

Section IV: The Outlook - Towards 2020

Chapter 10 The Future Today

10 The Future Today



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ABBREVIATIONS & ACRONYMS

AUB	American University of Beirut
COM	Council of Ministers
DGCA	Directorate General of Cadastral Affairs
EDL	Electricité Du Liban
EIA	Environmental Impact Assessment
EPA	Environment Protection Agency
GBA	Greater Beirut Area
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEO	Global Environment Outlook
GOL	Government of Lebanon
HCUP	Higher Council of Urban Planning
IRI	Industrial Research Institute
LARI	Lebanese Agricultural Research Institute
LCEC	Lebanese Center for Energy Conservation
LCPC	Lebanese Cleaner Production Center
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOEW	Ministry of Energy and Water
MOF	Ministry of Finance
MOI	Ministry of Industry
MOIM	Ministry of Interior and Municipalities
MOPH	Ministry of Public Health
MOPWT	Ministry of Public Works and Transport
NCSR	National Center for Scientific Research
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organization
PA	Protected Areas
SEA	Strategic Environmental Assessment
TEDO	Tripoli Environment and Development Observatory
UNDP	United Nations Development Program
UOB	University of Balamand
USEK	Université Saint Esprit Kaslik
USJ	Université Saint Joseph
WWTP	Wastewater Treatment Plant

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This chapter builds on previous chapters by exploring how current social, economic and environmental trends may unfold along divergent development paths in the future, and what this might mean for the environment, development and human well-being. It presents two scenarios to the year 2020, using narrative storylines and qualitative data to explore different policy approaches and societal choices. While the chapter is inspired by the Global Environment Outlook process, it departs from the process in several ways. In particular, the 2010 SOER uses only two scenarios (GEO 4 uses four); it focuses on specific policies and societal choices already discussed in the report (GEO 4 uses a suite of advanced global and regional models including International Futures, IMAGE, IMPACT, WaterGAP, LandSHIFT, Ecopath with Ecocism, etc.); and it examines future environmental change in Lebanon only (GEO 4 offers regional and global analysis).

10.1 ABOUT THE SCENARIOS

The GEO process has crafted four scenarios to predict the future state of the environment: *Market First*, *Policy First*, *Security First*, and *Sustainability First*. The 2010 SOER has selected and adapted two of these scenarios:

Market First. This would be equivalent to Business As Usual whereby market forces continue to dominate government policies and societal choices. With active government support, the private sector continues to pursue maximum economic growth as the best path to improve the environment and human well-being. There is little focus on the broader human-environment system. Technological fixes to environmental challenges are emphasized at the expense of other policy interventions and some tried-and-tested solutions.

Sustainability First. Government, civil society and the private sector work collaboratively to improve the environment and human well-being, with a strong emphasis on equity. Equal weight is given to environmental and socio-economic policies, and accountability and transparency are stressed across all actors. The Government works proactively to implement the recommendations and agreements of the Rio Earth Summit and all related multilateral environmental agreements affecting the environment (BSP, UNFCCC, UNCCD, Stockholm, etc.). Emphasis is placed on developing effective public-private sector partnerships not only in the context of projects but also in governance, ensuring that stakeholders across the spectrum

of the environment-development discourse provide strategic input to policy making and implementation. There is an acknowledgement that these processes take time, and that their impacts are likely to be more long-term than short-term. Civil sector reform is the order of the day.

Both scenarios assume that Lebanon will (1) enjoy a period of political stability and relative government coherence, and (2) not experience any significant military confrontation or flare-ups. Additionally, the *Sustainability First* scenario assumes that Lebanon will (3) implement measures to mainstream the environment in selected economic sectors, and (4) move towards improved environmental governance and the rule of law. Table 10.1 presents general assumptions for each scenario based on a set of drivers and sub-drivers. Table 10.2 at the end of the chapter summarizes detailed assumptions for each chapter in the 2010 SOER.

The *Policy First* scenario introduces some measures aimed at promoting sustainable development, but the tensions between environment and economic policies are biased towards social and economic considerations. The *Security First* scenario focuses on the interests of a minority: rich, national and regional. It emphasizes sustainable development only in the context of maximizing access to and use of the environment by the powerful.



Table 10.1 Overview of Drivers, Uncertainties, and Assumptions by Scenario

Driver and Sub-Driver	Markets First	Sustainability First
Governance		
<i>Dominant actor and power balance</i>	Private sector with strong government support; more power goes to the private sector	Balanced. Government, private sector, and civil society share power and influence decision making
<i>Governance approach</i>	Top-down (with emphasis on hierarchical structures)	Balanced. Bottom-up and top-down approaches
<i>Level of public participation</i>	Low public participation	High public participation
<i>Priority</i>	Maximum economic growth, with presumption that social and environmental concerns will realign with market forces	Social and environmental welfare with economic sufficiency
<i>Mainstreaming of social & environmental policies</i>	Low	High
Economic Growth		
<i>GDP growth</i>	Highest	Medium
<i>Diversification</i>	High towards services	High towards services
<i>Privatization</i>	Highest, no control	Medium with control
Demographic Growth		
<i>Population growth rate</i>	Moderate to high	Low to moderate
<i>Immigration (expatriates and labor force)</i>	Open, uncontrolled (market driven)	Partly controlled, with strong national substitution programs
<i>Urbanization</i>	High due to population growth rate, unplanned	Well planned, in sync with the NLUMP, stabilized in proportion to resources
Human Development		
<i>Level of investment in education and health</i>	Medium	Highest
<i>Capacity building and training programs</i>	Medium, left to market demands	Highest, well planned by leading government efforts
<i>Environmental awareness</i>	Medium, and ad-hoc subject to funding	Highest and integrated in mass media
Science & Technology		
<i>Level and type of investment</i>	High, but market driven by the private sector, for its own needs and problems, emphasis on profit	High, government and private sector, to solve mainly societal needs and problems (e.g., desalination technology)
<i>General level of technological progress and Science infiltration into society</i>	Low	Highest
Culture and Heritage		
<i>Global culture homogenization</i>	Highest	Wise! Diverse and accepting
<i>Individualism vs. community focus</i>	Individual	Community
<i>Indigenous culture and Heritage retention</i>	Eroded with conflicts (religious retreat)	Retained with least conflict
Regional Integration and Cooperation		
<i>Type, level, and rate</i>	Market driven (trade focus), medium to slow rate	Policy driven. Highest towards or approaching integration, fast rate
<i>General Status</i>	Worse	Best

10.2 MARKET FIRST – SCENARIO NARRATIVE

Environmental governance does not improve markedly. Key environmental laws and decrees (environmental prosecutor, environmental police, environmental impact assessment, environmental fund, etc.) are either approved/enacted but not implemented, or have yet to be approved/enacted. The Parliamentary Committee for Environment convenes irregularly, to respond to emerging issues and priorities (waste management contracts, spills, pollution, fires, etc.) but their work is often blurred by other national issues gripping the country (privatization, oil exploration, security, etc.). The ability of the Ministry of Environment and other line ministries and intergovernmental agencies to enforce environmental regulations is weak. Stop-and-go work planning by the MOE is affected by ministerial cabinet reshuffles and the National Environmental Action Plan does not crystallize. Patron-client relationships prevail in many sectors including construction, energy and industry. Leading public research organizations (IRI, LARI, NCSR, TEDO, LCEC, etc.) as well private environmental institutions located on university campuses (AUB, UOB, USJ, USEK, etc.) continue their work as usual, subject to funding availability and research priorities, with little interagency cooperation. Synergies among research organizations are only partially explored and pursued. Research and development is not always in sync with national environmental priorities. Access to environmental funding continues to depend on the goodwill of international development organizations and multilateral trust funds while the Government of Lebanon is unable or unwilling to divert and/or spend more resources on the environment.

Water resources will continue to dwindle over the next decade. Recent impacts of climate change on weather patterns including decreasing precipitation, receding snowline and shorter snow period, will reduce groundwater recharge and net exploitable resources. Annual water demand will increase from about 1,473 Mm³/year to about 2,055 Mm³/year (projection by the World Bank). While government efforts to build and complete water systems including dams and networks will achieve noteworthy results, the concomitant lack of progress in protecting water sources from large scale mountain developments, industrial effluent, wastewater discharge and waste disposal offsets the impact of such public expenditure in the water sector. The groundwater table will drop further in

the Bekaa Valley and other major agricultural regions. Seawater intrusion in coastal areas will also increase rendering it unsafe for irrigation. The Awali-Beirut water conveyance project will alleviate water stress in the Greater Beirut Area and reduce water rationing. Significant progress in the implementation of the national wastewater treatment plants (at least 5 new coastal WWTPs will come online by 2020) bodes well for the marine environment but at least two plants provide only pre-treatment and regional Water Establishments are unable to operate the new facilities. Outsourcing to the private sector is the preferred option but financing is lacking. The completion of at least four WWTPs in the Litani River basin reduces the environmental load entering the river system. The National Water Sector Strategy begins to show results but political commitment to forge ahead is lacking. Capital investment envisioned during the period 2011-2015 is only partially completed. The institutional reform defined under Law 221/2000 makes some headway but is not yet complete.

Air quality in Lebanon deteriorates slightly over the coming decade, due to increasing emissions from the transport, industry, and energy sectors. Annual vehicle registration increases by 5 percent annually (from 106,959 in 2008 to almost 200,000 in 2020). In the private car category, small fuel-efficient cars assume a bigger market share but gas-guzzling 4x4s are still prevalent and trendy. Emissions from energy industries increase but electricity production is gradually becoming more efficient thanks to a partial shift in the country's energy mix (from dirty fuels to cleaner fuels such as Nitrogen Gas and Liquid Nitrogen Gas). Sulfur emissions also decline because of stringer sulfur content standards, and improved inspection measures. Emissions from industries experience little change, if any, because pollution abatement initiatives by relevant ministries and the World Bank are offset by higher production and industrial output. The draft Law on the Protection of Air Quality (prepared in 2005) is not approved. Private electricity generation (20% in 2010) begins to drop thanks to higher energy production by EDL but power outages and rationing is still widespread. The ban on indoor smoking in public areas and government buildings is partially enforced. Lebanon's air quality monitoring capabilities improve but continue to rely on ad-hoc sources of funding to generate and share air quality data in a timely fashion. The Government approves and kick-starts the long-awaited taxi fleet renewal

program but so far only 2,000 taxi owners have switched to hybrid or fuel-efficient cars. Mass transport is limited to low-capacity buses which are in dire need of renewal.

Lebanon's biodiversity and forests come under increasing pressure from anthropogenic sources and due to climate change. The country begins to experience species extinction. Among Lebanon's 94 endemic species, at least half are now considered rare and/or threatened. The forest cover (about 23% in 2004) does not change greatly but the share of Other Wooded Land increases at the expense of natural forests. Urban sprawl and haphazard urbanization all over the territory consumes and/or degrades natural forests and accelerates the fragmentation of important biological habitats. New coastal resorts and marinas degrade marine ecosystems further and Lebanon's fisheries (mostly artisanal) begin to experience noticeable decline in fish catch, prompting some fishmongers to invest in larger boats and more sophisticated fishing gear and equipment, with the approval of the MOPWT and the Lebanese Army. The Government does not acquire new aerial and ground fire-fighting equipment and the country continues to experience more intense forest fires during late summer and fall (at least 300 fires consume 4,000ha in 2020). The absence of law enforcement (Law 92/2010) and accountability continues to encourage acts of arson especially near urban areas. The Higher Council for Hunting makes earnest attempts to regulate and control the hunting sector. The hunting exam and insurance becomes mandatory for all hunters but hunting practices and malpractices continue unabated. A myriad of reforestation efforts (MOE's National Reforestation Plan, USFS's Lebanon Reforestation Initiative, GEF-UNDP's Safeguarding and Restoring Lebanon's Woodland Resources, NGOs, etc.) convert about 500ha into forests each year but the supply, distribution and selection of forest seedlings is not optimal. The draft Framework Law on Nature Reserves is still not approved. Lebanon declares several new protected areas bringing the total area under *legal* protection to 300km² (up from 220km² in 2010) but the basis for declaring the areas protected is not clear and does not respond to ecological priorities. Improved ecosystem monitoring provides compelling evidence that climate change is stressing mountain ecosystems (e.g., recurrent spikes in the population of selected forest insects, increased incidence of dieback symptoms of key forest species at lower altitudes).

Land resources continue to face mounting pressure from anthropogenic sources. Population growth (from 4.2 million in 2010 including Palestinian refugees to about 4.6 million in 2020 assuming a 1% annual growth rate) will increase demand for housing. Much of this urban expansion occurs at the expense of agricultural land in the coastal zone and inland areas. Approved construction permits add approximately 10 million m² of floor space to the building stock every year, consuming 5km² of land area every year, 50km² by 2020. New housing development in mountain areas engenders new road construction in pristine habitats, degrading landscapes and mountain ecosystems. The current pace of change in land cover and land use continues. In particular, the total built-up area increases from 648km² in 1998 to almost 800km² in 2020. The Higher Council of Urban Planning approves new master plans covering five percent of the territory, bringing the total extent of zoning to about 21 percent. But the makeup of the HCUP and the methodology and procedures for preparing urban master plan remains unchanged. The National Land Use Master Plan is not mainstreamed into regional master plans.

The MOE continues to receive EIA studies for coastal development projects but is unable to introduce design changes to all projects equally to minimize environmental damages. The MOPWT approves the conditional use of the public maritime domain for at least a dozen new establishments and resorts. The Government is still undecided on the issue of settling illegal maritime properties. Lebanon's karst heritage comes under increasing pressure from quarrying and the construction sector, and several surface and underground karst formations are irreversibly damaged. The Lebanese Army clears 60 percent of the total area affected by unexploded cluster bombs in south Lebanon during the July 2006 war (about 20km² out of 35km²). The Higher Council for Quarries makes earnest attempts to implement Decree 8803/2002 and its amendments but enforcement remains erratic. The MOE rehabilitates at least five quarries using the money deposited from bank guarantees, to serve as pilots, but the total value of bank guarantees remains derisory compared to the market value of aggregates. Little progress is achieved in declaring and managing Lebanon's first national park in the upper Dinnieh-Hermel region.

Urbanization intensifies over the next decade.

Rural-urban migration accelerates in the absence of real growth opportunities outside major cities. Regional disturbances (financial crisis in Gulf countries) and conflicts (Ivory Coast and other African countries) encourage many expat Lebanese to return to their home country pushing property demand even higher, but at least seven percent of the housing stock is secondary housing (up from 5% in 2004). The rate of urbanization hits 90 percent by 2020 (up from 88% in 2010). Urbanization is primarily concentrated around urban poles (Tripoli, Saida, Baalbeck, Nabatiyeh, Zahle, etc.) but haphazard urbanization outside these areas continues unabated. At least 100 new high-rise towers mushroom in Beirut, changing the skyline, and erasing many cultural landmark buildings. The DGCA at the MOF makes significant progress in demarcating non-surveyed mountain lands but at least 35 percent of the territory has not been demarcated yet. Formal refugee camps and other informal settlements do not experience any change. The pace of construction of mountain resorts increases and most of these resorts escape the EIA and SEA process. Key environmental provisions in the urban planning (Legislative-Decree 69/1983) and construction laws (Law 646/2004) are not heeded nor implemented. There are no reported cases of construction permits revoked or denied based on environmental considerations and other natural hazards. Foreigners continue to buy and sell property in Lebanon, with relative ease, depriving the state of hundreds of millions of dollars in capital gain tax. Haphazard urbanization continues to impact groundwater recharge (from relentless excavation) and air quality (mostly from cement industry), infringes on fertile agricultural land, clutters roads, and fragments natural habitats. The demand for construction aggregates overrides efforts to control and regulate quarrying. Living conditions in major cities deteriorate due to population density, localized flooding during winter, congestion, noise, heat island effect, and the lack of green and public spaces.

Solid waste management in Lebanon experiences some improvements in the next decade.

In rural areas, capital investment by the EU-OMSAR and other development organizations yields positive results. Several solid waste treatment facilities (including composting and Waste-To-Energy) go online thereby reducing the prevalence of open dumping. Parallel efforts begin to rehabilitate and close selected inland open dumps. In

Beirut and Mount Lebanon (excluding the Caza of Jbail), the Government maintains status quo by extending its contracts with AVERDA for the collection, treatment, transport and disposal of solid waste from approximately 2 million people. Effectively, the Emergency Plan of 1997 is still the order of the day but the Naameh landfill is now closed and replaced with a new landfill site. The tonnage price increases by at least 15 percent to reach \$172 per tonne of solid waste. Construction contractors and truck drivers continue to dump excavation material and construction waste on roadsides and in ravines, undeterred, and in total impunity. Arcenciel increases its area coverage by collecting and treating 70 percent of the country's health care risk waste (up from 55% in 2010). The Saida seafront dumpsite is permanently closed and the new biological waste treatment facility goes online but faces technical difficulties. The inorganic fraction is disposed off in a controlled site inland. The Bourj Hammoud dumpsite north of Beirut remains idle. Lebanon is able to ship 200 tons of PCB oil and PCB-contaminated equipment abroad for destruction in partial fulfillment of its obligations under the Stockholm Convention. The first model slaughterhouse facility, equipped with its own treatment plant, is built outside Beirut and goes online. Remaining slaughterhouses continue business as usual. The draft law on Integrated Solid Waste Management is not finalized and waste minimization incentives are absent.

Lebanon's energy crisis show signs of recovery.

GDP growth is sustained (it plateaus around 5% in 2020) and continues to drive Lebanon's energy consumption. With an energy elasticity of 1.4, Total Primary Energy Supply will hit 10,000 KTOE in 2020 (up from 5,400 KTOE in 2009). The energy mix changes moderately, in favor of cleaner and less expensive fuels. The environmental performance of Lebanon's electricity sector does not improve noticeably. Storage facilities for imported hydrocarbon fuels do not undergo a detailed environmental audit, sludge is burnt or disposed in the municipal solid waste stream, the number of unlicensed gas stations continues to rise and the majority of storage tanks escape inspection. Unlicensed gas stations continue business as usual. Private electricity concessions and investors in renewable energy pressure the government to amend energy production legislation but EDL continues to maintain monopoly over the sector, as well as cost the Government billions of dollars annually in fuel subsidy. Demand for energy by the construction, transportation, and industry

sectors continues to rise. The Government launches several international tenders for oil exploration based on Law 132/2010 and awards one oil extraction and production contract. Despite environmental provisions in the law, risk prevention and emergency response procedures related to oil spills are not tried and tested. The Lebanese Center for Energy Conservation grows but is not fully integrated into the organizational structure of the MOEW. The Lebanon Green Building Council is unable to introduce noteworthy changes to the Lebanese Building Code (Law 646/2004). The 2010 Policy Paper for the Electricity Sector is only partially implemented.

10.3 SUSTAINABILITY FIRST – SCENARIO NARRATIVE

Environmental governance begins to improve as part of a national reform effort to increase participation, transparency and accountability in several sectors. Key environmental laws and decrees (environmental prosecutor, environmental police, environmental impact assessment, environmental fund, etc.) are approved and enacted and partially implemented. In particular, the judiciary system is now fitted with environmental prosecutors who can examine jurisprudence cases with a profound understanding of environmental issues and options. The EIA and SEA decrees are enacted and recognized by line ministries as a necessary step in the permitting process and as a preventive tool in natural resource management. The quality of EIA studies improves slightly but only to the extent of concomitant advances in the generation and dissemination of environmental data on water, air and biodiversity. The Parliamentarian Committee for Environment convenes at least twice every month to examine emerging issues and priorities proactively, and reaches out to civil society groups and the private sector to identify and prepare legislative instruments.

The Ministry of Environment gains recognition and authority. Its staff size grows from 60 to 100 (equivalent to 55% of the staff size prescribed in Decree 2275/2009) and its budget from \$5 million in 2010 to \$10 million in 2020. Its ability to monitor environmental change and respond to emerging issues in the country is enhanced through the Service of Regional Departments and Environmental Police. The ministry completes the National Environmental Action Plan which becomes the basis for its work planning activities. Leading public research organizations and private environmental

institutions explore synergies and collaborate in response to emerging environmental needs in water, air quality, ecology, and energy. The National Environmental Fund and the Arab Fund for the Environment are well established and mobilize at least \$30 million of funding in 2020 to environmental research and projects in the country. Spending is partly immune from patron-client relationships. Universities in Lebanon graduate at least 50 environmental graduates every year of which at least 60 percent are able to find green jobs in Lebanon within 6 months of graduation.

Water resources will continue to dwindle over the next decade but improved management of the resource alleviates water stress partially.

Although the impacts of climate change on net exploitable resources cannot be mitigated locally, public awareness and technological advances will curb water demand to reach 1,500 Mm³/year (projections MOEW). The government will complete at least three new dams in Lebanon and upgrade several water conveyance systems and networks. The impacts of such public expenditure will yield higher results on water availability and water quality thanks to a tougher government stance in relation to controlling large scale mountain developments, industrial effluent, wastewater discharge and waste disposal. The MOEW cracks down on unlicensed wells in the agricultural and industry sectors as well as households and provides incentives for water conservation and metering. The number of unlicensed wells drops from 22,500 to 15,000 by 2020. The drop in the groundwater table in major agricultural plains including the Bekaa Valley increases at a decreasing rate. The Awali-Beirut water conveyance project is completed and prolongs the continuity of water supply in the Greater Beirut Area.

Equally important, the Regional Water Establishments acquire the necessary tools and skills to detect network leakages and start a nationwide public information campaign to inform end users of water scarcity issues and opportunities for water conservation. Significant progress is achieved in the implementation of the national plan for wastewater treatment (at least 8 new coastal WWTPs will come online by 2020) and regional Water Establishments acquire the skills and resources to either operate the new facilities and/or outsource operation and maintenance to the private sector while maintaining effective oversight. The Ghadir WWTP is upgraded from pre-treatment to

biofiltration (secondary treatment). Improved tariffication and cost-recovery help finance service contracts. The completion of at least four WWTPs in the Litani River basin, including partial treatment of industrial effluent by selected industries, reduces the environmental load entering the river system. Successive governments are committed to implementing the 2010 National Water Sector Strategy and approve key capital investment projects during the period 2011-2015. The institutional reform defined under Law 221/2000 makes significant headway.

Air quality in Lebanon does not deteriorate over the coming decade. Emission reductions by some industries are offset by a growing energy demand from other sectors. Annual vehicle registration increases by three percent annually (from 106,959 in 2008 to about 152,000 in 2020). In the private car category, the Government imposes a CO₂ tax on gas-guzzling 4x4s; small fuel-efficient and hybrid cars assume a much bigger market share thanks to the approved amendment of Law 341/2001 providing incentives (tax cuts, tariff exemption and mécanique exemption for first registration) to private and public vehicle owners to switch to hybrid electric, fuel cell/Hydrogen and Natural Gas vehicles. Although emissions from energy industries increase, the environmental performance of the Lebanese electricity sector improves thanks to a significant shift in the country's energy mix (from dirty fuels to cleaner fuels such as Natural Gas and Liquid Natural Gas). Sulfur emissions also decline because of stringer sulfur content standards, and improved inspection measures. Emissions from selected industries stabilize or drop slightly thanks to effective pollution abatement initiatives by relevant ministries and the World Bank. Private electricity generation (20% in 2010) drops by half thanks to higher energy production by EDL and power outages and rationing is almost cut by half. The Jieh and Zouk power plants are renovated.

The ban on indoor smoking in public areas and government buildings is enforced and is supported by social media campaigns on Facebook and other venues. The draft law on the protection of air quality is approved whereby MOE sets new (1) Limit Values and Thresholds of Ambient Air Pollutants, (2) emission limit values for fixed sources, and (3) emission limit values for mobile sources. The Council of Ministers institutionalizes Lebanon's first national air quality monitoring program in collaboration

with leading universities working in collaboration with MOE. The program generates continuous air quality data in major cities and publishes the data in real-time. MOE monitors air pollution episodes especially when adverse meteorological conditions prevail, advises large polluters to temporarily curtail operations, and communicates with MOPH cautionary measures to the general public through mass media channels. The Government-approved taxi fleet renewal program achieves encouraging results and at least 5,000 taxi owners have switched to hybrid or fuel-efficient cars. The government further extends customs exemption to all hybrid vehicles entering the country. MOPWT and relevant municipalities (Al Fayhaa, Beirut, Zahle, etc.) introduce low-emission buses as part of a public-private partnership program for improved mass transport.

Lebanon's biodiversity and forests come under increasing pressure due to climate change but conservation measures are scaled up. Among Lebanon's 94 endemic species, only 25 percent are considered rare and/or threatened. The forest cover increases slightly (from 13% in 2004 to 15% in 2020) despite renewed and more intense forest fires in summer and fall. The Government acquires at least three more fire-fighting helicopters and equips the Civil Defense and the Ministry of Agriculture with additional fire trucks. Improved jurisprudence, with the support of environmental prosecutors, has a deterring effect on arsons. Urban sprawl continues but is limited to major cities, while haphazard urbanization slows down as a result of sounder urban planning and a more critical permitting process. New coastal resorts are approved without marinas and concrete piers and therefore do not adversely impact the marine environment. Subject to security conditions, the Government and Lebanese Army approve fishing to within 12 nautical miles from the coast, prompting fishermen and fishmongers to invest in larger boats.

The Higher Council for Hunting institutionalizes the mandatory hunting exam and insurance. Anti-hunting sentiments grow while bird watching activities gain popularity among tourism providers. Synergies between the country's major reforestation efforts (MOE-USFS, MOA-FAO and NGOs) convert about 2,000ha into forests each year and the supply, distribution and selection of forest seedlings appears to be sustainable. The draft Framework Law on Nature Reserves is approved which means that APACs have become legal employers

and can charge admission fees. Lebanon reclassifies its 10 nature reserves according to the new Protected Area classification system and demarcates at least 200km² of reserves. New requests for PA designation are examined against preset classification criteria. Monitoring capabilities generate new evidence of climate change, but also produce new data on wildlife status and habitats.

Land resources continue to face pressure from anthropogenic sources but selected pressures are controlled. Population growth (from 4.2 million in 2010 including Palestinian refugees to about 4.5 million in 2020 assuming a 0.75% annual growth rate) will increase demand for housing but developers provide smaller housing that is more attractive to lower and middle income families. Sounder urban planning makes it more difficult to build on agricultural land. The rate of approval of construction permits levels at around 8 million m² per year which is equivalent to about 4 km² of new construction each year, and 32 km² by 2020. The total built-up area increases from 648 km² in 1998 to about 720 km² in 2020. The Higher Council of Urban Planning approves new master plans covering 10 percent of the territory, bringing the total extent of zoning to about 26 percent. The SEA process is integrated in at least half of these urban master plans and all the plans are aligned with the recommendations of the National Land Use Master Plan, which is now fully integrated at the level of the regional departments of urban planning. The DGUP undergoes a major restructuring and hires several urban planners (or civil engineers and architects with considerable urban planning experience).

The MOPWT approves the conditional use of the public maritime domain of no more than three new developments and coastal resorts and only after a strict and thorough review of the corresponding EIA by the MOE. The Lebanese parliament debates a new law on the settlement of illegal infringements on the public maritime domain based on Decree 7919/1996. The Government (incl. MOEW, MOIM, MOPWT and MOE) take due note of Lebanon's most impressive and vulnerable karst formations mentioned in the 2010 SOER and take precautionary measures to avoid damages by road construction and quarrying. The Jeita Grotto is one of the seven wonders of nature. The Lebanese Army clears 80 percent of the total area affected by unexploded cluster bombs in south Lebanon during the July 2006 war (about 28 km² out of 35 km²). The Higher Council for

Quarries works collaboratively to implement Decree 8803/2002 and its amendments, and the first cases of illegal or non-compliant quarries are taken to court and result in hefty fines. The MOE rehabilitates at least five quarries using the money deposited from bank guarantees, to serve as pilots, and the total value of bank guarantees increases significantly and proportionally to the market value of aggregates (at least \$15 million in bank guarantees up from \$2.75 million in 2010). Lebanon's first national park is declared in the upper Dinnieh-Hermel region and local initiatives are backed by the Council of Ministers, the Governor and all local municipalities.

Haphazard Urbanization progresses at a slower pace. Rural-urban migration continues but at a decreasing rate thanks to Government initiatives related to decentralization and job creation in secondary cities and in rural areas. Internet services and bandwidth improve markedly allowing many small and medium-sized businesses to operation outside cities. The Government is unable to stop the flow of returning Lebanese expats due to regional security and financial disturbances but new housing projects are concentrated around cities. The rate of secondary housing does not change compared to its level in 2010. The rate of urbanization drops to about 80 percent by 2020. Urbanization is primarily concentrated around urban poles (Tripoli, Saida, Baalbeck, Nabatiyeh, Zahle, etc.) and the occurrence of haphazard urbanization subsides. The rate of new high-rise towers in Beirut replacing landmark buildings subsides but the city skyline has already changed. The DGCA at the MOF makes significant progress in demarcating non-surveyed mountain lands but at least 30 percent of the territory has not been demarcated yet. The ongoing national debate on extending basic civil rights to refugees intensifies and results in improved living conditions for refugees in at least five camps, with international support. The EIA and SEA processes are mainstreamed in the construction sector, notably large-scale developments in the coastal zone and mountain areas, with the backing of relevant ministries (MOPWT, MOF, etc.). Selected environmental provisions in the urban planning (Legislative-Decree 69/1983) and construction laws (Law 646/2004) are heeded by regional urban planning departments and the Order of Engineers and Architects, resulting in a growing number of cases in which construction permits are revoked or denied based on environmental considerations and other natural hazards. The Government amends Law 296/2001 related

to property ownership by non-Lebanese by introducing restrictions on the purchase of lands near the international borders and by capping the total area that a non-Lebanese can buy after obtaining COM approval. There is a raging debate over the introduction of a tax on capital gain. At least a dozen urban master plans are amended to limit excavation works, protect fertile agricultural land, and conserve natural habitats. All major cities inaugurate at least one new urban park and public playground.

Solid waste management in Lebanon experiences noteworthy and lasting progress in the next decade. In rural areas, capital investment by the EU-OMSAR and other development organizations yields positive results and the Government honors its commitment under Decree 3860/2010 to support and finance the operation and maintenance of the new facilities. The MOE and relevant municipalities rehabilitate and close at least 10 inland open dumps. The Government does not renew/extend the AVERDA contracts beyond 2013 and decides instead to open the market for competition, pursuant to the 2006 National Plan for Solid Waste Management and the 2010 Waste-To-Energy Plan. The cost of the new systems is variable but remains lower than the total cost of the AVERDA system. The Naameh Landfill is permanently closed and a long-term environmental monitoring system is put in place. New waste legislation recognizes limited exclusivity and opens new business opportunities for managing special waste including e-waste and tires.

Each caza designates an area (usually an abandoned quarry) for the disposal of construction and demolition waste and reported cases of haphazard dumping are prosecuted. Arcenciel and a second contractor collect and treat 90 percent of the country's health care risk waste (up from 55% in 2010) and all the facilities have received environmental permits based on the EIA process. The Saida seafront dumpsite is permanently closed and the new biological waste treatment facility goes online. The inorganic fraction is sorted in an adjacent plant; inert material is disposed off in a controlled site landfill. The Municipality of Bourj Hammoud resumes the debate on how to restore the seafront dumpsite. Lebanon is able to ship 200 tons of PCB oil and PCB-contaminated equipment abroad for destruction in partial fulfillment of its obligations under the Stockholm Convention. At least two model slaughterhouse facilities, equipped with their own treatment

plant, are built outside Beirut and go online. Remaining slaughterhouses continue business as usual. The draft law on Integrated Solid Waste Management is finalized and waste minimization incentives are mainstreamed.

The Government of Lebanon addresses the country's energy crisis head on. GDP growth continues to rise but at a decreasing rate (it plateaus around 3% in 2020). With an energy elasticity of 1.2, Total Primary Energy Supply will hit 7,500 KTOE in 2020 (up from 5,400 KTOE in 2009). The energy mix changes markedly, in favor of cleaner and less expensive fuels. The environmental performance of Lebanon's electricity sector improves on several fronts. For example, the Government requires oil importing companies to implement a sludge treatment facility and undergo biannual environmental facility audits. The Government also cracks down on illegal gas stations and does not license new stations. Under pressure by international lending organizations, the private sector and conservationists, the Parliament ends EDL's monopoly over the electricity production sector and the Council of Ministers regulates renewable energy and energy efficiency systems. Renewable Energy reaches 10 percent of total energy production in 2010. Demand for energy by the construction, transport, and industry sectors begin to level off thanks to a myriad of initiatives and tax incentives. The international tender related to oil exploration and production in Lebanese territorial waters coincides with the preparation of risk prevention and emergency response procedures related to oil spills, which is tried and tested with all relevant agencies and organizations in the country under MOE's supervision. The Lebanese Center for Energy Conservation grows and is fully integrated into the organizational structure of the MOEW. The Lebanon Green Building Council lobbies the Government, as well as the DGUP and the OEAs to introduce energy conservation measures to the Lebanese Building Code (Law 646/2004). Successive governments are committed to implementing relevant provisions of the 2010 Policy Paper for the Electricity Sector.

Table 10.2 Detailed assumptions related to each scenario (current and 2020)

<i>Chapter</i>	<i>Subject</i>	<i>Current Value (2010)</i>	
Environmental Governance	MOE staff	60	
	MOE budget	\$4.88 million	
	National Environmental Fund and the Arab Fund for the Environment	\$0	
Water Resources	Net Exploitable Resources	2,700 Mm ³ /year	
	Annual water demand	1,473 Mm ³ /year	
	Dams	2 (Qaraoun and Chabrouh)	
	Unlicensed wells	22,500	
	Coastal WWTPs in operation	2 (Ghadir and Saida, PT)	
	Inland WWTPs in operation (Litani River Basin)	2 (Baalbeck and Aitanit)	
Air Quality	<i>Transport sector:</i> annual vehicle registration Private cars	106,959 in 2008	
	<i>Energy Industries</i> Sulfur emissions	68% of National SO ₂ emissions in 2005	
	<i>Industries</i> Emissions from industries	13% of National CO ₂ emissions in 2005	
	Taxi fleet renewal program (taxi owners switch to hybrid or fuel-efficient cars)	0	
	Private electricity generation	20% of total electricity production in 2010	
Biodiversity and Forests	94 species endemic to Lebanon	17 rare, 4 nearing extinction, and 16 threatened	
	Forest cover (% of territory)	13% (2004)	
	Forest fires	705 fires (recorded between 2008-2009) consume 4,500ha	
	Reforestation	305ha (2002-2004) 279ha (2004-2006)	
	Protected Areas	220 Km ²	
Land Resources	Population growth	4.2 million in 2010 incl. refugees	
	Total floor area of construction permits	15.1 million m ²	
	Total built-up area	648 km ² (1998)	
	Extent of Master plans	16%	
	Total area affected by unexploded cluster bombs in south Lebanon	35 km ²	
Haphazard Urbanization	Secondary housing	5% (2004)	
	Rate of urbanization	88% in 2010	
	No of new high-rise towers in Beirut	Around 50	
	Number of construction permits rejected based on environment	0	
Solid Waste	Number of small scale Solid Waste Treatment Facilities in operation (outside GBA)	11	
	Major open dumps	27 (700 total)	
	Tonnage price of municipal SWM in GBA	\$150/t	
	Collection and treatment of Health Care risk waste	55% in 2010 (1 NGO)	
	PCB oil and PCB-contaminated equipment	In use	
Energy Crisis	GDP growth	7% \$34.5 billion	
	Primary Energy Supply	5,400 KTOE in 2009	
	Number of gas stations	2,130	
	Renewable energy	0.6%	

	Market First (2020)	Sustainability First (2020)
	80	100
	\$6 million	\$10 million
	\$0	\$30 million
	↓ with no protection measures of available water resources	↓ with public awareness and technological advances
	2,055 Mm ³ /year	1,500 Mm ³ /year
	2 new dams	3 new dams (290 million m ³)
	No change	15,000
	5	8
	4 (no treatment of industrial effluent)	4 (+ partial treatment of industrial effluent)
	200,000	152,000
	SO ₂ emissions ↓ (Shift to cleaner fuels)	SO ₂ emissions ↓ (Shift to cleaner fuels)
	CO ₂ emissions ↓ (Pollution abatement initiatives)	CO ₂ emissions ↓ (Pollution abatement initiatives)
	2,000	5,000
	15% (higher energy production by EDL)	10% (higher energy production by EDL)
	47 now considered rare and/or threatened	24 now considered rare and/or threatened
	10%	15%
	300 fires consume 4,000 ha	Number of forest fires ↓ (new fire-fighting equipment)
	500ha/yr converted into forests	2,000ha/yr converted into forests
	300 km ² but basis for declaring the areas protected still unclear	250 km ² (incl. reclassification of Lebanon's 10 nature reserves)
	4.6 million (1% annual growth rate)	4.5 million (0.75% annual growth rate)
	10 million m ² /yr	8 million m ² /yr
	800 km ²	720 km ²
	21%	26%
	60% cleared (20 km ² out of 35 km ²)	80% cleared (28 km ² out of 35 km ²)
	7%	5%
	90%	80%
	At least 100	<100 but city skyline already changed
	None	Several
	15	26 (Decree 3860/2010 enforced)
	Rehabilitation and closure of 3 inland open dumps	Rehabilitation and closure of at least 10 inland open dumps plus Saida
	\$172/t (↑15%)	Market competition
	70% (1 NGO)	90% (at least 2 organizations)
	200 tons of PCB oil and PCB-contaminated equipment shipped abroad for destruction	
	5%	3%
	10,000 KTOE (Energy Elasticity of 1.4)	7,500 KTOE (Energy Elasticity of 1.2)
	Number still rising	Crack down on illegal gas stations; no new licenses
	5%	8-10%