table 1-4).

SEA LEVEL RISE

- Implications on coastline areas

Countries located on the Mediterranean coast will be strongly threatened by sea level rise which could be accelerated by high tides and violent storms (Khattabi, 2009), even though evidence relating to the potential increase in occurrence of such events is weak and inconsistent.

The vulnerability of the coastal tourism sector in Lebanon concerns beaches and seaside facilities, notably small beach resorts with less adaptive capacity, which constitute the basis of currently promoted tourism in the summer.

The sea level in the Mediterranean is predicted to rise, with a wide margin of uncertainty, by an average 12 to 25 cm by 2030 (refer to coastal zone chapter). Furthermore, a study shows that a rise in SST induces a likely increase in the frequency and intensity of storms and hurricanes (Jäger *et al.*, 2008).

Coastal flooding and inundation due to projected sea level rise combined with potential extreme storm events may cause coastal erosion, loss of beach areas, higher costs to protect and maintain waterfronts, loss of vulnerable ecosystems and damage to public beaches. Seaside resorts will also be significantly affected due their proximity to the shoreline and their violation of the public maritime domain setback of 23m for commercial construction in many cases.

- Implications on natural areas of national interest

Sea level rise may damage coastal protected areas due to their location and nature:

- The Tyre Coastal Nature Reserve is the largest sandy beach in Lebanon. It harbors many species of plants, animals and insects.
- The Palm Islands Nature Reserve is located to the northwest of Tripoli and covers 5 km^2. Sanani, Ramkine and Palm Island together with their surrounding sea make up the Palm Islands Nature Reserve.

Indirect societal change impacts

The impact of climate change on infrastructure and the natural environment has the potential to affect the tourism industry. In some cases this could result in social and economic impacts given that tourism constitutes a major source of income and employment in Lebanon.

Tourists value the outdoor attractions available in Lebanon. Moreover, the entire social fabric and infrastructure of certain communities in the region are based on the tourist flows attracted by the recreational opportunities of the vulnerable systems already identified. Changes in the availability of those recreational opportunities could have wide-reaching impacts on attracting tourists, and thus on the livelihoods of permanent residents that rely on the region's multi-faceted outdoor recreation

industry. This in turn could lead to the migration of the affected groups that include hotels, restaurants, shops and other entities benefiting from the tourism sector.

Climate change impacts and their implications on tourism are summarized in Table 1-5.

Table 1-5 Impacts of climate change and their implications for tourism

IMPACT	IMPLICATIONS FOR TOURISM
Warmer temperatures	Altered seasonality, heat stress for tourists, increase in cooling costs, changes in plant-wildlife-insect populations and distribution, infectious disease ranges
Decreasing snow cover due to lower precipitation	Lack of snow in winter sport destinations, increased snow-making costs, shorter winter sports seasons, aesthetics of landscape reduced
Reduced precipitation and increased evaporation	Water shortages, competition over water between tourism and other sectors, desertification, increased wildfires threatening infrastructure and affecting demand
Sea level rise	Coastal erosion, loss of beach area, higher costs to protect and maintain seafront resorts
Sea surface temperatures rise	Higher SST leading to an extension of the swimming season
Changes in terrestrial and marine biodiversity	Loss of natural attractions and species from destinations, losses in nature-based tourism
Increasing frequency and intensity of extreme storms	Risk for tourism facilities, increased insurance costs/loss of insurability, business interruption costs
More frequent and larger forest fires due to higher temperatures and less precipitations	Loss of natural attractions; increase of flooding risk; damage to tourism infrastructure

Source: UNWTO & UNEP, 2008

1.1.5.3. Summary of impact assessment results

The following steps were used in assessing the likely impacts of future climatic changes on tourism.

1. Economic indicators that would measure changes in the vulnerable tourism destinations were chosen (Table 1-4).
2. Changes in the indicators under each of the two socio-economic scenarios were examined (Table 1-6).
3. Changes in the indicators under the climatic scenario were examined (Table 1-6).
4. The overall change in the indicators was assessed under each of the two socio-economic scenarios and under the likely climatic change scenario, i.e. combining the results from steps 2 and 3 (Table 1-6).

The results of the impact assessment are summarized in Table 1-6.

On the overall, despite the high vulnerability of some of the main tourism destinations in Lebanon to climate change, it is expected that this sector will adapt to the changes through increased investment in the tourism infrastructure.

Under scenario A, receipts from the tourism activities and the number of eco-tourists in the most vulnerable systems are likely to remain stable or slightly increase due to the growth in the sector which,

given stable political and security conditions, might overshadow any climate-induced negative impacts.

Under scenario B, receipts are likely to range from a moderate decrease to stable returns, which, relative to scenario A, is a worse-off situation. This is mainly due to the expected, unsustainable growth trend in the eco-tourism sector leading to a decrease in returns and the growth in mass tourism which might offset any losses due to climatic changes.

Table 1-6 Impacts of climate change on specific indicators

VULNERABLE HOTSPOTS	INDICATORS	CHANGE IN INDICATORS UNDER NON-CLIMATIC (BUSINESS-AS-USUAL) SCENARIOS		CHANGE IN CLIMATIC FACTORS	CHANGE IN INDICATORS UNDER THE CLIMATE CHANGE SCENARIO	OVERALL CHANGE IN INDICATORS	
High mountain areas - ski resorts and winter holiday destinations	Receipts from mountain winter activities	Scenario A*	High increase	Higher temperature and decreased precipitation, leading to shorter winter seasons and reduction of the area and the time of residence of the snow cover	High decrease	Scenario A	Stable
		Scenario B*	Moderate increase			Scenario B	Moderate decrease
Coastal areas	Receipts from coastal summer activities	Scenario A*	High increase	Higher temperature leading to warmer sea surface temperature and extension of the swimming season. Potential rise in sea level, leading to damage to coastal resorts and public beaches.	Moderate decrease	Scenario A	Slight increase
		Scenario B*	Moderate increase			Scenario B	Stable
Natural areas	Number of ecotourists	Scenario A*	Moderate increase	Higher temperatures and lower precipitation leading to higher frequency of forest fires; Potential rise in sea level, threatening coastal protected areas	Slight decrease	Scenario A	Slight increase
		Scenario B*	High decrease			Scenario B	Moderate decrease

*Scenario A: characterized by a considerable growth of the tourism sector and promotes eco-tourism (refer to section 1.1.3)

*Scenario B: characterized by an unsustainable growth of the tourism sector and high pressure on the environment (refer to section 1.1.3)

1.2. ADAPTATION MEASURES

Adaptation measures in the tourism sector can be selected according to the different locations of the touristic areas. Following are general recommended measures and recommended measures in specific types of destinations as delivered by the Second International Conference on Climate Change and Tourism, held in Davos, Switzerland, October 2007 (UNWTO& UNEP, 2008), in addition to added measures from stakeholders' inputs at the Stakeholder Consultation Workshop "Enabling Activities for the Preparation of Lebanon's Second National Communication (SNC) to the United Nations Framework Convention on Climate Change (UNFCCC)" that was held in Beirut, April 2010.

1.2.1. General recommended measures

- Strengthen the role of Ministry of Public Works and Transport in traffic management and in establishment of new roads to facilitate access to tourism destinations.
- Create financial incentives to encourage investment in more sustainable touristic activities such as ecotourism to be sponsored by the Ministry of Tourism.
- Establish "information offices" in regions of touristic importance such as areas where nature reserves are located. These information offices should be managed jointly by MoIM, MoT, MoPWT, municipalities and the private sector in order to promote the shift to adaptable and sustainable activities such as ecotourism.
- Facilitate communication between the private sector and the municipalities involved in touristic activities in order to enhance the adaptive capacity of the sector.
- Seek funds from international organizations to support projects for the development of eco-touristic activities across the country.
- Sponsor direct awareness of the tourists towards cultural and sustainable tourism in order to promote diversification of tourism activities. The Ministry of Tourism should lead the implementation of this measure.
- Mainstreaming sustainability and climate change risks in national and regional tourism development and promotion strategies.
- Education/awareness raising among tourism businesses and professionals on the potential risks from climate change.
- Improved provision of climatic information to the tourism sector through cooperation with the national meteorological services.
- Introduction of insurance schemes against weather-related risk.

1.2.2. Specific recommended measures

1.2.2.1. High mountain areas and winter tourism destinations at risk

Mountain regions are important destinations for global tourism. Snow cover and pristine mountain landscapes, the principal attractions for tourism in these regions, are the features that are most vulnerable to climate change. Besides the predicted vulnerability, climate change can also bring opportunities in mountain areas. While the winter season might become shorter, summer season might grow longer, providing opportunities for other types of outdoor activities and tourism businesses that supply them (e.g., trekking, hiking, mountain biking, etc.).

Recommended measures:

- Move ski areas to higher altitudes or to colder north slopes; Establish a plan to organize and assist ski resorts to invest in snow production or to shift to higher altitudes. In order to shift the ski slopes to higher altitudes, it is essential to involve the MoPWT in the excavation of roads leading to new ski slopes and the restoration of already existing ones.
- Improve insurance coverage in the face of extreme events, natural disasters and unprofitable seasons due to climatic changes.
- Promote industry partnerships (integration within resorts, cooperation between resorts) to reduce economic vulnerability.
- Enforce laws on controlling grazing in rangelands in the mountainous areas that are being afforested and reforested. The presence of green spaces in these arid areas would encourage summer outdoor activities. This should be addressed by the Ministry of Interior and Municipalities and the Ministry of Agriculture which may however be hindered by the overlapping responsibilities.
- Promote touristic activities in mountainous areas throughout the year to compensate for the shortening of the winter season.
- Restore the vegetation cover by making available seeds of adapted species which will improve the vegetation cover, reduce erosion, increase water infiltration, and contribute to reducing the speed of snow melt.
- Seek funds from international organizations to support projects such as snow production to increase the length of the snow season and restoration of the vegetation cover to increase residence time of the snow

1.2.2.2. Coastal areas at risk

Coastal and island destinations are highly vulnerable to climate change (such as storms and extreme climatic events, coastal erosion, physical damage to infrastructure, sea level rise, flooding, water shortages and water contamination), given that most infrastructure is located within short distance from the shoreline.

Recommended measures:

- Implement 'soft' coastal protection measures to prevent erosion. Soft coastal protection includes reforestation of the coastal zone and conservation of shore-stabilizing vegetation that act as natural buffers. In Lebanon, the optimal option would be to conserve and grow shore-stabilizing vegetation.
- Enforce enhanced design and planning guidelines for tourism establishments in order to make these more resilient to the impacts of climate change.
- Integration of climate change factors into regulatory frameworks for tourism development, such as:
    - Environmental Impact Assessment for tourism infrastructure and establishments;
    - Strategic Environmental Assessment of tourism strategies and plans at the national and regional levels;
    - Implementation of tourism development plans within the framework of Integrated Coastal Zone Management (ICZM) processes and spatial planning such as zoning;

- Adoption of water -saving measures at touristic establishments. Adaptation measures at the resort level involve both actions on supply and demand, such as:
  - infrastructure improvements (e.g., rainwater collectors);
  - water conservation (including the application of water-saving devices and raising guest awareness);
  - sustainability planning (e.g., considering long-term weather forecasts);
  - monitoring health and environmental protection (quality of water);
  - recycling (use of treated water for irrigation).
- Re-organize the urban sprawl in coastal areas.
- Preserve existing public beaches and marine ecosystems.

1.2.2.3. Natural areas at risk

Due to their location, some nature reserves in Lebanon are vulnerable to climate change. Adaptation measures to be adopted for those touristic destinations differ according to their locations and the potential impacts accordingly.

For example, the Palm Islands are threatened by sea-level rise; therefore, recommended measures include application of soft coastal measures to prevent sand erosion, and regulation of and monitoring the access and behavior of tourists on the island.

Another example is the Cedar forests that are threatened by a wood wasp that becomes active in high ambient temperatures. In this case, the adaptation measures should consider actions to control this wasp. Such measures can be extracted from adaptation measures in the forestry sector (terrestrial biodiversity).

Recommended measures:

- Development and promotion of alternative and sustainable types of tourism, such as eco-tourism.
- Support protected area management in order to enhance their resilience.
- Enhance and restore the forest cover in order to promote sustainable tourism.

On a macro-level, climate change adaptation can only be implemented effectively within an integrated policy framework. Therefore, coordination between agencies to allow mainstreaming of climate change and sustainable development are essential to effectively address climate change risks in national and regional tourism development strategies and plans. However, given the private nature of investment in the tourism sector, it is likely that investors will adapt autonomously to the changes in weather patterns. For instance, touristic establishments might want to respond to an earlier touristic season starting in mid-spring rather than in late spring or be ready to extend their seasonal operations to cover the shoulder seasons.

The recommended adaptation measures are elaborated into adaptation strategies in Table 1-7. It should be noted that the indicative budget is a rough estimate based on professional judgment, and sometimes reflects the cost of studies needed to be carried out prior to the implementation of the proposed activities. Each of the mentioned activities requires an in-depth assessment to determine its actual cost at the time of planning and implementation.

Table 1-7 Adaptation Action Plan for the Tourism Sector

IMPACT	PROPOSED ADAPTATION STRATEGY	ACTIVITIES	RESPONSIBILITY	PRIORITY (ST/ MT/ LT)	INDICATIVE BUDGET (USD)	SOURCES OF FINANCING/ IMPLEMENTATION PARTNERS
Decrease in receipts from mountain winter activities and reduced income to local communities	Establish a coordination framework for adaptation to climate change in mountain areas	Initiate dialogue between ski operators, mountain businesses' representatives, MoT, research bodies, Climate Change Coordination Unit, MoSA and municipalities. Setup task force committee to coordinate adaptation efforts.	Private sector MoT MoE Municipalities	ST	100,000 USD	Private sector, MoT budget, international donors Municipalities
	Diversify sources of income in mountain areas	Identify mountain activities other than skiing Improve infrastructure in vulnerable areas to support activities (other than skiing) throughout the year. Promote awareness to encourage people to practice mountain activities other than skiing Increase access to green areas through afforestation projects and increased control of grazing activities	Private sector Municipalities MoT MoE MoPWT	ST	50,000-100,000 USD per affected area for studies	Private sector MoT and MoE budgets Municipal budget International donors Adaptation fund when it becomes operational (as impacts are already being felt in the affected areas)
	Increase access to snow resources	Explore options for snow production (e.g. artificial snow production) Assess feasibility of access to higher elevations where snow cover lasts longer	Private sector (owners of the ski stations) Municipalities	ST	100,000 - 500,000 USD per site for studies	Private sector Municipal budget
		Identify seeds of adaptive plant species to increase snow retention	Research bodies (NCSR, academia for technical			

IMPACT	PROPOSED ADAPTATION STRATEGY	ACTIVITIES	RESPONSIBILITY	PRIORITY (ST/ MT/ LT)	INDICATIVE BUDGET (USD)	SOURCES OF FINANCING/ IMPLEMENTATION PARTNERS
			support)			
Decrease in receipts from coastal summer activities	Improve resilience of vulnerable coastal resources	Identify/confirm vulnerable coastal resources Design hard and soft measures to protect vulnerable areas Explore feasibility to develop special insurance schemes against weather-related risks	MoPWT Private operators OEA MoE	MT-LT	100,000-500,000 USD per site	MoPWT budget International donors technical assistance programs ESCWA

1.3. RECOMMENDATIONS FOR FURTHER WORK

The following recommendations for further work to improve the analysis of vulnerability of the tourism sector to climate change and its expected impacts can be made:

- Quantitative research is recommended on tourist preferences through conducting surveys and statistical data analysis.
- Studies on snow conditions are required, monitoring the changes in the snow cover area and snow residence time in order to relate it to potential changes in climate conditions and forecast impacts on skiing and winter tourism. The centralization of the data collected from the ski stations is recommended to facilitate accessibility.
- Sea-level rise monitoring and assessment of the most vulnerable coastal destinations accordingly in order to suggest suitable prevention measures.
- Further research is recommended for the following proposed adaptation measures to study the feasibility of their implementation in Lebanon:
    - The optimal type of 'soft' coastal protection to prevent erosion in Lebanon. Further studies are recommended in order to define the species of shore-stabilizing vegetation that could be planted.
    - Research of the type of vegetation cover that could reduce erosion and increase water infiltration into the ground in order to reduce the speed of snow melting.

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