

## LEBANON FOREST NOTE

# Reducing Wildfire Risk through Sustainable Forest Management





© 2023 International Bank for Reconstruction and Development / The World Bank  
1818 H Street NW Washington DC 20433

Telephone: **+1-202-473-1000**

Internet: [www.worldbank.org](http://www.worldbank.org)

This work is a product of the staff of the World Bank Group with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of the World Bank, its Board of Executive Directors, or the governments they represent.

The World Bank does not guarantee the accuracy, completeness, or currency of the data included in this work and does not assume responsibility for any errors, omissions, or discrepancies in the information, or liability with respect to the use of or failure to use the information, methods, processes, or conclusions set forth. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of the World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Nothing herein shall constitute or be construed or considered a limitation on or waiver of the privileges and immunities of the World Bank, all of which are specifically reserved.

### **Rights and Permissions**

The material in this work is subject to copyright. Because the World Bank encourages dissemination of its knowledge, this work may be reproduced, in whole or in part, for noncommercial purposes as long as full attribution to this work is given.

Please cite the work as follows: "World Bank. 2023. Lebanon Forest Note: Supporting Sustainable Forest Management for Forest Fire Risk Reduction. The World Bank: Washington D.C."

All queries on rights and licenses, including subsidiary rights, should be addressed to World Bank Publications, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2625; e-mail: [pubrights@worldbank.org](mailto:pubrights@worldbank.org).

Cover photos: Andrea Kutter. Further permission required for reuse.

# Acknowledgments

The World Bank would like to thank the Government of Lebanon—especially the Ministry of Environment, the Ministry of Agriculture, and the Disaster Risk Management Unit in the Office of the President—as well as other state and non-state actors for their partnership and cooperation during the development of this report. The World Bank owes special thanks to the representatives of these entities for their dedicated leadership and support in the protection and sustainable management of Lebanon's forest landscapes, and in addressing the increasing threat of forest fires due to climate change.

The World Bank is immensely grateful to all stakeholders who actively participated in the workshops and provided input into the technical reports and strategy development, for generously offering their time and sharing valuable perspectives and ideas.

This report was prepared under the leadership of Andrea Kutter (Senior Natural Resources Management Specialist) and Sandrine Jauffret (Senior Natural Resources Management Specialist) as part of a World Bank team that included Lamia Mansour (Senior Environmental Specialist); George Mitri (Consultant); and the OCA Global consulting team under the leadership of Fabiana Silva Shigaki. The report was produced in collaboration with the Nature Conservation Center at the American University of Beirut, represented by Salma N. Talhouk (Lead Expert); Edward Antoun (Forestry Specialist); and Suzan Zeidan (Environmental Specialist); Karine Zoghby (Institutional Policy Expert); Wassim Katerji (Forestry Data and Information Specialist) and Noura Jezzini (Environmental Analyst). The Arabic translation of the Executive Summary was done by Souleima Ghorayeb Boustany.

The World Bank also owes thanks to Jean Christophe Carret (Country Director, Middle East Department); Lia Sieghart (Practice Manager, Environment, Natural Resources and Blue Economy, Middle East, and North Africa); Salim Rouhana (Sustainable Development Sector Leader, Lebanon); and Timothy Brown (Senior Natural Management Specialist, Environment, Natural Resources, and the Blue Economy Global Practice) for the substantive orientation provided in conducting the technical work. Additional thanks go to Sachin Shahria (Consultant, Environment, Natural Resources, and the Blue Economy Global Practice) for his support as PROGREEN liaison. Editing and proofreading by Jennifer Stastny and design by The Ethical Agency.

Funding for this report was provided by [PROGREEN](#), an umbrella trust fund that supports a sustainable and integrated development of forest and other natural landscapes. The team would like to express its gratitude to all PROGREEN donors for making this work possible.



# CONTENTS

<b>Preface</b> .....	<b>1</b>
<b>Executive Summary</b> .....	<b>3</b>
<b>1. Country Context</b> .....	<b>18</b>
1.1 Lebanon's landscape .....	19
1.2 Contribution of forests to Lebanon's green recovery .....	23
<b>2. Characteristics of Forests in Lebanon</b> .....	<b>25</b>
2.1 Bioclimatic characteristics .....	31
2.2 Forest biodiversity and type of ecosystem services .....	31
<b>3. Forest Governance</b> .....	<b>35</b>
3.1 Institutional framework for sustainable forest management .....	36
3.2 Forest law and policy .....	40
<b>4. Contribution of Forests to the National Economy</b> .....	<b>44</b>
4.1 Economic value of forests in Lebanon .....	45
<b>5. National Forest Challenges</b> .....	<b>51</b>
5.1 Drivers of deforestation and forest degradation .....	52
5.2 Vulnerability to climate change and natural disasters .....	59
5.3 Private sector engagement .....	59
<b>6. Wildfires as Drivers of Forest and Landscape Degradation in Lebanon</b> .....	<b>63</b>
6.1 Lebanon forests' vulnerability to fire .....	64
6.2 Lebanon's forests and wildfires .....	65
6.3 Wildfire mitigation through sustainable forest management .....	67
<b>7. Opportunity Areas for Sustainable Forest Landscape Management and Addressing Fire Risks in Lebanon</b> .....	<b>70</b>
7.1 Improving governance and local capacities .....	72
7.2 Actions to improve data and information access on forest fires .....	78
7.3 Supporting industries for value-addition of wood and non-wood forest products .....	78
7.4 Supporting nature-based tourism .....	81
7.5 Supporting forest ecosystem restoration to reduce fragmentation and fire risks .....	84
<b>References</b> .....	<b>77</b>
<b>Annexes</b> .....	<b>85</b>
<b>Annex 1:</b> Bioclimatic zones of Lebanon .....	90
<b>Annex 2:</b> Examples of Lebanese environmental NGOs and their field of activity (State of the Environment Report 2020) .....	90

## LIST OF FIGURES

<b>Figure 1:</b> Administrative map of Lebanon .....	<b>19</b>
<b>Figure 2:</b> Monthly temperature (min, max, and mean) and precipitation from 1991–2020 .....	<b>20</b>
<b>Figure 3:</b> Rivers of Lebanon .....	<b>21</b>
<b>Figure 4:</b> Ownership of forested and other wooded lands in Lebanon .....	<b>26</b>
<b>Figure 5:</b> Forest map of Lebanon .....	<b>28</b>
<b>Figure 6:</b> Forest and other woodlands areas and trends over 20 years .....	<b>29</b>
<b>Figure 7:</b> Loss in vegetation cover between 2000 and 2010, and between 2010 and 2018 .....	<b>29</b>
<b>Figure 8:</b> Extent of forest loss per district (Kadaa) .....	<b>30</b>
<b>Figure 9:</b> Bioclimatic map of Lebanon .....	<b>31</b>
<b>Figure 10:</b> Mediterranean biodiversity hotspot .....	<b>31</b>
<b>Figure 11:</b> Horsh Beirut .....	<b>34</b>
<b>Figure 12:</b> Comparison of living biomass and carbon stock in Forest and OL .....	<b>34</b>
<b>Figure 13:</b> Timeline of forest-related laws in Lebanon .....	<b>40</b>
<b>Figure 14:</b> Different usage of each forest type by the local community .....	<b>46</b>
<b>Figure 15:</b> Distribution of the values (percent) of Lebanese forest ecosystem services components .....	<b>49</b>
<b>Figure 16:</b> Factors that attract visitors to rural areas .....	<b>50</b>
<b>Figure 17:</b> Increase of forest fragmentation between 1965 and 1998 on the eastern flank of Mount Lebanon .....	<b>52</b>
<b>Figure 18:</b> Extent of artificialization in the coastal zone between 1998 and 2010 .....	<b>53</b>
<b>Figure 19:</b> Extent (in square meters) and percentage of land-cover types affected by quarries .....	<b>53</b>
<b>Figure 20:</b> Charcoal production and illegal and unsustainable tree cutting .....	<b>54</b>
<b>Figure 21:</b> Estimation of forest loss from 2001 to 2021 due to cutting activities (for fuelwood and other uses) .....	<b>54</b>
<b>Figure 22:</b> Aakar: Hermel forest fire in 2021 .....	<b>55</b>
<b>Figure 23:</b> Average annual production in tonnes and variation of net revenue from pine-nut production in US\$ thousand between 1996 and 2016 .....	<b>56</b>
<b>Figure 24:</b> Synthesis of the different direct and indirect causes and drivers of deforestation and forest degradation in Lebanon .....	<b>58</b>
<b>Figure 25:</b> Benefits of PPP in Lebanon .....	<b>60</b>
<b>Figure 26:</b> Number of fires and burned areas in Lebanon from 2008 to 2021 .....	<b>64</b>
<b>Figure 27:</b> Wildfire risk map for Lebanon and types of landscape in Lebanon where primary ignition of wildfires was recorded between 2003 and 2015 .....	<b>65</b>
<b>Figure 28:</b> Cumulative fire occurrences and burned area from 2008 to 2020 .....	<b>66</b>
<b>Figure 29:</b> Average monthly number of fires and burned area in forests/shrublands and grasslands .....	<b>66</b>
<b>Figure 30:</b> Comparison in fire inter-annual seasonality .....	<b>67</b>
<b>Figure 31:</b> Local community structure .....	<b>75</b>



## LIST OF TABLES

<b>Table 1:</b> Summary of proposed strategies and short, medium, and long-term priorities for conserving Lebanon's forested lands .....	<b>7</b>
<b>Table 2:</b> List of main policies and strategies .....	<b>41</b>
<b>Table 3:</b> Value of forest benefits in CPMF countries .....	<b>49</b>
<b>Table 4:</b> Action required on forest governance .....	<b>73</b>
<b>Table 5:</b> Action required on community engagement .....	<b>76</b>
<b>Table 6:</b> Action required on wood-based industries (wood production, fuelwood and charcoal) .....	<b>79</b>
<b>Table 7:</b> Action required on non-wood forest products .....	<b>80</b>
<b>Table 8:</b> Action required on nature-based tourism .....	<b>82</b>
<b>Table 9:</b> Action required on forest ecosystem restoration .....	<b>84</b>

## LIST OF BOXES

<b>Box 1:</b> The International Union for Conservation of Nature/IUCN's first green-listed protected and conserved area in Lebanon .....	<b>33</b>
<b>Box 2:</b> The potential for the private sector to support sustainable forest management and protection .....	<b>61</b>
<b>Box 3:</b> Local PPP initiatives .....	<b>62</b>

## LIST OF ACRONYMS

<b>AFD</b>	French Development Agency
<b>AFDC</b>	Association for Forests Development and Conservation
<b>CAS</b>	Central Administration of Statistics of Lebanon
<b>CDR</b>	Council for Development and Reconstruction
<b>CEDRE</b>	<i>Conférence économique pour le développement, par les réformes et avec les entreprises</i>
<b>CPF</b>	Country Partnership Framework
<b>CPMF</b>	Collaborative Partnership on Mediterranean Forests
<b>DGUP</b>	Directorate General of Urban Planning
<b>DRDNR</b>	Directorate of Rural Development and Natural Resources
<b>DRI</b>	Democracy Reporting International
<b>DRM</b>	Disaster risk management
<b>EU</b>	European Union
<b>FAO</b>	Food and Agriculture Organization
<b>FRA</b>	Forest resources assessment
<b>GDP</b>	Gross domestic product
<b>GEF</b>	Global Environment Facility
<b>GHG</b>	Greenhouse gas
<b>GIZ</b>	German Agency for International Cooperation
<b>ha</b>	Hectares
<b>IFFMS</b>	Integrated Forest Fire Information Management System

<b>ILO</b>	International Labour Organization
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>LARI</b>	Lebanese Agricultural Research Institute
<b>LDN</b>	Land Degradation Neutrality
<b>LEV</b>	Economic Vision of Lebanon
<b>LNCSR</b>	Lebanese National Council for Scientific Research
<b>LRI</b>	Lebanon Reforestation Initiatives
<b>MoA</b>	Ministry of Agriculture
<b>MoE</b>	Ministry of Environment
<b>MEW</b>	Ministry of Energy and Water
<b>MoT</b>	Ministry of Tourism
<b>NARP</b>	National Afforestation/Reforestation Programme
<b>NDC</b>	Nationally Determined Contributions
<b>NFFMS</b>	National Forest Fire Management Strategy
<b>NFFS</b>	National Forest Fire Strategy
<b>NFP</b>	National Forest Programme
<b>NGO</b>	Non-governmental organization
<b>NRP</b>	National Reforestation Plan
<b>NWFP</b>	Non-wood forest products
<b>OWL</b>	Other wooded land
<b>PARSIFAL</b>	<i>Programme d'appui à la Résilience Sociale, aux Infrastructures, à la Forêt et à l'agriculture au Liban</i>
<b>PPP</b>	Public-private partnerships
<b>RDNRD</b>	Rural Development and Natural Resources Directorate
<b>SALMA</b>	Smart Adaptation of Forest Landscapes in Mountain Areas
<b>SFM</b>	Sustainable forest management
<b>SLMQ</b>	Sustainable Land Management in the Qaraoun Catchment
<b>TEV</b>	Total economic value
<b>UNCCD</b>	United Nations Convention to Combat Desertification
<b>UNDP</b>	United Nations Development Programme
<b>UNEP</b>	United Nations Environment Programme
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNHCR</b>	United Nations High Commissioner for Refugees
<b>UNICEF</b>	United Nations International Children's Emergency Fund
<b>UoB</b>	University of Balamand
<b>WUI</b>	Wildland-urban interface





# Preface

Country Forest Notes (CFNs) are centerpieces of the World Bank Group Forest Action Plan (2016–2020) and the World Bank Climate Action Plan (2020–2025).

They provide a thorough assessment of the status of forests and the forestry sector, and of the investment needed to sustainably manage this valuable renewable natural resource. As stated in the World Bank Group’s Forest Action Plan, “The World Bank aims to support client countries’ efforts to implement priority actions linked to forests and their development priorities, by focusing more deliberately on the positive contributions that forests make to poverty reduction, food security, economic development, building resilience towards climate change, and climate change mitigation.”

The World Bank promotes a forest landscape approach and is committed to providing assistance to developing countries to:



Address climate change and resilience



Support rights and participation



Integrate the sustainable management of forests into development decisions



Strengthen institutions and governance

*The emerging Lebanon Climate Change Development Report (CCDR) will guide the World Bank’s future engagement portfolio with Lebanon, with a special focus on addressing climate change risks.* The CCDR will stress the need for safeguarding Lebanon’s recovery from various crises—including climate change—by exploring opportunities to invest in growth-driving sectors, thereby creating jobs and addressing inequalities. Climate-smart recovery investments hold the potential to address deep inefficiencies, especially in the energy sector. They can also protect Lebanon’s natural capital and open up much-needed new income and job opportunities, especially in natural-resources-dependent sectors such as agriculture and

tourism. Climate-smart recovery investments can also generate potential competitiveness gains and access to new markets for businesses. Lebanon’s natural capital (including its forests) is a critical pillar of the country’s economic and social recovery, as it feeds directly into key growth- and recovery-driving sectors.

*Based on the findings in the Lebanon Forest Note, the World Bank and the Government of Lebanon look forward to collaborating on the best way to implement the identified opportunities in support of sustainable forest management and a reduced risk of forest fires.*



The World Bank aims to support client countries’ efforts to implement priority actions linked to forests and their development priorities, by focusing more deliberately on **the positive contributions that forests make to poverty reduction, food security, economic development, building resilience towards climate change, and climate change mitigation.**





# Executive Summary

The Lebanon Forest Note (Note) articulates opportunities for supporting the protection and sustainable management of Lebanon's forest landscapes. It considers the increasing pressure on natural resources due to anthropogenic activities/stresses, as well as their increased vulnerability to climate change and natural disasters, especially forest fires.

The Note presents a forward-looking business case for Lebanon to protect its forest ecosystem services, while increasing the socioeconomic benefits for Lebanon's sustainable development goals and global environmental commitments.



© Shutterstock

© Freepik

© Freepik

*The business case is based on an analysis of challenges to, and opportunities for, making the forest sector (and other sectors dependent on forest ecosystem services) dynamic and effective contributors to Lebanon's gross domestic product (GDP). It also considers ways to manage increased risks, especially from forest fires. The Note is intended to serve as a basis for further discussions with the government and other partners, with a view to realizing identified opportunities.*

*Lebanon's forest landscapes are unique in the Mediterranean region and, over the centuries, have provided multiple socioeconomic, cultural, and environmental benefits. However, societal changes have had a significant impact on these landscapes, putting them at risk of further degradation.* Lifestyle changes and restrictions on access to forests and woodlands have contributed to the abandonment of traditional community use, management, and protection of forests. This neglect has left forests vulnerable to arson, vandalism, and natural disasters. If not managed, increasing pressure on forests jeopardizes the sustained delivery of the ecosystem services provided by Lebanon's forestry sector, estimated at a value of US\$587 per hectare (ha).

*In 2015, the Government of Lebanon approved the National Forest Program (NFP) 2015–2025. This provides a framework for development of the forestry sector in Lebanon, aligns national goals with international agreements, and modernizes the existing laws and regulations.* The program presents the government's current national policies and strategies, as well as its long-term vision and mission for forest and rangeland management and conservation. It also fosters active community participation and collaboration with public and private stakeholders. The recent focus on community-based forest conservation (involving local stakeholders in the management of forests and woodlands, and combining scientific with traditional knowledge) has renewed interest in protecting and sustaining Lebanon's forests and trees.

*Owing to an alarming increase in the occurrence and severity of wildfires impacting Lebanon's forest landscapes, a National Forest Fire Management Strategy (NFFMS) was developed in 2009 and updated in 2023.* Successful implementation of the NFFMS will depend on several conditions, namely:

- The creation of a formal mechanism through which relevant agencies (especially the Ministry of Agriculture, the Ministry of Environment, and the Disaster Risk Management Unit at the Prime Minister's Office) can communicate and jointly strategize
- A unified system of fire data and information collection and management
- Appropriate allocation in the national budget for implementation of the NFFMS.

*Despite multiple challenges, Lebanon is strongly committed to conserving forest landscapes and increasing forest cover.* Sustainable forest management provides the basis for a triple win: for Lebanon's economic growth; for the security of Lebanese peoples' livelihoods; and for the global environmental agenda—by helping to combat climate change, conserve biodiversity, and contribute to achieving land degradation neutrality. Sustainable forest management is also a proven concept for better managing forest fire risks, actual events, and restoration efforts. Exploring opportunities for developing small and medium-sized forest-based enterprises would not only generate increased revenue for the Government of Lebanon but also develop higher or new income sources (especially for the rural population and vulnerable groups) through additional job prospects in wood-based and non-wood-based industries. Development of forest-based enterprises would also bring non-monetary co-benefits linked to increased resilience, climate-change mitigation, and biodiversity conservation.

*The opportunities identified in this Note are sensitive and responsive to Lebanon's unique size, geography, and political and economic circumstances.* Six opportunity areas are identified for sustaining Lebanon's forests and forest landscapes and strengthening the forest sector—notably by supporting sustainable forest management, including wildfire risk management. These opportunity areas reflect activities that address the gaps and weaknesses discussed in the analytical segment of the Note. While some proposed activities are long-term, short- and mid-term recommendations are suggested as priorities for consideration by the Government of Lebanon.

## THE IDENTIFIED OPPORTUNITIES ARE TO:

- Improve governance and local capacity for sustainable forest management
- Improve access to data and information on forest fires
- Add value to wood and non-wood forest products
- Restore forest ecosystems to reduce fragmentation and fire risks
- Incentivize private landowners to protect and manage forest and trees on their properties
- Support sustainable nature-based tourism enterprises

**These are discussed below, with additional detail in Table 1 on page 7.**





## Improve governance and local capacity for sustainable forest management, including wildfire risk management

**Forest governance and institutional capacities are essential for ensuring the protection and sustainable management of forests and the long-term provision of their ecological, economic, and social benefits.** Effective forest governance provides a framework for decision-making, planning, and implementation of forest-related policies and programs. It also ensures the participation of stakeholders—such as local communities and civil society—in decision-making processes. The need for community involvement in sustainable forest management is based on a growing appreciation of forests as an important carbon sink, as well as a crucial source of livelihood for many. Community participation plays a vital role in addressing drivers of deforestation and forest degradation—such as forest fires and unsustainable harvesting of forest resources for commercial activities.

**Given the considerable extent of forest landscapes under private ownership in Lebanon, it is imperative to devise strategies that support private landowners' interests in conserving forested lands.** The proposed strategies focus on: fostering collaboration between public institutions and enhancing governance to strengthen sustainable forest management; engaging communities on sustainable forest management, including wildfire mitigation; and involving private landowners (Table 1 on page 7.).



## Add value to wood and non-wood forest products

**Production of wood products and non-wood forest products (NWFPs) may be an important economic activity in countries with forests.** Tree species valued for their wood are used for various purposes, including construction, furniture, and fuel. However, Lebanon has no viable industry for wood products and NWFPs (such as pine nuts, honey, and carob). Studies suggest that, in some countries, the direct contribution of NWFPs to food security can amount to roughly 50 percent compared to other staple foods. NWFPs also contribute indirectly to food security, as they can be sold to buy other products in times of need. NWFPs are therefore an important safety net for the rural population in Lebanon, the most vulnerable segment of society. However, overexploitation and unsustainable management practices have led to a decline in the availability of these products and produced negative economic and environmental impacts. Table 1 sets out opportunities for adding value to wood and non-wood products in the short, medium, and long term.



## Improve access to data and information on forest fires

**Lebanon's forest landscapes are highly vulnerable to fires, and climate change will aggravate this situation.** Currently, information on fire risks, fire events, and post-fire activities in Lebanon is fragmented, and not readily accessible to all relevant stakeholders.

**An integrated forest fire information management system (IFFMS) would provide a common and accessible platform for such information (Table 1).** A roadmap and terms of reference for the development of an IFFMS have been made available to the Government of Lebanon.



## Restore forest ecosystems to reduce fragmentation and fire risks

**Forest ecosystem restoration can yield multiple benefits, including climate resilience, carbon sequestration, conservation of biodiversity, and reduction of fire risk by restoring degraded forests to a more natural state.** This is of particular importance for highly fragmented and degraded forests. Reducing fire risks can also positively impact the socioeconomic fabric of rural forest landscapes and so strengthen local communities. Measures to prevent catastrophic fires include education and awareness campaigns on the value of forest landscapes.



## Support sustainable nature-based tourism

**Nature-based tourism is a significant contributor to the country's tourism industries and the economy.** Forest landscapes are home to diverse wildlife and vegetation, making them an ideal destination for nature-oriented tourists seeking to explore and enjoy nature. Nature-based tourism has the potential to contribute to local economies and provide local job opportunities. However, access to natural and forest landscapes by tourists and tour operators rarely benefits landowners and communities.

**It is imperative that access to natural landscapes and forests recognizes local ownership and provides support schemes for community involvement.** This would include access to jobs in the hospitality sector to incentivize locals to support forest management and protection. Nature-based tourism provides visitors with an opportunity to experience the local culture and traditional way of life of communities living in and around the forests, as well as the environmental benefits of forest management and conservation.

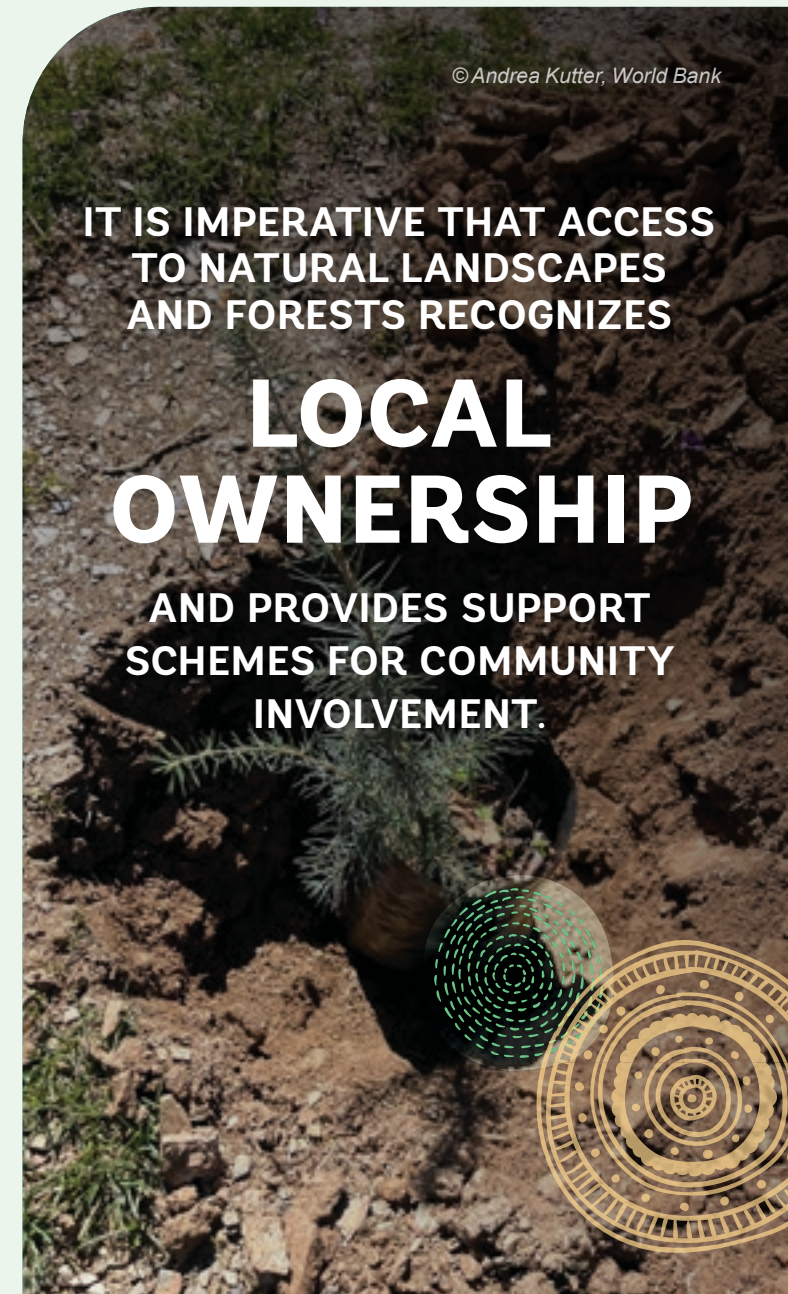


## Conclusion

**The implementation of the proposed actions will help to protect Lebanon's forest landscapes and enhance the robustness of the forest sector in the context of current and future challenges, including climate change.** The proposed interventions (summarized in Table 1) are consistent with the various national plans and strategies noted, specifically the National Forest Program and the National Forest Fire Emergency Plan. However, successful realization of these target interventions will require a dedicated budget (including allocations from national budget), an emergency fund, revenues, bonds, a national forest fund, and credit lines.



© Adobe Stock

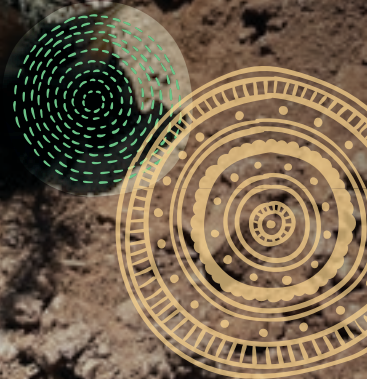


© Andrea Kutter, World Bank

IT IS IMPERATIVE THAT ACCESS TO NATURAL LANDSCAPES AND FORESTS RECOGNIZES

**LOCAL OWNERSHIP**

AND PROVIDES SUPPORT SCHEMES FOR COMMUNITY INVOLVEMENT.





**Table 1:** Summary of proposed strategies and short-, medium-, and long-term priorities for conserving Lebanon’s forested lands

Strategic focus	Short- to medium-term priorities	Long-term prospects
<p><b>Improve governance and local capacity</b></p> <p>Promote collaboration between public institutions and enhance governance to strengthen sustainable forest management</p>	<p>Create a multi-sectoral “government forest mechanism” consisting of public institutions and government entities concerned with forest landscapes (including the Ministry of Agriculture (MoA), the Ministry of Environment (MoE), the Disaster Risk Management (DRM) Unit, and other government and municipal entities) and ensure that the framework sets out the agreed roles and responsibilities of relevant entities, and identifies key issues for effective coordination</p> <p>Hold regular meetings or develop communication tools, such as email lists and messaging apps, to ensure that entities can break departmental and regional silos and engage with peers. Communication will ensure awareness of latest developments and of projects, laws, and upcoming events and opportunities for collaboration</p> <p>Develop new legislation to update and enhance the roles and responsibilities of each government institution, and to ensure open and timely collaboration and sharing of data and information between various stakeholders</p>	<p>Formalize the coordination mechanism on Lebanon’s forest landscapes with clear mandates and agreed roles, responsibilities, and reporting lines (for example, through a Council of Ministers decree or memorandum of understanding)</p> <p>Develop a mechanism to access climate finance, including carbon finance, to support forest conservation and forest fire mitigation</p>
<p>Engage communities on sustainable forest management, including wildfire mitigation</p>	<p>Conduct a needs assessment to identify current knowledge and skills of local communities regarding sustainable forest management and fire management</p> <p>Develop a related capacity-development plan and organize capacity-development events on sustainable forest management and fire mitigation</p> <p>Establish a local forest and woodland volunteer program. Enroll, train, and involve residents and youth in basic practices such as clearing of herbaceous biomass near village residences, and along roads and walking paths</p> <p>Offer capacity development and training for local communities, including access and benefit-sharing plans for forest management and product uses</p> <p>Develop community forest management plans<sup>1</sup> that consider local needs, priorities, and resources</p>	<p>Develop community forest management plans into forest operational plans</p> <p>Develop long-term funding and resource strategies, including relevant lines in the national budget for community-based forest management, sustainable practices, and wildfire prevention and suppression efforts</p> <p>Develop a comprehensive national monitoring, reporting and evaluation/ verification system to track the progress of forest and wildfire management efforts by local communities</p>

<sup>1</sup> Community forest management plans are initial management plans to be developed over time into a forest operational plan.

Strategic focus	Short- to medium-term priorities	Long-term prospects
<p>Involve private landowners</p>	<p>Assess the status of forests and trees on privately owned land and private landowners’ willingness to, <i>inter alia</i>, collaborate with municipalities to improve forest management and reduce fire risks on their land</p>	<p>Develop a range of policy tools—from local initiatives to national programs—and engage private forest landowners on options and opportunities for forest stewardship (for example, land use ordinances that aim to achieve zero net forest loss; tax incentives and easements; and direct financial incentives)</p> <p>In the case of absent landowners or contested tenure, develop strategies that protect and empower the community and local authorities, thereby making landowners accountable for the imminent threat of fire and ensuring that abandoned forests do not become a liability to communities</p>
<p><b>Improve access to data and information on forest fires</b></p>	<p>Verify the road map for the development of an Integrated Forest Fire Information Management System (IFFMS)</p> <p>Secure funding for implementing the terms of reference</p>	<p>Develop an IFFMS</p> <p>Design an outreach program that provides data and information on forest fires, and targets relevant entities at national and local levels</p>





Strategic focus	Short- to medium-term priorities	Long-term prospects
<p><b>Add value to wood and non-wood products</b></p> <p>Wood products and fuelwood</p>	<p>Conduct a feasibility analysis for developing a wood-based industry, including the value chain for NWFPs</p> <p>Engage forest owners, managers, and local communities by providing capacity-building opportunities and training on sustainable forest management practices and productive uses of forest products</p> <p>Strengthen the legal and regulatory framework for sustainable use of forests for wood production, including by developing clear policies and guidelines</p> <p>Develop a subsidized distribution plan for tree seedlings, as well as technical assistance and financial incentives to encourage municipalities, farmers, and private landowners to plant more trees on their properties</p> <p>Provide financial and technical support to small-scale wood producers to adopt sustainable forest management practices and improve their productivity and profitability</p>	<p>Develop forest operational management plans that build on community forest management plans, including reforestation schemes, setting sustainable annual wood harvesting levels, and other management objectives</p>
<p>Non-wood forest products (NWFPs)</p>	<p>Develop an inventory and status report on NWFPs in Lebanon</p> <p>Create awareness about the importance of NWFPs and their role in forest sustainability</p> <p>Develop sustainable harvesting guidelines and training sessions for collectors</p> <p>Expand the licensing program to collect additional NWFP species</p> <p>Promote local initiatives related to NWFPs, such as community gardens, farmers' markets, and nature-based tourism</p> <p>Expand policies that support the sustainable use and conservation of NWFPs, such as promoting the certification of sustainably harvested NWFPs and creating incentives for their value-addition</p>	<p>Develop a local and international market strategy for NWFPs</p> <p>Establish seed banks and nurseries for NWFPs to preserve and propagate endemic plant species</p> <p>Fund research into NWFPs and identify priorities, including management strategies that take into account their ecological role and economic potential</p>

Strategic focus	Short- to medium-term priorities	Long-term prospects
<p><b>Restore forest ecosystems to reduce fragmentation and fire risks</b></p>	<p>Prioritize restoration actions to reduce forest fragmentation and reverse land degradation, as agreed in the NFP 2015–2025 and the 2023 National Forest Fire Emergency Management Plan</p> <p>Support forest operation plans that promote restoration efforts with endemic, climate-resilient species</p> <p>Conduct fire prevention measures in fire hotspots</p> <p>Empower local communities to manage community-owned forest landscapes, based on an agreed management plan</p> <p>Incentivize private landowners to proactively manage forest and trees on their properties</p>	<p>Develop forest operational plans that reflect sustainable management practices for wood and NWFPs (by prescribing annual cutting and harvesting levels) and follow guidelines for restoration efforts</p> <p>Design and operate a national forest monitoring system (NFMS) with monitoring, reporting, and verification (MRV) including:</p> <ul style="list-style-type: none"> <li>• Periodic forest assessments for deforestation and forest degradation monitoring</li> <li>• Technical guidance and institutional/capacity support to the institutional setups at subnational and local levels</li> <li>• Coordinated collection of subnational-level information</li> </ul> <p>Scale up forest restoration efforts, as agreed in the NFP 2015–2025 and the 2023 National Forest Fire Emergency Management Plan</p>
<p><b>Support sustainable nature-based tourism</b></p>	<p>Develop municipal guidelines for creating tourism-related infrastructure in forest landscapes</p> <p>Train contractors to develop tourism infrastructure such as trails, visitor centers, and rest areas</p> <p>Train communities and tour operators to support responsible tourism and provide information to visitors about forest conservation and fire risks</p> <p>Encourage municipal planning of nature-based tourism activities that highlight the natural beauty of forest landscapes</p> <p>Develop campsites, lodges, and other accommodation options that are nature-friendly and sustainable</p> <p>Develop the capacity of tour operators to promote sustainable tourism practices and work with tourists to prevent environmental damage, including from forest fires</p>	<p>Establish partnerships between local communities and conservation organizations, private companies, and government agencies to promote sustainable tourism in forest areas and protect forest ecosystems</p> <p>Develop a nature-based tourism strategy and action plan, including clear regulations</p> <p>Train tourism operators in tools and safety measures related to forest conservation and fire mitigation</p>



# الموجز التنفيذي

تستعرض هذه الورقة حول غابات لبنان (الورقة) الفرص المتاحة من أجل حماية المساحات الحرجية الطبيعية وإدارتها المستدامة. كما تنظر هذه الدراسة إلى مستوى الضغط المتزايد على الموارد الطبيعية الذي تتسبب به الأنشطة/الضغوط التي هي من صنع الإنسان، وإلى زيادة هشاشتها لجهة تغيير المناخ والكوارث الطبيعية، ولا سيما حرائق الغابات.

وتعرض الورقة بيان جدوى تطلعيّ للبنان يهدف إلى حماية الخدمات التي يوفرها النظام البيئي للغابات، وإلى زيادة الفوائد الاجتماعية والاقتصادية لأهداف التنمية المستدامة والتزامات لبنان البيئية العالمية.

يستند بيان الجدوى إلى تحليل التحدّيات والفرص المتاحة من أجل جعل قطاع الغابات (والقطاعات الأخرى التي تعتمد على خدمات النظم الإيكولوجية للغابات) من عناصر مساهمة بشكل ديناميكي وفعال في الناتج المحلي الإجمالي للبنان. كما أنه ينظر في طرق إدارة المخاطر المتزايدة، وبخاصة تلك الناتجة عن حرائق الغابات. وتهدف الورقة إلى أن تكون أساساً للمزيد من المناقشات مع الحكومة والشركاء الآخرين، بغية تحقيق الفرص التي تمّ تحديدها.

تعدّ المساحات والمناظر الحرجية الطبيعية في لبنان فريدة من نوعها في منطقة البحر الأبيض المتوسط، وقد وفرت على مرّ القرون كمًا هائلًا من الفوائد الاجتماعية والاقتصادية والثقافية والبيئية. ومع ذلك، كان للتغيرات المجتمعية تأثيرًا كبيرًا على هذه المناظر الطبيعية، مما عرضها لخطر المزيد من التدهور. التغييرات في نمط الحياة والقيود المفروضة على الوصول إلى الغابات والأراضي الحرجية في التخلي عن الاستخدام المجتمعي التقليدي للغابات وإدارتها وحمايتها. وقد ترك هذا الإهمال الغابات عرضة للحرائق المتعمّدة والتخريب والكوارث الطبيعية. وفي حال لم تجر إدارة هذه المساحات والمناظر الحرجية الطبيعية، فإن الضغط المتزايد على الغابات يضع استدامة خدمات النظام الإيكولوجي التي يقدّمها قطاع الغابات في لبنان في دائرة الخطر. تجدر الإشارة إلى أن هذه الخدمات تقدّر قيمتها بـ 587 دولارًا أمريكيًا للهكتار الواحد.

في عام 2015، وافقت الحكومة اللبنانية على البرنامج الوطني للغابات 2015-2025. في الواقع، يوفر هذا البرنامج إطارًا لتطوير قطاع الغابات في لبنان، ويوائم الأهداف الوطنية مع الاتفاقيات الدولية، ويحدّث القوانين والأنظمة القائمة. ويعرض البرنامج السياسات والاستراتيجيات الوطنية الحالية للحكومة، ويحدّد رؤيتها ورسالتها على المدى الطويل في موضوع إدارة الغابات والمراعي والحفاظ عليها. كما أنه يعزز المشاركة المجتمعية النشطة والتعاون مع أصحاب المصلحة من القطاعين العام والخاص. وقد أدّى التركيز مؤخرًا على أهمية الحفاظ المجتمعيّ على الغابات (أي إشراك أصحاب المصلحة المحليين في إدارة الغابات والأراضي الحرجية، والجمع بين المعارف العلمية والتقليدية) إلى تجديد الاهتمام بحماية الغابات والأشجار في لبنان واستدامتها.

نظرًا للزيادة المقلقة في حرائق الغابات التي تؤثر على المناظر الحرجية الطبيعية في لبنان ونظرًا لشدّتها، تمّ تطوير استراتيجية وطنية لإدارة مخاطر حرائق الغابات في عام 2009 ومن ثمّ جرى تحديثها في عام 2023.

وسوف يعتمد التنفيذ الناجح لهذه الاستراتيجية على شروط عديدة، وهي:

- إنشاء آلية رسمية تسمح للإدارات ذات الصلة (وبخاصة وزارة الزراعة ووزارة البيئة ووحدة إدارة مخاطر الكوارث في مكتب رئيس الوزراء) بالتواصل ورسم الاستراتيجيات بشكل مشترك.
- وجود نظام موحد لجمع البيانات والمعلومات عن الحرائق وإدارتها.
- تخصيص اعتمادات مناسبة في الموازنة الوطنية لتنفيذ الاستراتيجية الوطنية لإدارة مخاطر حرائق الغابات.

على الرغم من التحديات المتعدّدة، فإن لبنان ملتزم بشدة بالحفاظ على المساحات والمناظر الحرجية الطبيعية وزيادة الغطاء الحرجي. وتوفّر الإدارة المستدامة للغابات الأساس لتحقيق فوز ثلاثي الأبعاد: من أجل النمو الاقتصادي في لبنان؛ ومن أجل ضمان أمن سبل رزق الشعب اللبناني؛ ومن أجل الأجندة البيئية العالمية—من خلال المساعدة في مكافحة تغير المناخ. والحفاظ على التنوع البيولوجي، والمساهمة في الحد من تدهور الأراضي. وتعتبر الإدارة المستدامة للغابات هي أيضا مفهومًا مثيرًا لإدارة أفضل لمخاطر حرائق الغابات والأحداث التي تجري على أرض الواقع وجهود إعادة التأهيل. ولن يؤدي استكشاف فرص تطوير مؤسسات صغيرة ومتوسطة الحجم القائمة على الغابات

إلى زيادة في إيرادات الحكومة اللبنانية فحسب، بل سيؤدّي أيضًا إلى تطوير مصادر دخل أعلى أو جديدة (بخاصة لسكان الريف والفئات المستضعفة) من خلال فرص عمل إضافية في الصناعات الخشبية وغير الخشبية. كما أن تطوير المؤسسات القائمة على الغابات من شأنه أن يوفر منافع مشتركة غير نقدية مرتبطة بزيادة المرونة، والتخفيف من تغير المناخ، والحفاظ على التنوع البيولوجي.

أما الفرص التي تحدّدها هذه الورقة فحساسة وتستجيب لحجم لبنان الفريد وجغرافيته وظروفه السياسية والاقتصادية. تم تحديد ستّة مجالات للفرص التي تسمح في استدامة الغابات والمناظر الطبيعية للغابات في لبنان وتعزيز هذا القطاع—لا سيما من خلال دعم الإدارة المستدامة للغابات، بما في ذلك إدارة مخاطر حرائق الغابات. وتعكس مجالات الفرص هذه الأنشطة التي تعالج الثغرات ونقاط الضعف التي نوقشت في الجزء التحليلي من الورقة. وفي حين أن بعض الأنشطة المقترحة طويلة الأجل، تورد الورقة توصيات قصيرة ومتوسطة الأجل كأولويات مقترحة على حكومة لبنان لتنظر فيها.

## أما الفرص المحددة هي:

- تحسين الحوكمة والقدرات المحلية من أجل الإدارة المستدامة للغابات.
- تحسين الوصول إلى البيانات والمعلومات المتعلقة بحرائق الغابات.
- إضافة قيمة إلى المنتجات الحرجية الخشبية وغير الخشبية.
- استعادة النظم الإيكولوجية للغابات للحد من مخاطر التجزئة والحرائق.
- تحفيز أصحاب الأراضي الخاصة لحماية الغابات والأشجار الواقعة على ممتلكاتهم وحسن إدارتها.
- دعم مؤسسات السياحة المستدامة القائمة على الطبيعة.

وتناقش الورقة هذه المسائل أدناه، وترد تفاصيل إضافية في الجدول 1 في الصفحة 7.





## تحسين الحوكمة والقدرات المحلية من أجل إدارة مستدامة، ولا سيما إدارة جيدة لمخاطر حرائق الغابات

إن الحوكمة في إدارة الغابات والقدرات المؤسسية ضرورية لضمان حماية الغابات وإدارتها المستدامة والحفاظ على فوائدها الإيكولوجية والاقتصادية والاجتماعية على الأمد الطويل. وتوفّر الحوكمة الفعّالة للغابات إطاراً لصنع القرار والتخطيط وتنفيذ السياسات والبرامج المتعلقة بالغابات. كما أنها تضمن مشاركة أصحاب المصلحة - مثل المجتمعات المحلية والمجتمع المدني- في صنع القرار. فالحاجة إلى مشاركة المجتمع المحلي في الإدارة المستدامة للغابات تستند إلى تقدير متزايد لأهمية الغابات باعتبارها خزان كربون غاية بالأهمية، فضلاً عن كونها مصدراً حاسماً لكسب الرزق بالنسبة للكثيرين. وتؤدي مشاركة المجتمعات المحلية دوراً حيوياً في التصدي لدوافع إزالة الغابات وتدهورها—مثل حرائق الغابات والحصاد غير المستدام لموارد الغابات لأغراض الأنشطة التجارية.

بالنظر إلى الامتداد الواسع للمساحات الحرجية الطبيعية الخاضعة للملكية الخاصة في لبنان، لا بدّ من تصميم استراتيجيات تدعم مصالح مالكي الأراضي الخاصة في الحفاظ على الأراضي الحرجية. وتركز الاستراتيجيات المقترحة على ما يلي: تعزيز التعاون بين المؤسسات العامة وتعزيز الحوكمة لتقوية الإدارة المستدامة للغابات؛ وإشراك المجتمعات في الإدارة المستدامة للغابات، بما في ذلك التخفيف من حرائق الغابات؛ وإشراك مالكي الأراضي من القطاع الخاص (الجدول 1 - الصفحة 5).



## قيمة مضافة للمنتجات الحرجية الخشبية وغير خشبية

قد يكون إنتاج المنتجات الحرجية الخشبية وغير الخشبية نشاطاً اقتصادياً هاماً في البلدان ذات غطاء حرجي. وتستخدم أصناف الأشجار المختلفة المشهورة بخصبها لأغراض مختلفة، بما في ذلك البناء والأثاث والوقود. ومع ذلك، لا يعرف لبنان صناعة كبرى للمنتجات الخشبية وغير الخشبية (مثل الصنوبر والعسل والخروب). وتشير الدراسات إلى أنّ بعض البلدان تشهد مساهمة مباشرة للمنتجات الحرجية غير الخشبية في الأمن الغذائي تصل إلى ما يقارب 50 في المئة مقارنة بالأغذية الأساسية الأخرى. كما تساهم المنتجات الحرجية غير الخشبية بشكل غير مباشر في الأمن الغذائي، وذلك لإمكانية بيعها من أجل شراء منتجات أخرى في أوقات الحاجة. وبالتالي، فإن المنتجات الحرجية غير الخشبية شبكة أمان مهمة لسكان الريف في لبنان، وهم الشريحة الأضعف في المجتمع.

ومع ذلك، أدى الاستغلال المفرط وممارسات الإدارة غير المستدامة إلى انخفاض في توافر هذه المنتجات وكان له آثار اقتصادية وبيئية سلبية. يحدّد الجدول ١ فرصاً لإضافة قيمة إلى المنتجات الخشبية وغير الخشبية على الأجل القصير والمتوسط والطويل.



## تحسين الوصول إلى البيانات والمعلومات المتعلقة بحرائق الغابات

تعتبر المساحات والمناظر الحرجية الطبيعية في لبنان معرضة بشدة للحرائق وسيؤدي تغير المناخ إلى تفاقم هذا الوضع. حالياً، في لبنان، إن المعلومات المتعلقة بمخاطر الحرائق واندلاعها وأنشطة ما بعد الحريق مجزأة، ولا يسهل على أصحاب المصلحة المعنيين كافة الوصول إليها.

ومن شأن نظام متكامل لإدارة المعلومات المتعلقة بحرائق الغابات (IFFMS) أن يوفر منصةً مشتركة ومتاحة لهذه المعلومات (الجدول 1). لقد تمّ وضع خارطة طريق لبلورة نظام متكامل لإدارة المعلومات المتعلقة بحرائق الغابات وتحديد الشروط الخاصة بها وتمّ توفيرها للحكومة اللبنانية.



## إعادة تأهيل النظم الإيكولوجية للغابات للحدّ من مخاطر التجزئة والحرائق

لإعادة تأهيل النظام البيئي للغابات فوائد متعدّدة، بما في ذلك المرونة المناخية، وعزل الكربون، والحفاظ على التنوع البيولوجي، والحدّ من مخاطر الحرائق من خلال إعادة الغابات المندھورة إلى حالة طبيعية أكثر. ويكتسي هذا الأمر أهمية خاصة بالنسبة للغابات شديدة التجزؤ والتدهور. يمكن أن يؤثر الحد من مخاطر الحرائق أيضاً بشكل إيجابي على النسيج الاجتماعي والاقتصادي للمناظر الحرجية الطبيعية في الأرياف وبالتالي تعزيز المجتمعات المحلية. وتشمل تدابير منع الحرائق الكارثية حملات التثقيف والتوعية بشأن قيمة المناظر الحرجية الطبيعية.



## دعم السياحة المستدامة القائمة على الطبيعة

تساهم السياحة القائمة على الطبيعة مساهمة كبيرة في صناعات السياحة والاقتصاد في البلاد. وتعدّ المساحات والمناظر الحرجية الطبيعية موطناً للحياة البرية والنباتات المتنوعة، ممّا يجعلها وجهة مثالية للسياح المهتمين بالطبيعة والذين يسعون لاستكشافها والاستمتاع بها. وللسياحة القائمة على الطبيعة القدرة على المساهمة في الاقتصادات المحلية وتوفير فرص العمل المحلية. ومع ذلك، فإن وصول السياح ومنظمي الرحلات السياحية إلى المساحات والمناظر الحرجية الطبيعية نادراً ما يفيد مالكي الأراضي والجماعات.

لذا، من الضروري أن تكون نشاطات الوصول إلى المساحات والمناظر الحرجية الطبيعية واعية لطبيعتها ملكيتها وأن تعترف بهذه الملكية كما من الضروري أن توفّر خطط دعم لمشاركة الجماعات فيها. وسيشمل ذلك الأمر إيجاد الوظائف في قطاع الضيافة لتحفيز السكان المحليين على دعم إدارة الغابات وحمايتها. وتوفّر السياحة القائمة على الطبيعة للزوار فرصة لاختبار الثقافة المحلية وطريقة الحياة التقليدية للجماعات المحلية التي تعيش في الغابات و من حولها، فضلاً عن الفوائد البيئية لإدارة الغابات وحفظها.



## الخاتمة

سيساعد تنفيذ الإجراءات المقترحة على حماية المساحات والمناظر الحرجية الطبيعية في لبنان وتعزيز متانة قطاع الغابات في سياق التحديات الحالية والمستقبلية، بما في ذلك تغير المناخ. أمّا التدخلات المقترحة (الملخصة في الجدول ١) فتتماشى مع مختلف الخطط والاستراتيجيات الوطنية المذكورة أعلاه وتتسق معها، وتحديداً البرنامج الوطني للغابات والخطة الطارئة الوطنية بشأن حرائق الغابات. ومع ذلك، فإن النجاح في تحقيق هذه التدخلات المستهدفة يتطلب موازنة مخصصة لها (مخصصات من الموازنة الوطنية)، وصندوق للطوارئ، وإيرادات، وسندات، وصندوق وطني للغابات، وخطوط ائتمان.

© Andrea Kutter, World Bank

لا بد للوصول إلى  
المساحات والمناظر  
الحرجية الطبيعية  
والغابات أن يعترف  
بالملكية المحلية وأن  
يوفر خطط دعم  
للمشاركة المجتمعية









# 1 Country Context

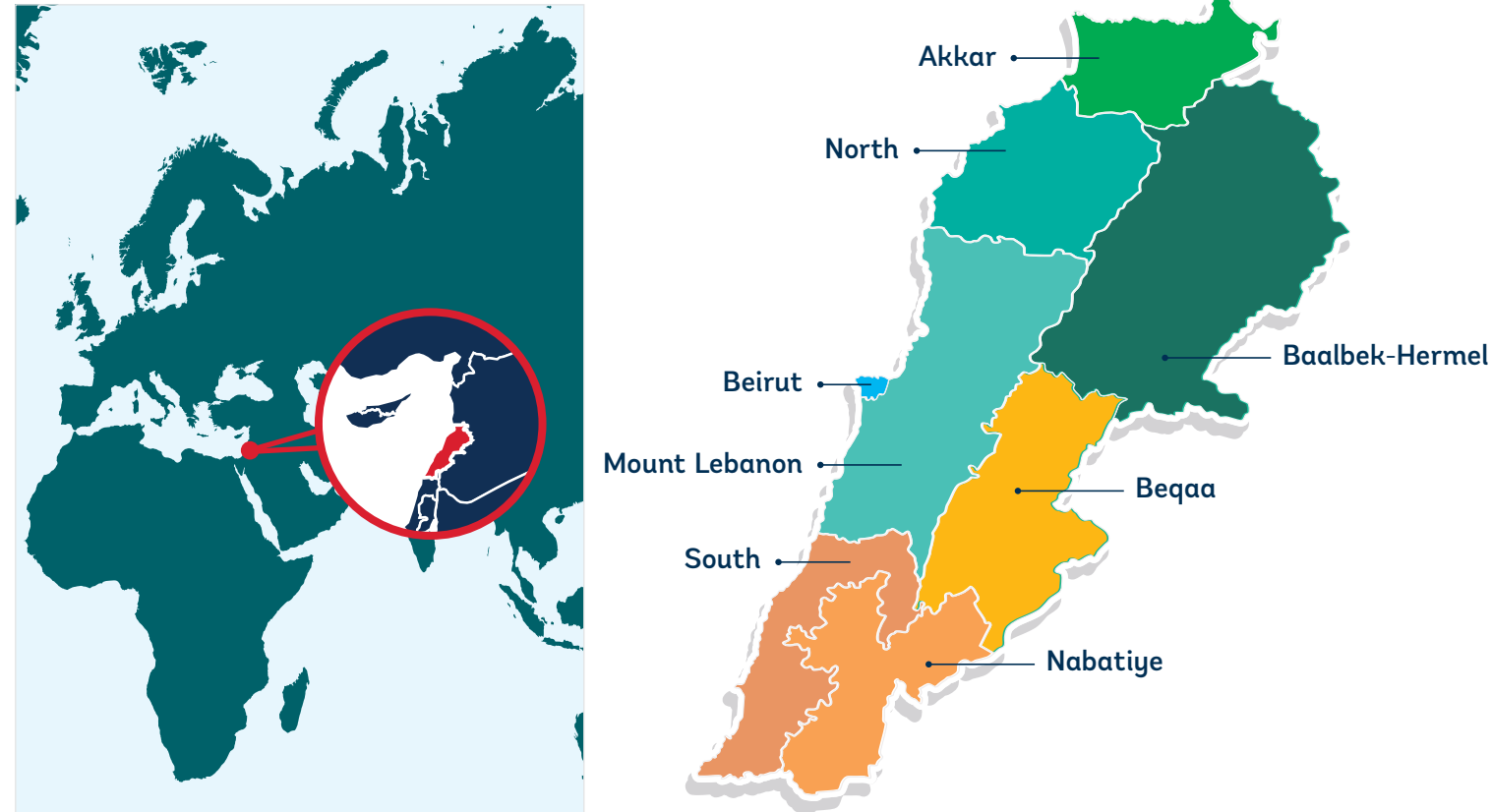
Lebanon is a small country in the Middle East region with a surface area of 10,452 square kilometers (km<sup>2</sup>) and an estimated population of 6,769,151 (World Bank 2021). The country is on the eastern shore of the Mediterranean Sea and extends 217 kilometers from northeast to southwest and 56 kilometers from southeast to northwest. Lebanon is divided administratively into eight governorates: Beirut, Mount Lebanon, North, Akkar, Baalbek-Hermel, Beqaa, South, and Nabatiyeh (Figure 1 on page 11).

الهدف الاستراتيجي	الأولويات القصيرة والمتوسطة الأجل	آفاق طويلة الأجل
إعادة تأهيل النظم الإيكولوجية للغابات للحد من مخاطر التجزئة والحرائق	إعطاء الأولوية لإجراءات إعادة التأهيل للحد من تجزئة الغابات وعكس اتجاه تدهور الأراضي، على النحو المتفق عليه في البرنامج الوطني للغابات للفترة 2015-2025 والخطة الطارئة الوطنية بشأن حرائق الغابات لعام 2023. دعم خطط تشغيل الغابات التي تعزز جهود إعادة التأهيل عبر الأنواع المستوطنة القادرة على التكيف مع المناخ. اتخاذ تدابير الوقاية من الحرائق في النقاط الحساسة للحرائق. تمكين المجتمعات المحلية من إدارة المناظر الحرجية الطبيعية للغابات التي هي ملك المجتمع، بناء على خطة إدارة متفق عليها. تحفيز مالكي الأراضي من القطاع الخاص على إدارة الغابات والأشجار بشكل استباقي في ممتلكاتهم.	تصميم خطط تشغيلية للغابات تعكس ممارسات الإدارة المستدامة للأخشاب والمنتجات الحرجية غير الخشبية (من خلال تحديد مستويات القطع والجمع السنوية) واتباع الخطوط التوجيهية لجهود إعادة التأهيل. تصميم نظام وطني وتشغيله لرصد الغابات يشمل على الرصد والإبلاغ والتحقق بما في ذلك: • التقييمات الدورية لرصد إزالة الغابات وتدهورها • تقديم التوجيه التقني والدعم على مستوى المؤسسة/ القدرات إلى الأجهزة المؤسسية على الصعيدين دون الوطني والمحلي • تنسيق جمع المعلومات على الصعيد دون الوطني توسيع نطاق جهود إعادة تأهيل الغابات، على النحو المتفق عليه في البرنامج الوطني للغابات 2015-2025 والخطة الطارئة الوطنية بشأن حرائق الغابات لعام 2023.
دعم السياحة المستدامة القائمة على الطبيعة	وضع المبادئ التوجيهية البلدية لإقامة البنية التحتية ذات الصلة بالسياحة ضمن المناظر الحرجية الطبيعية. تدريب المقاولين على تطوير البنية التحتية السياحية مثل ممرات المشي والمراكز للزوار ومناطق الراحة. تدريب الجماعات ومنظمي الرحلات على دعم السياحة المسؤولة وتوفير المعلومات للزوار حول الحفاظ على الغابات ومخاطر الحرائق. تشجيع التخطيط البلدي للأنشطة السياحية القائمة على الطبيعة التي تسلط الضوء على الجمال الطبيعي للمناظر الحرجية الطبيعية. تطوير مساحات التخيم والنزل وخيارات الإقامة الأخرى الصديقة للطبيعة والمستدامة. تطوير قدرة منظمي الرحلات السياحية على تعزيز ممارسات السياحة المستدامة والعمل مع السياح لمنع الإضرار بالبيئة، بما في ذلك من حرائق الغابات.	إقامة شراكات بين المجتمعات المحلية ومنظمات المحافظة على الغابات والشركات الخاصة والوكالات الحكومية لتعزيز السياحة المستدامة في المناطق الحرجية وحماية النظم الإيكولوجية للغابات. وضع استراتيجية وخطة عمل للسياحة القائمة على الطبيعة، بما في ذلك أنظمة واضحة. تدريب منظمي الرحلات السياحية على وسائل السلامة وتدابيرها المتعلقة بحفظ الغابات وتخفيف الحرائق.



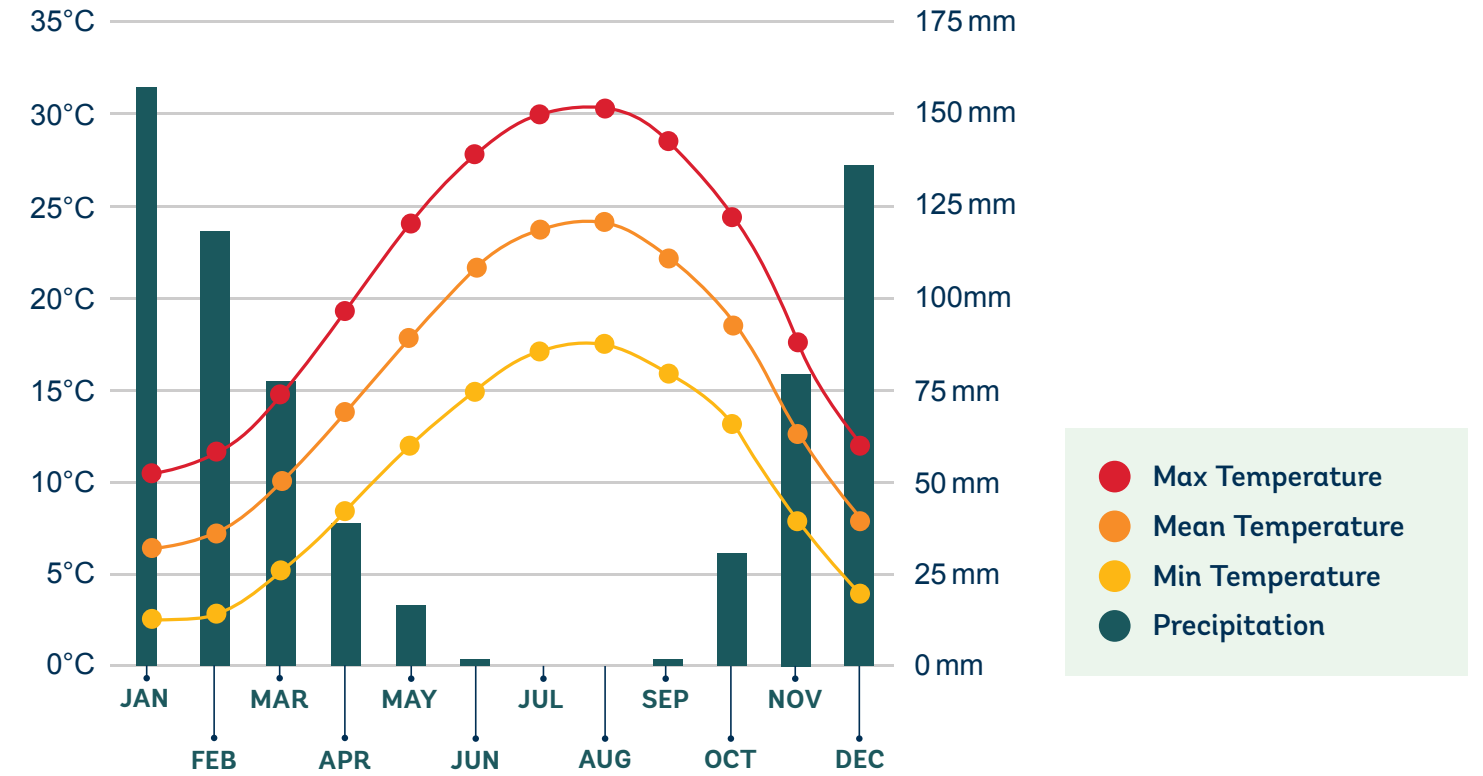


Figure 1: Administrative map of Lebanon



Source: Council for Development and Reconstruction ECODIT 2005

Figure 2: Monthly temperature (min, max, and mean) and precipitation from 1991–2020



Source: World Bank 2022a

## 1.1 Lebanon's landscape

**The landscape of Lebanon** is dominated by rugged mountains made of Jurassic and Cretaceous limestone and sandstone, which give rise to substantial karst formations. The mountains occur in two parallel chains, the Lebanon and the Anti-Lebanon, which together cover more than 70 percent of the country's total area.

**Lebanon's climate** is characterized as Mediterranean. Summers (June to September) are hot and dry, and winters (December to mid-March) are cool and rainy. The average annual temperature is 15 degrees Celsius, and the mean annual rainfall ranges between 700 and 1,000 millimeters on the coast and 1,600 millimeters in the highlands, where precipitation is in the form of rain and snow (Figure 2) (World Bank 2022a).



© Andrea Kutter, World Bank

**Lebanon has several bioclimatic zones** due to its diverse topography and climate features (Annex 1). Its forest cover and other wooded land extends to around 23 percent of the country area, making Lebanon rich in biodiversity (it contributes 1.11 percent of the world's plant species). The number of recorded species in Lebanon includes as many as 2,600 terrestrial plant species. Eight and a half percent of these species are broadly endemic to Lebanon, Syria, and Palestine, and 3.5 percent are strictly endemic to Lebanon. Lebanon has one of the highest densities of floral diversity in the Mediterranean Basin (MoE, UNDP, UNICEF, and UNHCR 2020)<sup>2</sup> with an exceptionally high species per area ratio, at 0.25 species per square kilometer (MoE, UNEP, and GEF 2016).<sup>3</sup>

**Rivers in Lebanon are considered abundant relative to the size of the region.** Despite its small size, the country has 14 rivers of short length, characterized by small catchments and an estimated annual discharge of 2,800 million cubic meters. Owing to the country's steep topography, a substantial percentage of water from these rivers flows into the sea. The remaining available water from rivers is channeled for domestic use, for agriculture, and for electricity generation (supplying 20 percent of the electricity needs of the country). The remainder is lost to evapotranspiration or directed towards groundwater recharge (Shaban 2021).

Rivers constitute about 42 percent of water resources in Lebanon (Shaban 2021). In addition, Lebanon's mountains and high rainfall contribute to the replenishment of groundwater reservoirs (Fanack Water 2022).

<sup>2</sup> MoE (Ministry of Environment); UNDP (United Nations Development Program); UNICEF (United Nations International Children's Emergency Fund); UNHCR (United Nations High Commissioner for Refugees).

<sup>3</sup> UNEP (United Nations Environment Program); GEF (Global Environment Facility).



Figure 3: Rivers of Lebanon



Source: Shaban 2021

**Watersheds—encompassing the areas surrounding rivers, lakes, and groundwater sources—play a vital role in preserving water resources.** They serve as natural filters and regulators, influencing the quality and quantity of water available. Effective watershed management strategies are crucial for maintaining healthy water systems. However, encroachment, deforestation, and improper land use practices have disrupted watersheds in Lebanon, compromising their ability to provide clean and sustainable water (UNDP 2018). Article 4 of Lebanon's Water Law No. 77 of 2018 states the general objectives of sustainable water management, which includes the conservation and restoration of aquatic environments, as well as terrestrial ecosystems and associated wetlands.

**Forest watersheds play a vital role in preserving and enhancing water resources in Lebanon.** These ecosystems offer numerous benefits that are essential for sustainable water management. Forests act as natural water filters, reducing sedimentation and pollutant loads in rivers and streams (Ghabayen and Mosleh 2020). The root systems of trees help stabilize slopes and reduce erosion, protecting water sources from sediment runoff. Furthermore, the dense vegetation cover in forests helps retain moisture in the soil, ensuring a sustained supply of water to springs, rivers, and wells during dry periods (Saba 2019). This natural regulation of water flow helps maintain the ecological balance and contributes to the

overall health of water resources. Additionally, forests provide various ecosystem services, including carbon sequestration, biodiversity conservation, and recreational opportunities. Preservation, restoration, and sustainable management of forested watersheds are crucial not only for water security but also to help mitigate climate change and promote sustainable development in Lebanon (UNEP 2016).

**Lebanon's water resources face numerous challenges, owing to increasing demand, pollution, and climate change impacts** (Shaban 2020). The country experiences a significant imbalance between water supply and demand, particularly during dry seasons. Population growth, urbanization, and agricultural expansion contribute to overexploitation of water sources, leading to water scarcity issues. Inefficient irrigation practices and inadequate wastewater treatment further degrade water quality. The Ministry of Energy and Water (MEW) has recognized the need for comprehensive water resource management strategies to address these challenges (MEW 2016 and Food and Agriculture Organization (FAO) 2015). Hence, an Updated National Water Sector Strategy (2020-2035) (MEW 2022) was developed.

**Recent economic, political, and social challenges, and soaring black-market prices have affected the capacity of many communities to access and purchase fuel for heating and cooking.** The country's GDP plummeted from US\$55 billion in 2018 to US\$18.8 billion in 2021, while real GDP per capita fell by 37.1 percent (World Bank 2021). As a result, the poverty rate reached 82 percent in 2021, compared to 30 percent between 2011 and 2018. Unemployment reached 30 percent in 2022, up from 11 percent in 2019 (World Bank 2023). This constant crisis mode has crippled Lebanon, obstructing its development and decimating its coping capacity, with vulnerable households bearing the brunt of limited

access to food, healthcare, education, and other basic services. The inflation rate—which increased from 3 percent in 2019 to 154 percent in 2021 (World Bank 2021)—was accompanied by currency devaluation. This had adverse consequences, including a collapse in basic services.

**In the face of economic collapse, there has been a surge in wood harvesting to meet subsistence needs as communities have turned to cutting down trees for firewood and for producing charcoal.** In fact, the return to the use of local natural resources is reflected in the growth of the agriculture, forestry, and fishing sectors. These grew from 3.2 percent of the GDP in 2018 and 2019 to 8.9 percent in 2020, despite the related socioeconomic challenges. For example, the rental of forested lands increased from 0.001 percent in 2018 to 0.003 percent in 2020 (World Bank 2022b).

**In addition to drought and heat events, increased forest fires and forest pest outbreaks due to anthropogenic pressures are threatening the fragile biodiversity, ecosystems, and natural habitats of Lebanon** (MoE and UNDP 2011). The socioeconomic challenges that Lebanon faces are compounded by climate change, which adds to the country's long-term vulnerabilities. According to Lebanon's fourth national communication to the United Nations Framework Convention on Climate Change (UNFCCC), scenarios developed to predict changes in temperature and precipitation suggest that by 2040 there will be a 1 degree Celsius increase in temperature on the coast and a 2 degrees Celsius increase inland. Their projection is that the rainfall pattern will concomitantly decrease by 10 to 20 percent. Rising temperatures and altered rainfall patterns, particularly extreme events, will pose significant challenges for water resource management and affect key sectors, including agriculture and forestry.



© Andrea Kutter, World Bank



## 1.2 Contribution of forests to Lebanon's green recovery

**The challenges Lebanon has been facing (a severe economic and monetary crisis, the Port of Beirut explosion, the Covid-19 pandemic, and political instability) urgently call for a green recovery, which delivers economic growth alongside emissions reductions and increased resilience** (UNDP 2021). More than half the population is below the national poverty line (World Bank 2021) and unemployment rates have increased significantly, especially among the youth (ILO and the Central Administration of Statistics (CAS) of Lebanon 2022). The arrival of approximately 1.13 million displaced people as a result of the Syrian crisis has further strained the country's resources, causing an increase in road traffic, greenhouse gas (GHG) emissions, and pressures on natural resources, including forests. The economic situation remains difficult, with the Gross Public Debt at an all-time high, triggering banking debt and exchange rate crises, and resulting in a long-lasting recession (UNDP 2021).

**To outline its recovery from the most recent financial crises and to define future growth, Lebanon has created three national plans** (UNDP 2021):

- The 3-year development priorities of the Financial Recovery Plan. This plan's main goal is to overcome immediate financial obstacles.
- Economic Vision of Lebanon (LEV). The LEV lays out a comprehensive plan for reviving the country's economy through targeted investments in the industries identified as the main drivers of growth.
- The Capital Investment Plan (CIP). The CIP lists infrastructure initiatives that will advance short- and medium-term opportunities for economic growth, while also supporting national development objectives.

**Moving on from the CIP, a McKinsey report published in 2019 provided a more in-depth investigation into the economic challenges and opportunities facing Lebanon today.** The report focused on the need to improve "productive sectors" (industry, agriculture, tourism, knowledge economy, and financial services) and acknowledged the vicious economic cycle Lebanon is currently caught in. The results from the McKinsey report, the presentation of the CIP, and Lebanon's commitments at CEDRE (Conférence économique pour le développement, par les réformes et avec les entreprises),<sup>9</sup> clearly focus on the need for stabilizing the economy, ensuring growth, and addressing unemployment through job creation (UNDP 2021). Structural reforms covering all sectors of the economy are identified as key to unlocking the economy's growth potential, making it sustainable, and generating jobs (The Lebanese Government's Financial Recovery Plan 2020).

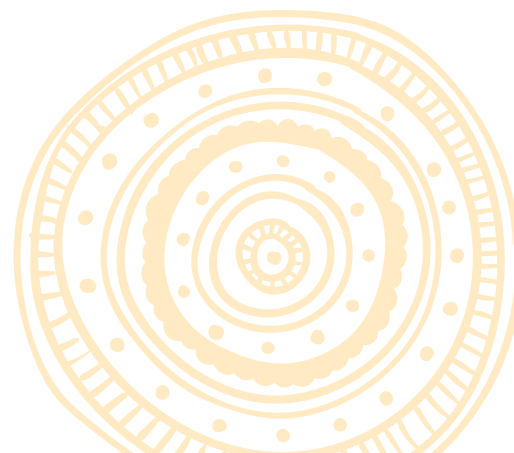
**Forests are a foundation of a green economy, sustaining a wide range of sectors and livelihoods** (UNEP 2012). The production of timber is not the only contribution of forests to a green economy. Forests improve people's wellbeing in numerous ways: directly, by providing resources for basic needs such as energy, shelter, and food; and indirectly, by providing the ecological foundations for GDP in many other sectors: agriculture, tourism, water supply, health, and so forth (UNEP 2015).

**Forest restoration and conservation have generated new job opportunities that contribute to producing goods or providing services that benefit the economy, the environment, and society-at-large.** The following key forest programs are intended to concurrently restore forest landscapes and support local economies by creating green job opportunities and enhancing livelihoods (UNCCD and MoA 2018):

- The National Afforestation/Reforestation Program (NARP) launched by the Ministry of Agriculture in 2012 is known as the Blueprint for the 40 Million Trees Campaign in Lebanon. The project aims to increase the forest cover of Lebanon by 7 percent, from 13 percent to 20 percent, over 20 years. It will do so by engaging communities throughout Lebanon in the planting of 40 million forest trees and encouraging local practices that lead to the sustainable conservation of forests and other wooded lands (UNCCD and MoA 2018).
- Smart Adaptation of Forest Landscapes in Mountain Areas (SALMA) is a five-year project funded by GEF, implemented by the FAO and executed by the MoA. The project's goal is to restore up to 1,000 ha of forests and manage another 1,000 ha by engaging communities.
- PARSIFAL (Programme d'appui à la Résilience Sociale, aux Infrastructures, à la Forêt et à l'agriculture au Liban) is a project funded by the French Development Agency (AFD), implemented by AFD, and executed by AFD and the Council for Development and Reconstruction. Its intention is to help vulnerable populations by restoring a range of products and services to no less than 700 ha of land with native species.
- Safeguarding and Restoring Lebanon's Woodland, a project supporting the activities and strategies of reforestation in Lebanon, was funded by GEF, implemented by UNDP, and executed by the MoE. It was completed in 2016.

**According to the Second Biennial Update Report submitted to the UNFCCC in 2017, Lebanon's forest sector contributed 3.9 percent (0.78 million tons) of the country's total GHG emissions in 2010—primarily owing to deforestation, forest degradation, and the burning of wood for energy.** However, Lebanon's forests, if effectively managed, can play a significant role in carbon sequestration and storage: they are estimated to remove 1.9 million tons of carbon dioxide equivalent (CO<sub>2</sub>e) per year through photosynthesis and carbon storage. Yet, this potential is threatened by several factors such as climate change, unsustainable forest management practices, and other threats such as forest fires. Lebanon's GHG emissions, primarily from the energy sector, are expected to grow significantly under a business-as-usual scenario. In 2015, GHG emissions totaled 27,107 Gg of CO<sub>2</sub>e. As part of its updated Nationally Determined Contribution (NDC) under the Paris Agreement in 2021, Lebanon committed to reducing GHG emissions by 20 percent by 2030 as an unconditional target, and 31 percent by 2030 as a conditional

target (UNDP 2021). The commitment suggests that the forest sector, by playing an important role in reducing greenhouse gas (GHG) emissions, will contribute substantially towards meeting these targets for mitigating climate change. Forests act as carbon sinks, absorbing carbon dioxide from the atmosphere through the process of photosynthesis and storing it in their biomass and soils (FAO 2021). Accordingly, forest conservation and reforestation efforts can contribute significantly to reducing global GHG emissions (World Resources Institute (WRI) 2021). Lebanon's updated NDC highlights the importance of preserving and expanding its forest areas, implementing sustainable forest management practices, and enhancing the capacity of forest ecosystems to store carbon (UNDP 2021). Therefore, Lebanon's forest sector can contribute to the country's overall efforts to reduce GHG emissions and mitigate climate change; its updated NDC recognizes this potential by including measures to support forest conservation and reforestation.



<sup>9</sup> CEDRE is the primary platform for political discourse in Lebanon.



# 2

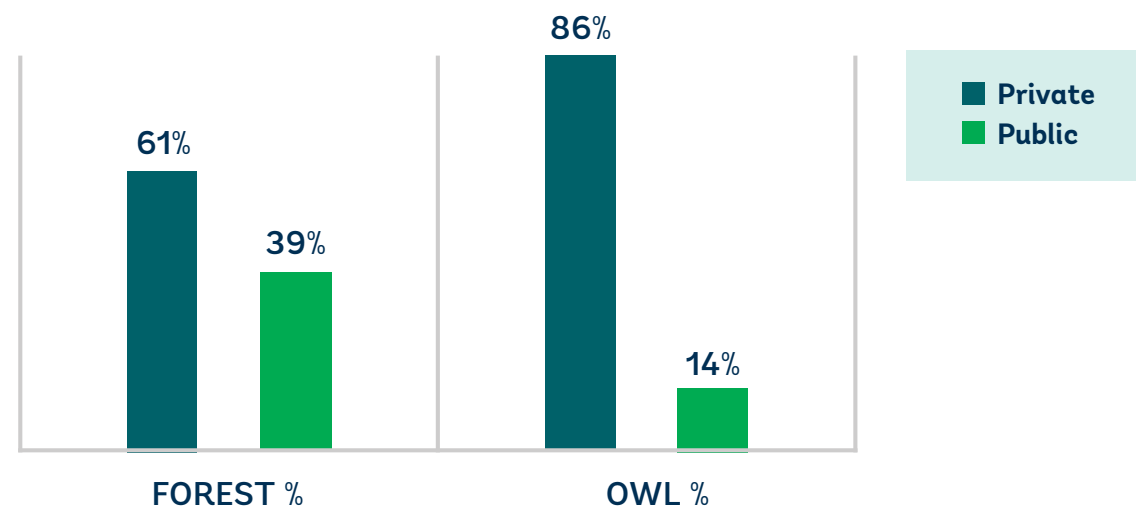
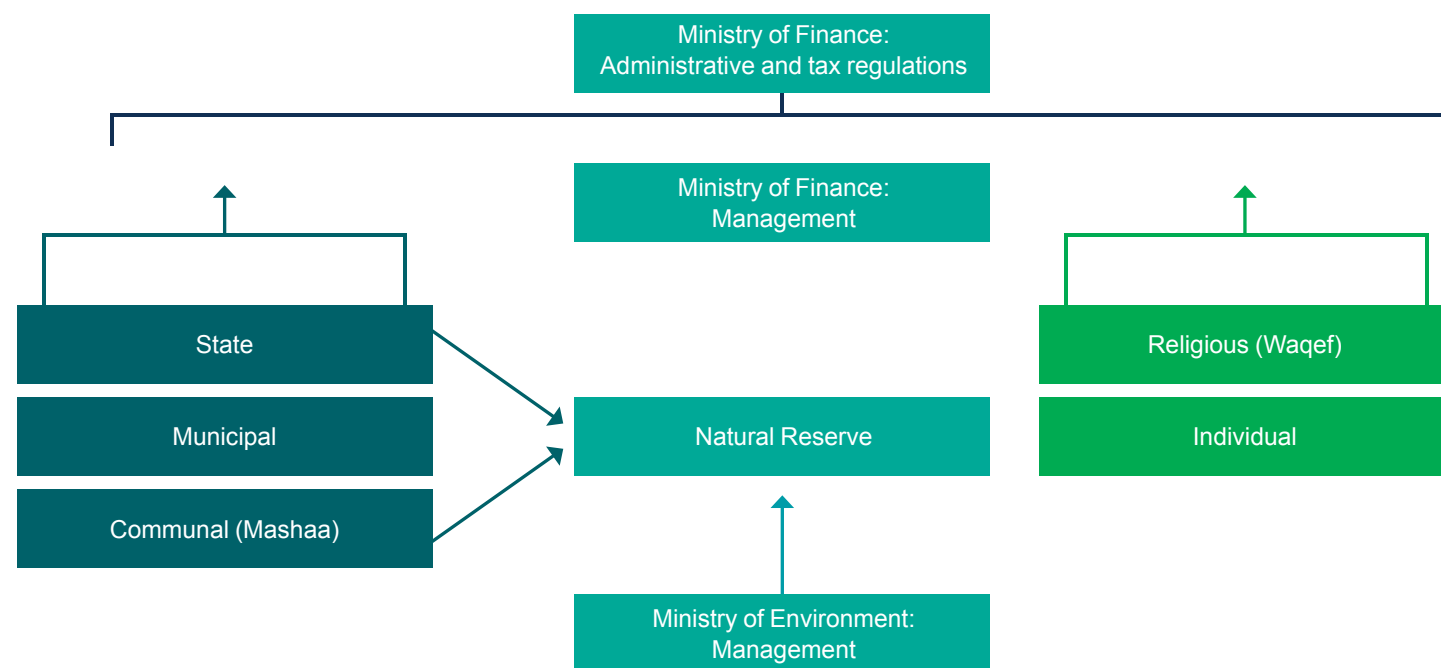
# Characteristics of Forests in Lebanon

Lebanon's unique forests have captured the attention of several civilizations. There are many ancient texts describing trade of wood, resins, and essential oils from Lebanon's cedar and other cone-producing (coniferous) trees such as fir, pine, and juniper for precious materials, food, and clothing.

Forests in Lebanon have either regenerated naturally or were planted on a large scale. Lebanon's forests, including the local coniferous species—stone pine (*Pinus brutia*), Aleppo pine (*Pinus halepensis*), Lebanese cedar (*Cedrus libani*), Cilician fir (*Abies cilicica*), juniper (*Juniperus spp.*) and Italian cypress (*Cupressus sempervirens*)—have regenerated naturally after extensive cutting. Changes in traditional land use and lifestyles over the course of the twentieth century (characterized by depopulation of rural areas and migration towards urban areas, land abandonment, and a decrease in traditional grazing and wood gathering practices) contributed to natural forest regrowth. This natural regeneration increased fuel biomass and subsequently raised wildfire risk or altered the fire regime by increasing the frequency, size, and severity of fires (Mitri et al. 2014; Mantero et al. 2020).

Forest ownership presents several challenges for effective forest management. More than half the Lebanese forests (61 percent) and the majority of other wooded land (OWL) (86 percent) are privately owned (Figure 4). Private owners seek to maximize revenues from their land, which can lead to profit-driven management decisions that prioritize land conversion for building development or agriculture. Furthermore, the limited authority of state agencies over private lands makes it difficult to apply and enforce management strategies and achieve forest conservation goals.

Figure 4: Ownership of forested and other wooded lands in Lebanon







© Andrea Kutter, World Bank

**Ideally, private forest properties are managed by their respective owners. However, while Lebanon’s forest laws include recommendations on managing private forests, landowners are not legally enforced to manage and rid forested areas of flammable dead plant matter (fire fuel).** While there are expectations and recommendations for landowners to undertake this responsibility, the absence of a legal obligation means that if a landowner lacks the financial means or is otherwise unable to carry out such actions, there is no mechanism in place to compel them to do so. As a result, the responsibility for fire fuel clearance and related forest management practices falls upon the voluntary actions and capabilities of individual landowners (Al Hajal 2021).

**Implementing a comprehensive set of incentives can effectively encourage private landowners in Lebanon to engage in sustainable forest and tree management.** While long-term options—like payment for environmental services and access to carbon markets—require system implementation and legal considerations, short- and medium-term alternatives can provide immediate benefits. Access to dedicated impact funds, such as the Land Degradation Neutrality (LDN) Fund, can incentivize private landowners to adopt sustainable practices.

**Another viable option for unmanaged private forestland near communities involves municipal control.** The municipality places a lien on the property, or temporarily assumes management rights until the landowner recommences responsible forest and tree management. This temporary management could be facilitated by the surrounding communities, which would directly benefit from the arrangement. Clear criteria for defining “unmanaged” areas must be developed, and a community forest management plan should be established to clarify access and benefit-sharing arrangements. It is essential to consider necessary amendments to municipality or governorate laws and regulations to ensure successful implementation of these incentives.

**Lifestyle changes and restrictions imposed on forest and woodland access have contributed to the abandonment of traditional community forest use, management, and protection.** This, in turn, has resulted in neglect of Lebanon’s forests, leaving them vulnerable to arson, vandalism, and natural disasters (Talhok et al. 2014). However, the recent focus on community-based forest conservation, involving local stakeholders in the management of forests and woodlands, and combining scientific with traditional knowledge, has renewed the interest in protecting and sustaining forests and trees.

**Forests in Lebanon are unique in the semi-arid environment of the eastern Mediterranean region.** This is because of extreme variability in physiography, soils, and microclimatic conditions, which has created diverse ecosystems and habitats delineated by changes in type and structure caused by different patterns of natural resources exploitation (Sattout and Abboud 2007).

**The Ministry of Agriculture (MoA) has adopted the FAO definition of a forest as a basis for assessing forest resources.** According to the FAO definition, a forest is a “land spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of more than 10 percent or trees able to reach these thresholds in situ”. Woodlands are not classified as “forest” and are defined as “spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5–10 percent”.

Figure 5: Forest map of Lebanon



Source: FAO and MoA 2005



© Andrea Kutter, World Bank

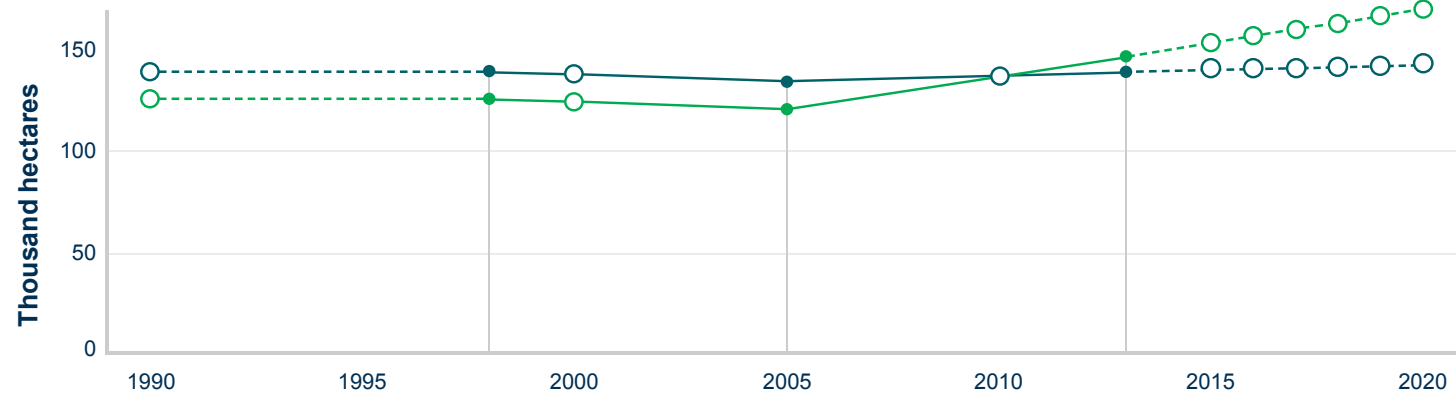
<sup>4</sup> Land cover refers to the surface cover on the ground (whether vegetation, urban infrastructure, water, bare soil, or other) and land use refers to the purpose the land serves. Land use/land cover map of Lebanon 2017, 1:20,000 (vector map) developed by the National Scientific Research Center (CNRS).



The MoA has launched a new FRA to update Lebanon's forest data and map, with results expected by 2023 (MoA 2022). Additional national forest resources assessment reports were published in 2010, 2015, and 2020 (FAO 2020b). However, these were based on the initial official data from 2005 and do not provide added information based on field data collection. As a result, these reports have led to incorrect assumptions about

the forest's current state, resulting in poor decision-making and inadequate planning and implementation of better management practices. For example, these reports generated trends predicting that forest areas in Lebanon will remain the same, while OWL areas will increase (Figure 6). Yet these predictions do not consider the level of fragmentation of Lebanon's forests, which poses a threat and causes further forest degradation.

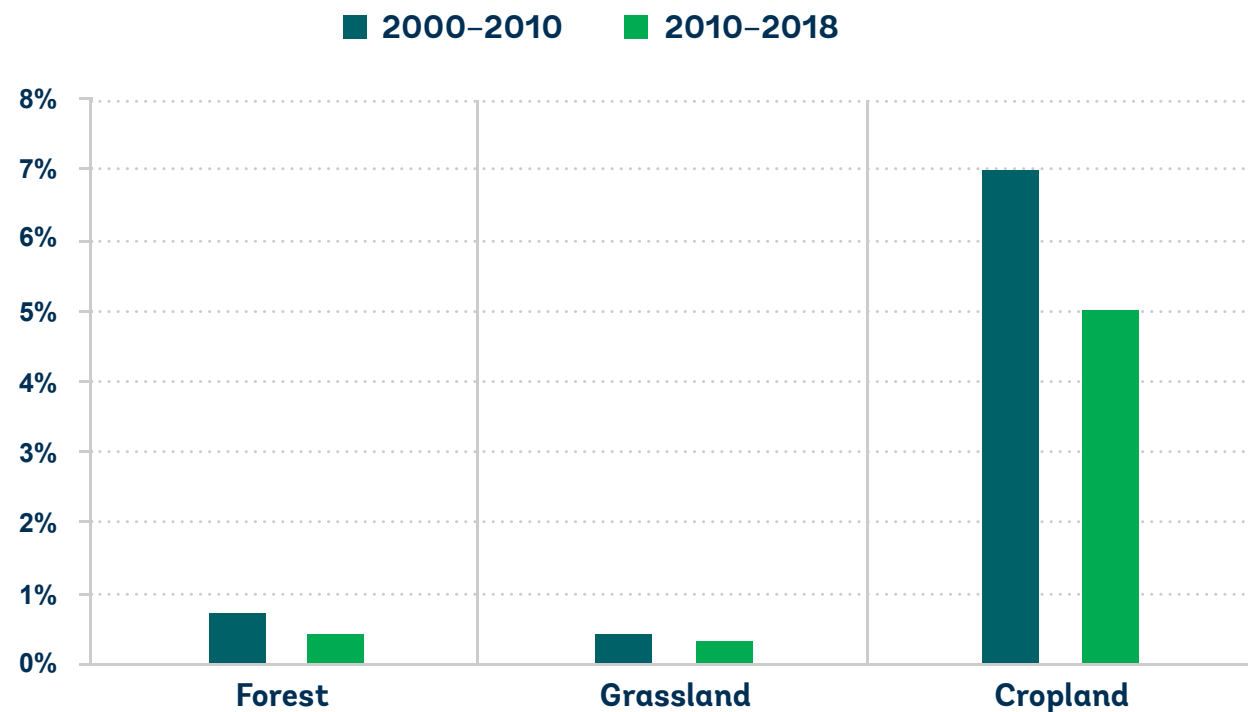
Figure 6: Forest and other woodlands areas and trends over 20 years



Source: FAO 2020b

The National Report on Land Degradation Neutrality (LDN) reported 1,783 ha (0.7 percent) loss of forested lands between 2000 and 2010 (MoA 2018) and 1,065.43 ha (0.42 percent) between 2010 and 2018 (Association for Forests Development and Conservation (AFDC) and MoA 2023). Loss of grasslands and crop lands for the same periods was reported at 1,201 ha (0.4 percent) and 934.87 ha (0.3 percent), and 2,257 ha (7 percent) and 1,588.43 ha (5 percent) respectively (Figure 7).

Figure 7: Loss in vegetation cover between 2000 and 2010, and between 2010 and 2018

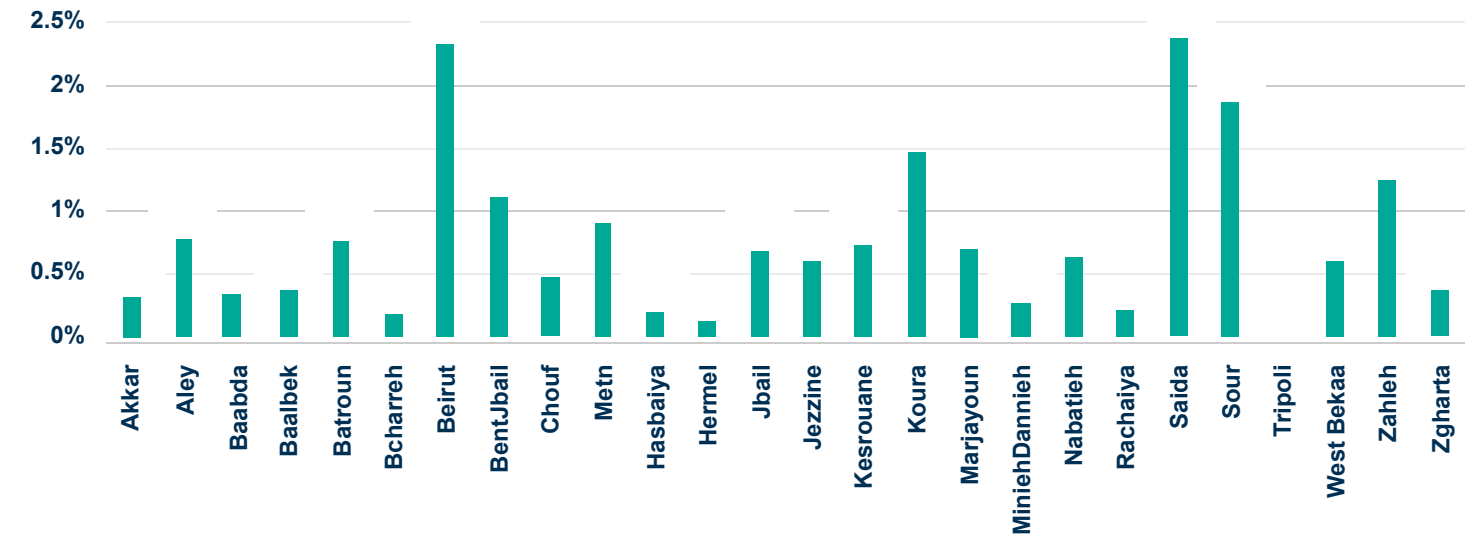


Source: MoA 2018; AFDC and MoA 2023

The increasing pressure on coastal forests due to urban expansion is evident as the percentage loss of forest lands is highest near dense coastal cities such as Beirut, Saida, and Sour (Figure 8). Low-altitude coastal forests are semi-natural and exhibit varying degrees of degradation (Makhzoumi et al. 1999). Examples of coastal tree species

include wild pistachio (*Pistacia* spp.), oak (*Quercus* spp.), and carob (*Ceratonia siliqua*), all of which have evolved to withstand drought and hot summer temperatures (Christodoulakis 1992), and occupy coastal soils that have typically poor agricultural capability (Talhouk et al. 2018).

Figure 8: Extent of forest loss per district (Kadaa)<sup>5</sup> (Source: United Nations Convention to Combat Desertification and MoA 2018)



The forests most vulnerable to climate change are those located in north Lebanon (Akkar) and Hermel. In the most recent fire events high mountain regions were also susceptible, since they have been affected by a change in local climate—from a sub-humid to a semi-arid bioclimatic level (MoA 2015; Mitri and Gebrael 2022). Calabrian pine, the Kermes or Palestine oak (*Q. calliprinos*), and the Mediterranean cypress (*Cupressus sempervirens*) are displacing the Aleppo oak (*Q. infectoria*) at higher elevations on the western slopes in the northern part of the Lebanon mountain range (Chouchani 1972).

Juniper (*Juniperus excelsa*), cedar (*Cedrus libani*), fir (*Abies cilicica*), Turkey oak (*Quercus cerris* L. var. *pseudo-cerris*), ash (*Fraxinus ornus*), and hornbeam (*Ostrya carpinifolia*) are categorized as extremely sensitive to climate change (AFDC 2019). In addition to the impacts of climate change, forests are subjected to multiple stresses that negatively impact their resilience, including fragmentation, pest outbreaks, and unsuitable management practices.



<sup>5</sup> District (Kadaa) is an administrative division of the Governorate (Mohafazah) in Lebanon.







**BOX 1**

## The International Union for Conservation of Nature/ IUCN’s first green-listed protected and conserved area in Lebanon (IUCN 2023).

### The Shouf Biosphere Reserve in Lebanon (green-listed in 2018)

Why is the Shouf Biosphere Reserve green-listed?

The Shouf Biosphere Reserve is the largest of Lebanon’s nature reserves, stretching over 156.47 square kilometers. The reserve hosts 32 species of wild mammals, of which nine are considered rare internationally. Covered with oak forests on its northeastern slopes and juniper and oak forests on its southeastern slopes, the reserve’s most famous attractions are its three magnificent cedar forests, which extend over four villages (about 620 hectares of cedar, or *Cedrus libani*, forest). These Cedar forests account for a quarter of the remaining cedar forest in Lebanon and represent the natural southern limit of this tree, with some trees estimated to be 2,000 years old. The size of the reserve makes it a suitable location for the conservation of medium-size mammals such as the wolf and the Lebanese jungle cat, as well as various species of mountain gazelle and endemic plants. There are 436 identified plant species distributed over 61 families.

The reserve provides habitats for 25 internationally and nationally threatened species. There are 48 species endemic to Lebanon (Lebanon/Syria/Turkey) and 14 rare species, while 214 species are restricted to the eastern Mediterranean/Middle East area.

The Green List Sustainability Standards provide a global benchmark for how to meet the environmental challenges of the twenty-first century.

The Shouf Biosphere Reserve is one of the successful models of sustainable management of protected areas. It should encourage all other national and regional reserves to learn from its example, exchange expertise, and empower people to preserve nature.

© Andrea Kutter, World Bank

## 2.2.2 TREES OUTSIDE FORESTS

**There is no specific definition of Trees Outside Forests.**

The concept is defined by FAO only by default in reference to the forest in general. The FAO refers to trees growing outside forests and not belonging to the category of forests, forest lands, or other wooded land: “Trees outside forests are located on Other Land (OL). It includes trees and shrubs on agricultural land, agroforestry systems, orchards, barren land, urban areas, gardens, parks etc. Trees outside forests may be productive, such as orchards, and trees in fields and other agroforestry systems, or protective, such as trees with an ecological or landscaping function; or ornamental, such as trees around houses, and in parks and towns.” (Bellefontaine et al. 2002).

**In Lebanon, the olive tree (56,300 ha), the stone pine (14,000 ha) (Investment Development Authority of Lebanon (IDAL) 2017), and the carob tree (241 ha) are multifunctional resources with a wide range of**

**socioeconomic and environmental services both to rural and urban communities— in agricultural and urban tree-based systems respectively** (Nabbout et al. 2018).

**Trees outside forests in urban areas provide numerous services to cities, including improving air quality, reducing urban heat islands, enhancing the aesthetics of neighborhoods, and contributing to the wellbeing of residents.** Assessing the health and condition of urban trees allows timely interventions to maintain tree health and prevent potential hazards.

**In 2022 an assessment was performed on trees in the Beirut Green areas.** The findings revealed that all green spaces assessed are badly maintained and in need of rehabilitation or additional planting. The absence of regular maintenance is

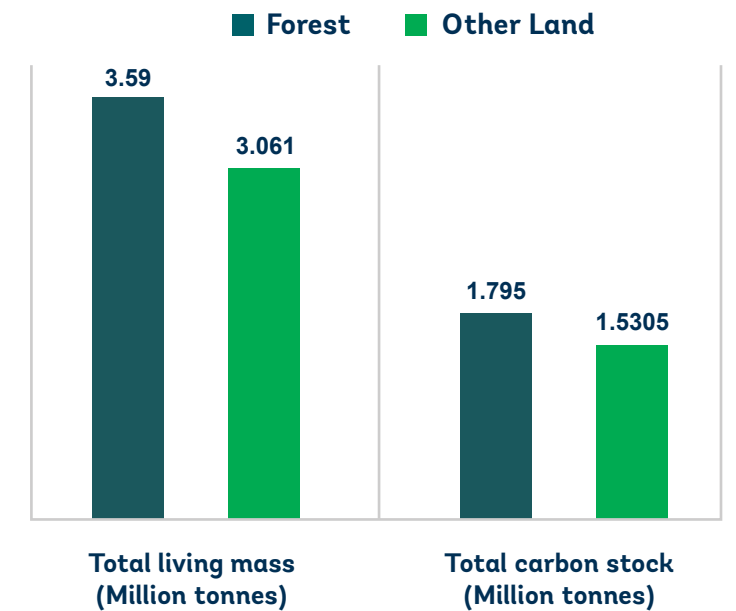
because municipalities face a lack of funding and bureaucratic complexities when intending to plan or achieve tasks. There is a need to improve the capacity of municipalities to expand and manage trees outside forests to ensure sustainability of urban forests.

**A National Forest Resources Assessment conducted in 2005 indicated that Trees Outside Forests were ornamental species found in urban areas; remnant native trees found in woodlots or along rivers; old juniper trees in grasslands; riparian trees along rivers; and olive trees in olive groves.** Trees Outside Forests have been identified as providing several important functions (FAO and MoA, 2005). They offer:

- A means of income (productive trees, wood collection)
- A form of protection (wind break, soil, and water conservation)
- A source of recreation and tourism (parks, green areas, and so on)
- An environmental benefit (carbon sequestration and pollution reduction, among other benefits).

**Figure 12 provides evidence that Trees Outside Forests are as important as trees inside forests in terms of biomass and carbon stock, and are therefore an important tree resource on the national level.** Further assessment and monitoring of Trees Outside Forests is required to highlight their importance and generate better national policies and decisions.

Figure 12: Comparison of living biomass and carbon stock in Forest and OL



Source: G. FAO and MoA 2005

Figure 11: Horsh Beirut.



Source: G. Mitri (Source: FAO 2018)



# 3 Forest Governance

Forest governance in Lebanon is challenging. This is because prolonged political vacuum and lack of political consensus have led to overlapping administrative roles and responsibilities, absence of cadastral data, conflicting regulations, absence of law enforcement, lack of compliance to laws and regulations, and corruption.

*Laws and regulations that govern the forest sector in Lebanon are limited in scope, and administrative regulations are issued according to specific needs and sites.* The lack of protection, sustainable management, and restoration of forests is also the result of conflicting land-use regulations, linked to multiple laws created by various government departments (FOA 2020a). Furthermore, most state-owned forests are not mapped, and their borders are not delineated. This leads to land-tenure and user-rights conflicts. In some regions, illegal activities such as cultivation, construction, and quarries have been observed on parts of state-owned forest lands. In fact, to date, Lebanon does not have a digitized cadaster system that is accessible to multiple public institutions and that includes forest data. This legal ambiguity relating to land tenure, coupled with the lack of data and illegal activities on public forest lands, has increased the level of complexity of forest management and created major obstacles for the forest sector, especially in terms of planning, monitoring, and resource assessment. This challenge is further aggravated by overlapping roles and responsibilities between relevant institutions, especially between the MoA and the MoE; lack of coordination between public institutions as well as the public and the private sector; limited involvement of local stakeholders; limited financial resources; and government employees working in an unstable political and economic environment.

*As a result of the challenges described above, forest management in Lebanon has historically lacked a long-term vision on how the country's forests should be managed and protected to meet economic, ecological, and social objectives* (MoA 2015). The Government of Lebanon, through its public institutions and the support of development partners, has made efforts to address different issues and regulate forest management through several initiatives. These include developing plans and strategies such as the National Afforestation/Reforestation Program (NARP), the National Forest Program (NFP) 2015–2025, and the National Forest Fire Management Strategy (NFFMS) 2023.

*Paradoxically, while contributing to the forest sector by filling the gap created by a weak government, national non-governmental organizations (NGOs) also contribute to the weakening of government institutions*—by diverting funds needed to support and develop the capacity of government employees and institutions. NGOs have raised significant international resources to monitor and advocate for improved forest management policies and practices.

## 3.1 Institutional framework for sustainable forest management

*Forest management is directly and indirectly dependent on multiple sectors and government agencies that govern land use, natural resources, and livelihoods.* This includes government and non-governmental institutions tasked with territorial planning at national and subnational levels, as well as private forest owners, forest users, and farmers.

### 3.1.1 GOVERNMENT

*The MoA is the primary institution governing the forest sector. However, competing, scattered, and overlapping responsibilities and activities in different ministries are weakening its ability to lead the national governance of the sector* (Food and Agriculture Organization 2020a). All forest lands, rangelands, and open areas—except those in natural reserves—are under the direct authority of the MoA's Directorate of Rural Development and Natural Resources (DRDNR). Under the DRDNR is the Department of Forests and Natural Resources, which has three divisions: (i) the Division of Reforestation and Investment; (ii) the Division of Public Garden and Rangeland, and (iii) the Division of Fishing and Wildlife. There are 34 forest centers, eight regional offices/divisions, and eight forest nurseries. Through these departments and divisions, the DRDNR sets priorities and policies for conservation, restoration, management, and use of forest and land resources in Lebanon. It issues laws and regulations related to forest and rangelands, and is responsible for mainstreaming, capacity building, and local planning through regional forest centers. DRDNR also monitors and enforces laws and regulations through 220 forest guards and eight agricultural engineers.

*The MoA issues decisions to direct and organize actions affecting the forest sector and forest management.* The MoA submits to the Council of Ministers national programs related to the protection, conservation, use, and restoration of forests and rangelands. The Council of Ministers has the mandate to approve and define the basis of Lebanon's forest policy, while Lebanon's Parliament adopts legislation related to forests. However, the DRDNR is currently crippled by national political standoffs and lack of coordination with other government institutions, and marginalized by internationally supported NGOs. As a result, most of the regional offices and forest centers are understaffed, have multiple responsibilities, and oversee large forest areas that exceed their capacity. In addition, limited coordination with other enforcement agencies such as the national police and justice authorities results in weak enforcement of the law and a reduced ability to stop forest violations.



**The MoE is the primary institution governing the protection and conservation of forest biodiversity and the management of forests inside nature reserves and natural sites.** The MoE is the national authority in Lebanon with the mandate to protect the country's environment and is the lead agency responsible for natural protected area management. As noted earlier, protected areas in Lebanon are divided into the following four categories, each with unique management objectives: nature reserves, natural parks; natural sites, and Himas (Law 130, dated 30/4/2019). The MoE executes its role through the introduction of regulatory instruments; the participation in the formulation of strategies, plans, and programs; and the mobilization of resources for the purpose of ensuring a nationwide enabling environment for sustainable environmental development (UNDP 2017).

**The MoA and MoE have complementary—but at times overlapping—mandates, requiring close coordination.** For example, the management, conservation, and law enforcement functions of forests fall primarily under the MoA, while nature reserves, biodiversity conservation, carbon sequestration, and climate change fall primarily under the jurisdiction of the MoE. With respect to forest fire management, both institutions (the MoA and the MoE) are tasked with implementing specific components of the NFFMS. Regarding land use changes, the MoA issues authorizations for forest land-use changes, while the MoE conducts environmental impact assessments related to land-use changes. Challenges to collaboration, as a result of indeterminate roles and responsibilities, and redundancies between MoE and MoA activities, are most obvious in national reforestation strategies. For instance, in 2001 the MoE initiated and led the National Reforestation Plan to increase total forest cover by up to 20 percent over 20 years. In 2012, the MoA launched the National Afforestation/Reforestation Plan, the “40 Million Trees Campaign,” committing to increase the forest cover from 13 percent to 20 percent by 2030.



© Andrea Kutter, World Bank

**The Disaster Risk Management (DRM) Unit of the Office of the Prime Minister strengthens disaster risk management capacities in Lebanon, which includes managing forest fires.** Established in 2009, the DRM Unit works towards enhancing Lebanon's resilience to withstand natural and manmade disasters, reducing vulnerabilities, maintaining development objectives, and connecting partners to respond to disasters.

The DRM Unit plays a significant role in addressing forest fire disasters, especially by activating the “National Operation Room” and organizing the national response; disseminating a daily fire-risk situation report; taking measurements; conducting analyses, and recommending preventative actions; building capacity and sharing knowledge with governorate focal points; and reporting for regional and local stakeholders.

**The Ministry of Interior and Municipalities plays a direct and an indirect role in forest management and fire mitigation,**

**by overseeing and developing the needs and capacities of municipalities and providing support to control disasters** (such as firefighting through the Civil Defense, and law enforcement through the Internal Security Forces). To ensure the protection and sustainable use of forests, municipalities and communities need to follow laws and regulations; implement operational forest management plans, including reforestation activities; coordinate concerns with ministries and other relevant entities; and help monitor the proper use of the forest resources. Despite their significant role at the local level, engagement by municipalities and communities in general is limited. The forest code mandates municipalities to manage publicly owned forests under the supervision of the MoA and DRDNR according to a specific plan established by a decree (Article 54). In addition, municipalities have designated guards to be approved by the Minister in the MoA (Article 55).

**The Lebanese Army, through the Ministry of National Defense Control, provides support to local communities, including by combating forest fires and engaging in reforestation activities.**

**Through the General Directorate of Land Registry and Cadaster, the Ministry of Finance controls all types of land ownership (public and private), in terms of administrative procedures and financial and tax-related issues and activities.** It also provides the annual budget to the MoA, the MoE, and other entities involved in forest matters. The budget of the MoA has remained well below 1 percent of the total government expenditure for most years since 1994 (International Labour Organization/ILO and FAO 2020). As a result, the allocated budget for relevant forest activities is almost absent.

**The Ministry of Tourism oversees policies and regulations related to the improvement and development of tourism, especially in natural areas and natural reserves.** In 2015, the Ministry of Tourism issued a National Rural Tourism Strategy, which supports nature-based tourism, including activities such as hiking, trekking, bird watching, and mountain biking in natural areas, forests, nature reserves and PAs (Ministry of Tourism 2015).

**Through the National Center for Educational Research and Development, the Ministry of Education and Higher Education develops educational programs, and plans and updates curricula for all fields, including those related to the environment** (See CRDP Lebanon). An environmental education is urgently needed, as sustainable management and protection of natural resources begins at an early age and continues throughout a person's life. Furthermore, environmental education is the cornerstone of long-term environmental strategies for solving and preventing environmental problems and ensuring environmentally sound development (UNESCO

and UNEP 1992). In 1997, environmental education was introduced for the first time in the Lebanese general education curriculum. However, continuous refinement and improvement of these programs is needed to improve the effectiveness of the country's environmental curriculum (Makki et al. 2003).

**The Ministry of Justice is responsible for organising judicial matters, ensuring effective law enforcement, and the application of the related regulations.** It is also responsible for preparing bills and statutory texts and expressing views on relevant matters.

**The National Council for Scientific Research provides ministries with generated data and shared knowledge relating to forest conservation, sustainable forest management, and forest fire mitigation** (AFDC 2019).

### 3.1.2 NON-GOVERNMENTAL ORGANIZATIONS AND UNIVERSITIES

**Lebanon has more than 816 NGOs<sup>6</sup> with environmental objectives registered at the Ministry of Interior and Municipalities (MoIM)** (MoE, UNDP, UNICEF, and UNHCR 2020) (See Annex 2 for examples). In addition, many Lebanese universities are engaged in research and activities related to climate change mitigation; conservation of natural resources; restoration of natural ecosystems following land degradation; assessment of wildfires and the economic value of forest

resources and agroforestry; and so on. Based on the Capacity Needs Assessment report, several national NGOs have been singled out for their positive impact on forest fire and sustainable forest management in Lebanon. Most national NGOs are credited for their advocacy in relation to development and implementation of national strategies, development of guidance notes, and local community capacity building and strengthening. Both NGOs and universities have responsibilities in relation to forest management, fire management, and community engagement, and have implemented several interventions. However, there needs to be more effective coordination between public and private, government and non-government entities, and their research data and findings need to be fed into an open and transparent system, so that everyone will benefit from it (Source: Road Map for an IFFMS). Most NGOs use a participatory, community-based approach for planning and implementing Sustainable Forest Management, as they have expertise in the development of operational management plans, management of forest and trees resources, and the development and implementation of fire management activities (Capacity Needs Assessment). Moreover, several development partners support Lebanon's forest sector through projects with public institutions, universities, and NGOs. However, given the current paralysis in the government, development partners' resources may be steered toward the private sector (universities and NGOs). This will, in turn, further degrade the capacities of governmental entities to fulfill their mandates in the mid and long term.



<sup>6</sup> Refer to Annex 4 for a list of selected NGOs and their field of activity.

© Andrea Kutter, World Bank





## 3.2 Forest law and policy

**Until 1935, Lebanon followed the Ottoman Forest Laws.** In 1949 the government adopted the “Forest Law,” one of the oldest in the region, which covered all forests in Middle Eastern countries that were under the French mandate. This law is still in effect today; it was amended in 2000 (Law No. 195) to include criminalizing illegal operations and acts. Lebanon’s Forest Law outlines forest management and protection, and regulates forest activities including grazing, pruning, coppicing, thinning, and charcoal production. The first clause of the 1949 Forest Law defines the Forest as “a grove that includes different trees wrapped around each other, large or small, and bushes that include trees that are not large and not intertwined with each other, and generally used only for industry and fuel” (translation by the authors). Furthermore, Lebanon’s Forest Law sets a clear classification of forests into four categories, according to ownership.

**In 1991, the Government of Lebanon issued a new law (Law 85) imposing severe restrictions on forest activities to preserve and protect the remaining forests after the long and devastating armed conflict.** The law includes a total ban on harvesting from and cutting resinous trees. It stipulates that all cedar, fir, cypress, oak, juniper, and other forests in Lebanon are protected. While the law has helped protect resinous forests and effectively reduced deforestation, it has restrained the sustainable management of these forests, making them vulnerable to pests and forest fires.

**Between 1991 and today, Lebanon has issued different laws and regulations, at national and international levels, to regulate forest management, usage, protection, conservation, and rehabilitation.** The laws, decrees, and ministerial decisions that regulate the sustainable use and management of forests and Other Wooded Land (OWL) in Lebanon are shown in Box 1, to provide an overview of the legal instruments governing the forest sector. For example, the Forest Law (Law 49) is regulated by four decrees, one of which (Decree 9923) is about the organization of forest guards. The Forest Law was amended by five ministerial decisions related to forest management and the use of forest resources. In terms of regulatory tools and control measures, some laws impose monetary fines for tree-felling for urban expansion and/or for collecting firewood. Nevertheless, these regulatory laws do not deal with management of forests, or address the significant problems facing these forested areas.

Figure 13: Timeline of forest-related laws in Lebanon





In 2015 the Government of Lebanon issued the **Lebanese National Forest Program (NFP)**. The NFP provides a framework for the development of the forestry sector in Lebanon, aligning national goals with international agreements, and modernizing the existing laws and regulations (MoA 2019). Lebanese forests still face many threats like fires, urbanization, unsustainable management, quarries, wars, diseases and so on. For this reason, the German Agency for International Development (GIZ) offered support to the MoA, through the Rural Development and Natural Resources Directorate (RDNRD), to develop the NFP 2015–2025. This is a framework program for the development of the forestry sector in Lebanon and an attempt to guarantee effective organization and collaboration with all public and private stakeholders. A long-term vision and mission were drawn up, focusing on international strategic goals related to forest and rangeland management and conservation, active community participation, and current national policies and strategies (AFDC 2019). The main goal of the NFP is to restore degraded lands and increase forest cover in Lebanon to meet the ecological, social, and economic needs of sustainable forest management at the national and regional levels (MoA 2015). In line with this objective, the Ministry of Agriculture (through the RDNRD) and the FAO launched the

project, Smart Adaptation of Forest Landscapes in Mountain Areas (SALMA). This is fully aligned with this national framework and contributes to forest management through the development and implementation of Sustainable Forest Management Plans on around 1,000 ha. SALMA's particular focus is on increasing the resilience of the forests to climate change, forest fires and insects, pests and diseases, and improving the livelihoods of the local communities (FAO 2016a).

**In 2017, the Government of Lebanon initiated a review of the Forest Code to align with the economic, ecological, and social objectives of sustainable forest management, taking into consideration the diversity of stakeholders and other laws that impact forests and the forest sector.** The MoA put the Forest Code under review and reformed it to align its provisions with new forest and rangeland management approaches and concepts. Much work remains to be done to strengthen inter-institutional coordination and the enforcement capacity of environmental agencies, to tackle legal ambiguities, and to integrate environmental criteria into law more effectively.

**A list of the main national programs and strategies associated with various aspects related to forests is presented in Table 2:**

Table 2: List of main policies and strategies

National programs and strategies	Lead government institution	General objective	Activities/themes
<b>National Strategy for Agriculture Sector 2020–2025</b>	MoA	Improves governance and promotes sustainable use of natural resources	Strengthens management and sustainable use of resources  Promotes sustainable investment and management of rangelands  Regulates management of non-wood forest products
<b>Updated Lebanon's Nationally Determined Contribution (NDC) 2020</b>	MoE	Provides a stepping stone to achieving the Low Emission Development Strategy objectives by 2050	Mobilizes climate action for sustainable development and a green economy  Contributes towards climate mitigation and adaptation
<b>Land Degradation Neutrality (LDN) 2018</b> (A second LDN report is underway)	MoA	Promotes sustainable land management practices and land degradation neutrality	Assesses baseline trends in land cover/land use, land productivity, and soil organic carbon stocks, using geo-processing tools  Maps exposure to land degradation and sets national voluntary targets for land degradation neutrality

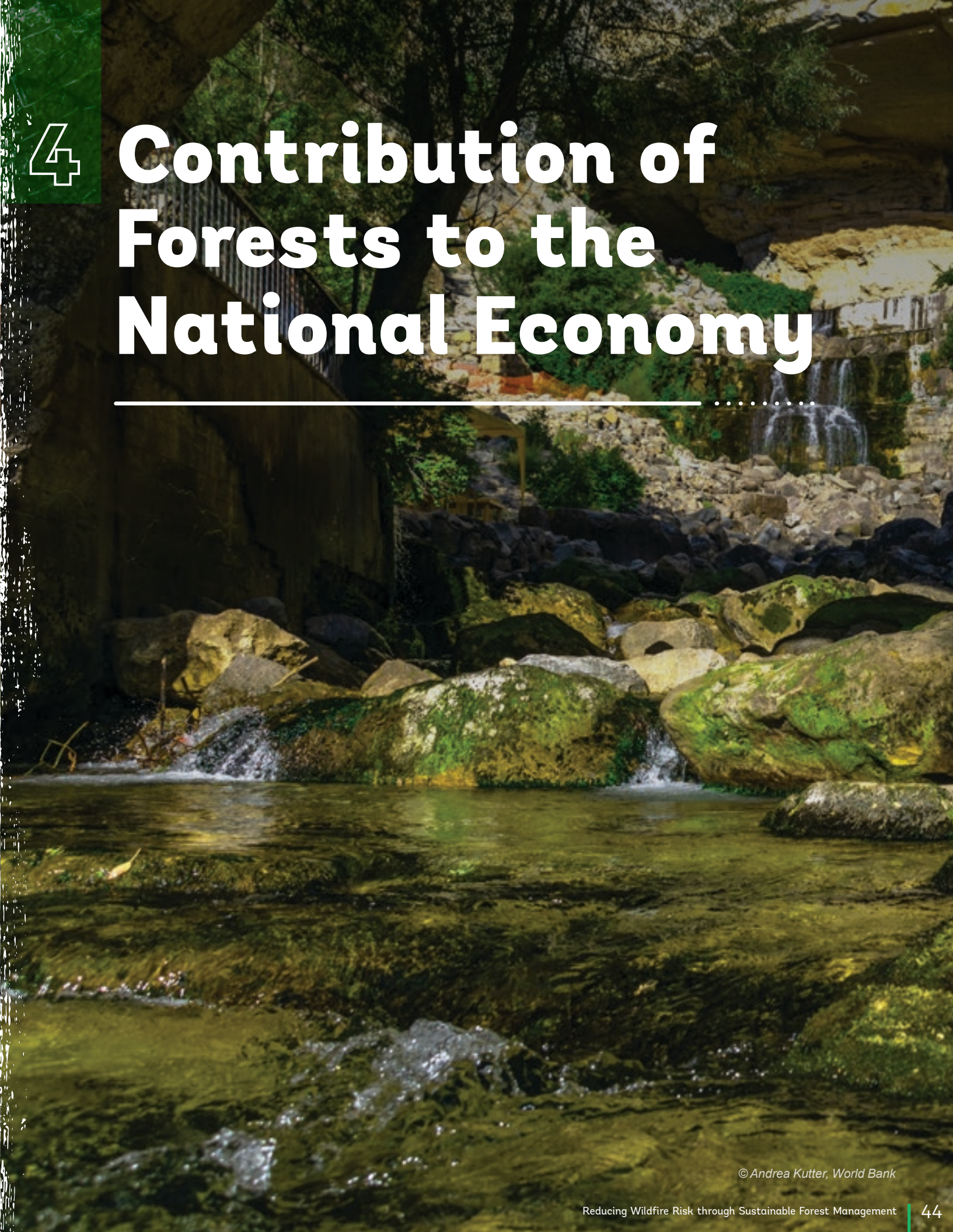
National programs and strategies	Lead government institution	General objective	Activities/themes
<b>Lebanon's National Biodiversity and Action Plan (NBSAP) 2016–2030</b>	MoE	Addresses Lebanon's obligations under Article 6a of the Convention on Biological Diversity and is an update of the country's first NBSAP issued	Mainstreams biodiversity into sectoral and cross-sectoral strategies, plans, and programs
<b>Lebanon National Forest Program (NFP) 2015–2025</b>	MoA	Defines national forest policy	Achieves sustainable forest management (SFM) through establishing restoration and rehabilitation plans in degraded lands and enhancing ecosystem resilience in forestland to mitigate the impact of climate change
<b>National Afforestation and Reforestation Program (NARP) 2014–2028</b>	MoA	Implements the "40 Million Trees Campaign"	Strengthens collaboration between sectors towards a consensual land-use planning system
<b>MoA Action Program 2010–2014</b>	MoA	Adopts integrated pro-grams for forest ecosystems	Promotes sustainable management of forests and forest resources
<b>National Strategy for Forest Fire Management in Lebanon 2009 Decision no. 52/2009</b> (Updated version launched in May 2023)	MoE	Reduces the intensity and frequency of forest fires	Provides a risk-management framework that will focus on the following: <ul style="list-style-type: none"> <li>• Common database on forest fires</li> <li>• Prevention measures to reduce risk</li> <li>• Readiness to fight fire</li> <li>• Response to fires</li> <li>• Recovery after fires</li> </ul>
<b>National Forest and Tree Assessment and Inventory (Final Report 2005)</b> (A new FRA report will be published by the end of 2023)	MoA	Assesses forest resources	Sets plans and programs for forest ecosystems management
<b>National Land Use Master Plan (NLUMP) 2005</b>	CDR – DGUP	Provides master plan for land use on the national level	Accounts for the following, regarding natural resources: <ul style="list-style-type: none"> <li>• Delineation of areas of ecological and cultural importance</li> <li>• Delineation of forest lands</li> </ul>
<b>National Reforestation Plan (NRP) 2001</b>	MoE	Combats desertification and restores degraded land	Increases the forested area of the country by about 20 percent and combats desertification  Provides an implementation instrument with detailed technical methods for afforestation and specifications for seedlings



**Despite the national regulations and policies described above, there are currently few forest management plans in Lebanon.** Forest management planning is new in the Lebanese forestry context. Only a few forest areas, such as Bkassine Pine Forest and Shouf Biosphere Reserve, have taken steps toward forest management planning and implementation. Furthermore, at the national level, the MoA still needs to approve the national forest management guidelines, which are available only in draft form. As mentioned previously, the FAO, through the MoA, is currently implementing SALMA. Funded by the Global Environment Facility (GEF), SALMA will develop management plans for eight different public forests. In addition, the project, Sustainable Land Management in the Qaraoun Catchment (SLMQ) (funded by the GEF, implemented by the UNDP, and executed by the MoE Service of Natural Resources Department of Natural Resources Protection), will develop seven forest management plans.

# 4

# Contribution of Forests to the National Economy





## 4.1 Economic value of forests in Lebanon

Forests in Lebanon are multifunctional, and they play a significant role in the provision of goods and services to local communities that rely on these services for their livelihoods. These forests provide direct goods like pine kernels, honey, non-wood forest products (NWFP), and wood products, indirect ecosystem services like pollination, watershed protection, and carbon sequestration. Furthermore, forests are important tourist and recreational destinations for city dwellers (MoA 2015). The high values for NWFPs and wood products (Sattout 2014) discussed in Section 3.2. demonstrate the potential for investing in small- and medium-size forest enterprises, as well as the significance of empowering women and local communities in managing forests in Lebanon (AFDC 2019).

According to the National Forest Biomass Blueprint (NFBP) (Mitri 2016a), forest biomass is an important measure of ecosystem productivity that is used to quantify the role of forests in the carbon cycle and of providing wood products for energy production. Sustainable forest management, including the extraction of felling and pruning residues from forests, has direct and indirect social, economic, and ecological benefits. These benefits range from ecological goals such as reducing fire risks and controlling pests, to socioeconomic goals related to renewable fuel for energy and economic opportunities in the community. The lack of forest management plans and unsustainable harvesting of forest biomass can pose a threat to forest values—including biodiversity, recreation, water quality, and wildlife habitat. Guidelines for sustainable forest management are necessary to ensure the sustainable use of forest biomass within a multifunctional set of goals.



© Andrea Kutter, World Bank

### 4.1.1 WOOD AND OTHER PRODUCTS

There is only marginal wood (timber) production in Lebanon and the related industry is small and often not profitable. It is estimated that 1 ha of timber from broadleaf trees exploited over a 20-year cutting cycle may generate between US\$2,175 and US\$14,500 (Stephan 2013). The exploitation of wood from coniferous trees remains prohibited (Law 85) and as such these species currently provide no direct economic benefits. Timber extraction has declined in Lebanon over the past few decades due to deforestation, illegal logging, and climate change, all of which have led to a decrease in the country's forest area (Fakhoury et al. 2020). Consequently, Lebanon has become heavily reliant on imported timber to meet its demand (UNDP 2019). According to the International Trade Centre, Lebanon imported around US\$107 million worth of wood products in 2019, with most of it coming from Europe and North Africa (UNDP 2019). This heavy reliance on timber imports has made Lebanon vulnerable to market fluctuations, price increases, and supply chain disruptions.

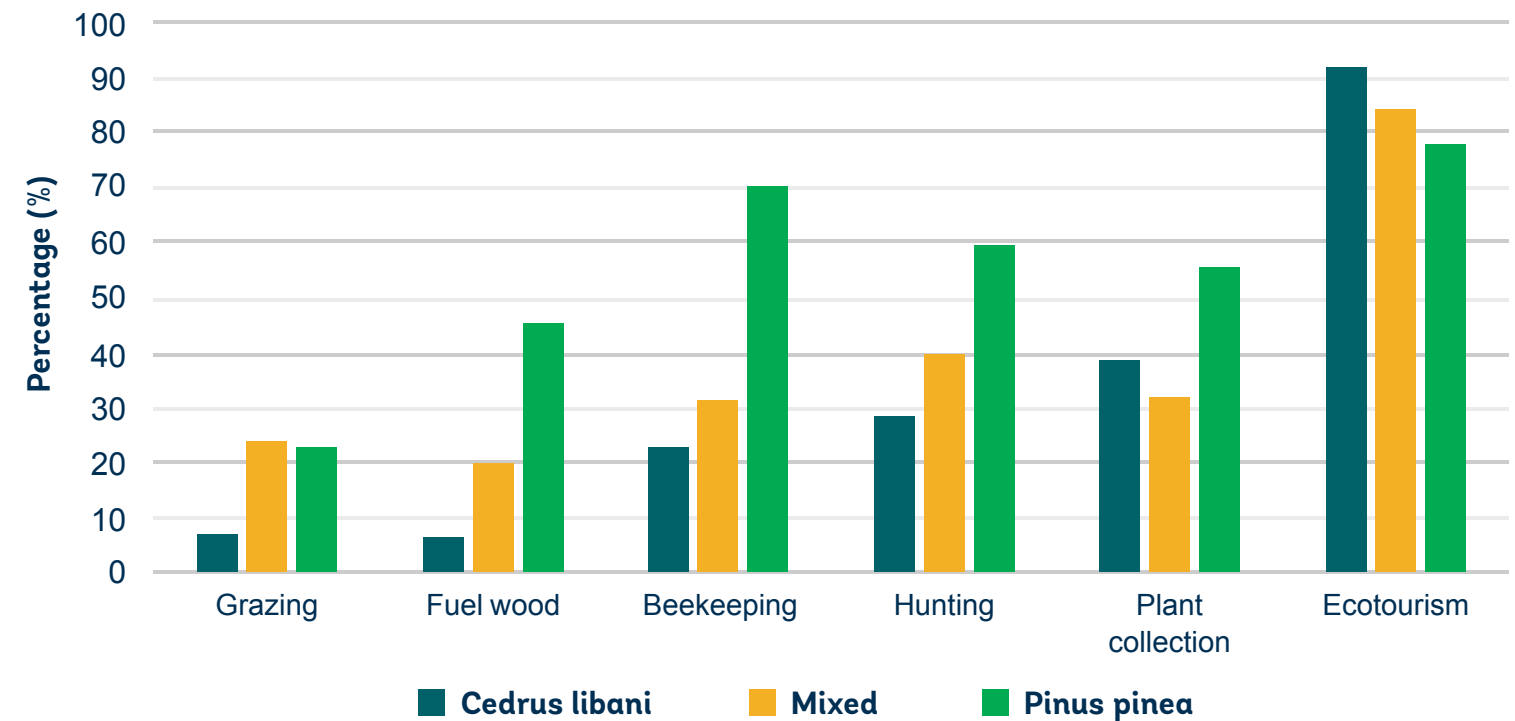
Fuelwood and charcoal in Lebanon have significant socioeconomic implications. It is estimated that using fuelwood for heating in rural areas would save US\$425 for each ton of imported fuel oil (Stephan 2013). Fuelwood resources in Lebanon include harvest residues; small diameter trees; trees removed for degraded stand rehabilitation; trees damaged by wildfire, insects, and diseases; and short rotation woody crops. Pruning and thinning in forests can also provide significant wood resources (Mitri 2016b). Permit-based harvesting is currently allowed only in broadleaf forests (FAO 2010). The consumption of fuelwood for heating and cooking is quite common in the highlands of Lebanon; a case study report indicated that almost 20 percent of mountain village residences consume around 190 tons of wood per year (Saad et al. 2020). The baseline inventory of energy consumption calculated by the study revealed that wood remains an important source of energy, supplying 4,219 MWh to residential buildings after domestic diesel (10,981 MWh), while the rest is supplied by solar thermal energy (1,722 MWh) and by liquid gas (1,599 MWh) (Saad et al. 2020).

Investing in forest wood biomass for bioenergy in Lebanon is challenging because outdated laws make it difficult to establish sustainable harvesting. In addition, many forests are located on private land, which adds additional challenges and limitations. Therefore, the national forest strategy seeks to increase forest areas on public lands. According to data from FAO, Lebanon's forest area has decreased by almost half: from 576,000 ha in 1990 to 284,000 ha in 2020 (UNDP 2019). This decrease is primarily attributed to deforestation, which has occurred at an alarming rate, with estimates suggesting that the country loses around 1 percent of its forest cover every year.

### 4.1.2 NON-WOOD FOREST PRODUCTS

Non-wood forest products (NWFPs) are an important income-generating resource in rural areas of Lebanon, generating an estimated US\$80 million to US\$97 million in annual sales, and providing primary and secondary income to 10,000 to 15,000 rural households. In 2016, FAO published a comprehensive report that lists the main NWFPs currently used in Lebanon. It outlined the value chains for the following fire-related products: pine seeds, honey, Syrian oregano (*Origanum syriacum*), sage (*Salvia fruticosa*), carob (*Ceratonia siliqua*), and laurel (*Laurus nobilis*). Thus, upgrading and supporting the NWFP value chains can aid forest conservation as well as the sustainability of rural communities' livelihoods. Below is an example of multifunctional values of Lebanon's forests.

Figure 14: Different usage of each forest type by the local community



#### ◆◆◆ Pine nuts

Pine nut exploitation covers 5,684 ha of land, accounting for about 2.6 percent of total forest cover (AFDC 2019). Stone pine forests are found mostly on the western slopes of Mount Lebanon, and are particularly present in the Metn, Baabda, and Jezzine areas, at elevations ranging from sea level to 1,500 meters. Other types of pine forests are found at lower elevations, whereas *P. brutia* forests cover a large area in North Lebanon (Hamade 2016). The average production of pine nuts has decreased by 40 percent to 60 percent (MoA 2021 private

interview) compared to the previous range of 800 to 1,000 tons per year reported by FAO in 2012. Lebanon exported 44 tons of pine nuts in 2014 and 30 tons in 2015, for a total value of US\$0.9 million and US\$0.27 million, respectively. The quantity of *P. pinea* nuts produced in Lebanon is limited by the excessive costs of harvesting and unsustainable forest management practices. As a result, it is critical to focus on quality promotion—including branding and sign-value—and the long-term viability of forest-use activities (Hamade 2016).



## Honey

*There are about 6,200 beekeepers in Lebanon (MoA and FAO 2010). Honey production is estimated at 1,620 tons per year, with a total estimated value of US\$32 million, of which US\$23 million is attributed to forests and shrubland honey (United States Agency for International Development (USAID) 2013). Lebanon exports 50 tons of honey per year for a value of US\$0.63 million, whereas imports are much larger—around 250 tons of honey were imported in 2014 for a value of US\$2.54 million (Lebanese Customs 2018).*

*In Lebanon, beekeeping is a complementary activity for both farmers and other individuals, and it provides a significant source of secondary income.* Honey is produced primarily from two sources: 1) forest and shrubland/forest-

based honey made from honeydew (oak and cedar honey) and wildflowers like Syrian oregano, and 2) orange blossom honey, which is estimated to account for one third of total Lebanese honey production and is 33 percent cheaper than forest and shrubland honey (Hamade 2016, AFDC 2019).

*The honey sector in Lebanon is underutilized; honey production remains below the country's potential.* There is a possibility of increasing honey production by capitalizing on export markets to both the Gulf Council Countries and countries of the Lebanese diaspora. Furthermore, policymakers and state institutions can use honey production as a rural development tool, contributing to poverty alleviation and valorizing local forest and natural resources (Hamade 2016).

## Aromatic and Medicinal Plants

*The aromatic plant Syrian oregano (Origanum syriacum) is the most collected wild plant in Lebanon. Its annual collection volume is estimated to be around 1,000 tons and 1 kilogram of the product is valued between US\$5.6 and US\$30, depending on quality (AFDC 2019).* Syrian oregano can be found in forests, shrubland, and wooded areas, as well as non-wooded areas—particularly at altitudes ranging from 200 to 1,500 meters, on Lebanon's Western Lebanon Mountain Range.

*The collection value of non-processed, non-mixed Syrian oregano is approximately US\$5.33 million.* In 2014, the total export of dried and za'atar mixes was estimated to be 548 tons, worth approximately US\$1.9 million. Approximately 32 tons of za'atar mixes, with a value of US\$270,000, are imported from Jordan and Syria (AFDC 2019).

*Direct sales are made by: (i) local collectors and processors, who sell to consumers in the area and neighboring villages, through direct channels; (ii) women's cooperatives, which assist local collectors in selling their products by participating in fairs, local exhibitions, and specialized news sources, (iii) nature reserves that have invested significantly in developing branded local traditional products, such as za'atar mixes.* For example, the Shouf Cedar Nature Reserve purchases hand-ground Syrian oregano from local collectors at a premium price of US\$17 per kilogram, and then creates specific za'atar mixes, including a traditional local mix containing Aleppo pine (*Pinus halepensis*) nuts, which sells for US\$30 per kilogram (Hamade 2016).



*Sage (Salvia fruticosa), a medicinal herb, is another important plant collected in Lebanon.* Every year, 600 to 1,000 tons of sage are collected, with a total value of US\$1.8 million to US\$3 million. Sage is sold to traders at US\$3 per dried kilogram. A small portion of the product is sold on the local market, and the remainder is sold to Jordan (AFDC 2019).

## Carob products

*Total annual carob production is estimated at 2,200 tons of pods, producing around 220 tons of seeds, and 660 to 770 tons of molasses (FAO 2016a).* *Ceratonia siliqua*, also known as the carob tree, grows along Lebanon's coast and on Mount Lebanon's western slopes, up to an elevation of 800 meters. Carob trees are planted as part of reforestation activities. After pitting, carob pods are transformed into molasses. The National

Agricultural Survey estimates that there are about 1,400 carob plantations covering about 240 ha. Moreover, Lebanon was estimated to have exported 154 tons of carob molasses in 2014. The goal is to increase carob molasses production to meet the potential demand of the Lebanese diaspora as well as the growing demand in niche food markets (GIZ and MoA 2016).



## Laurel

*Production of laurel oil in Lebanon is a small-scale, regional endeavor, with an estimated household production of 64 kilograms per season and earnings between US\$800 and US\$1,200 per season.* Historically, the fruits were extracted for oil and the leaves were used as a cooking spice in Menjez, Akkar, in northern Lebanon, as well as in Aita Al-Shaab and the surrounding villages in southern Lebanon. Essential oil has traditionally been used to make soap, whereas laurel essential oil is used in the cosmetic industry. The total oil production is estimated to be around 7 tons of laurel crude oil worth US\$112,000. In 2014, less than 15 tons of oil, including laurel oil, were imported at a cost of US\$120,000 (Lebanese Customs 2018).

*Overexploitation of this resource is indirectly prevented by labor-intensive production processes and difficult access to border forests.* Additionally, there are few chances for production to increase, especially given that soap manufacturers' access to Syrian laurel oil is anticipated to bring down prices.





### 4.1.3 ECOSYSTEM SERVICES

Lebanon's forests contribute 0.5 percent of the country's GDP. One ha of forest land in Lebanon is assumed to have a total economic value (TEV)<sup>7</sup> of US\$296. This is a high value compared to other Collaborative Partnership on Mediterranean Forests (CPMF)<sup>8</sup> countries (Table 3). Based on the NFP 2015–2025, the total value of forest products and services with sustainable management and adequate implementation of NFP requirements may reach US\$181,274 million. This would equate to US\$587 per ha (MoA 2015). This estimated value is higher than the corresponding TEV for Lebanon, which in 2010 was calculated at US\$296 per ha.

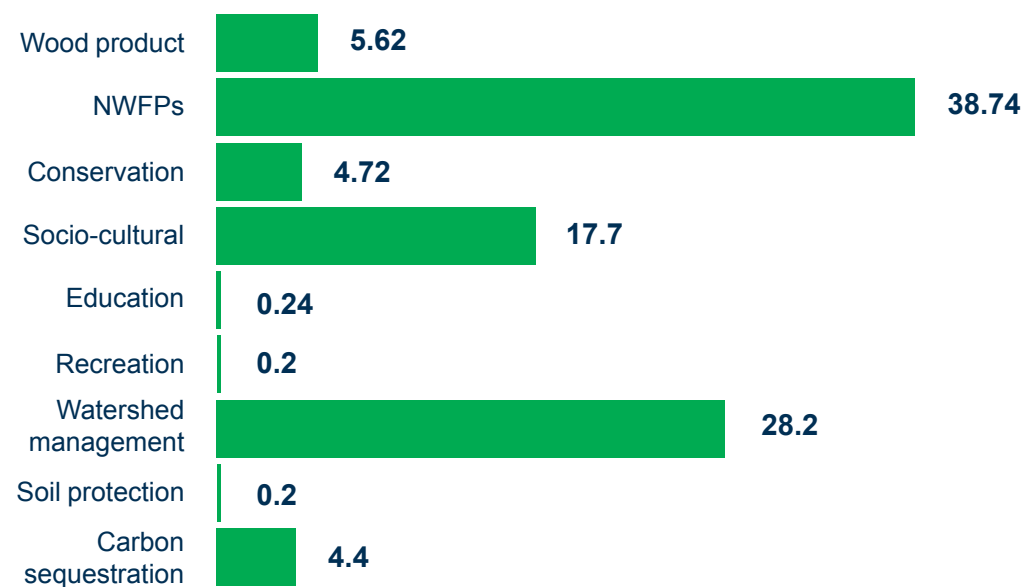
Table 3: Value of forest benefits in CPMF countries (US\$, 2010 prices) (Source: Croitoru and Liagre 2013)

Country	WFPs*	Grazing and NWFPs <sup>b</sup>	Recreation, hunting	Watershed protection	Carbon <sup>d</sup>	Biodiversity	TEV
Algeria	-7	47	n.c	32	-3	n.c	69
Morocco	29	44	-6	29	-3	n.c	94
Tunisia	6	73	1	26	3	9	112
Lebanon	-10	187	125	n.c	-15	8	296
Syria	4	10	n.c	101	8	n.c	123
Turkey	32	21	1	-8	11	7	63
<b>Weighted Average*</b>	<b>25</b>	<b>31</b>	<b>n.c</b>	<b>8</b>	<b>6</b>	<b>7</b>	<b>77</b>

Accordingly, the NFP estimate is a good indicator to guide the present national policy. Provisioning services, on which local communities rely, account for 44 percent of the benefits of ecosystem services. NWFPs have the highest benefit (38.74 percent), and cultural services account for approximately 18

percent of all services, with education and recreation identified as integral components. These latter are partly dependent on the conservation of forest ecosystems (habitat/support services), the value of which accounts for 4.7 percent of total forest benefits (Figure 15) (MoA 2015).

Figure 15: Distribution of the values (percent) of Lebanese forest ecosystem services components (Source: MoA 2015)



<sup>7</sup> Based on the Organization for Economic Cooperation and Development (OECD) definition, TEV is the overall economic value of a particular natural resource, considering both use and non-use values.

<sup>8</sup> The Collaborative Partnership on Mediterranean Forests (CPMF) countries are Algeria, Lebanon, Morocco, Syria, Tunisia, and Turkey.

Additionally, in Lebanon, culture and nature have interacted closely to create distinctive cultural landscapes heavily reliant on the natural world and its resources (AFDC 2019). Traditional Lebanese cuisine, for instance, frequently uses NWFPs like pine, molasses, and several types of sweets made from local products, fostering a close relationship and interaction between local cultures and the forest as a resource.

The hotspots of forest ecosystem services are highlighted in a new report from Lebanon Reforestation Initiatives (LRI 2021). The report enables comparison of the total value of four ecosystem services offered by the forests in each district, including forest tourism, carbon sequestration and storage, improved air quality, and forest honey.

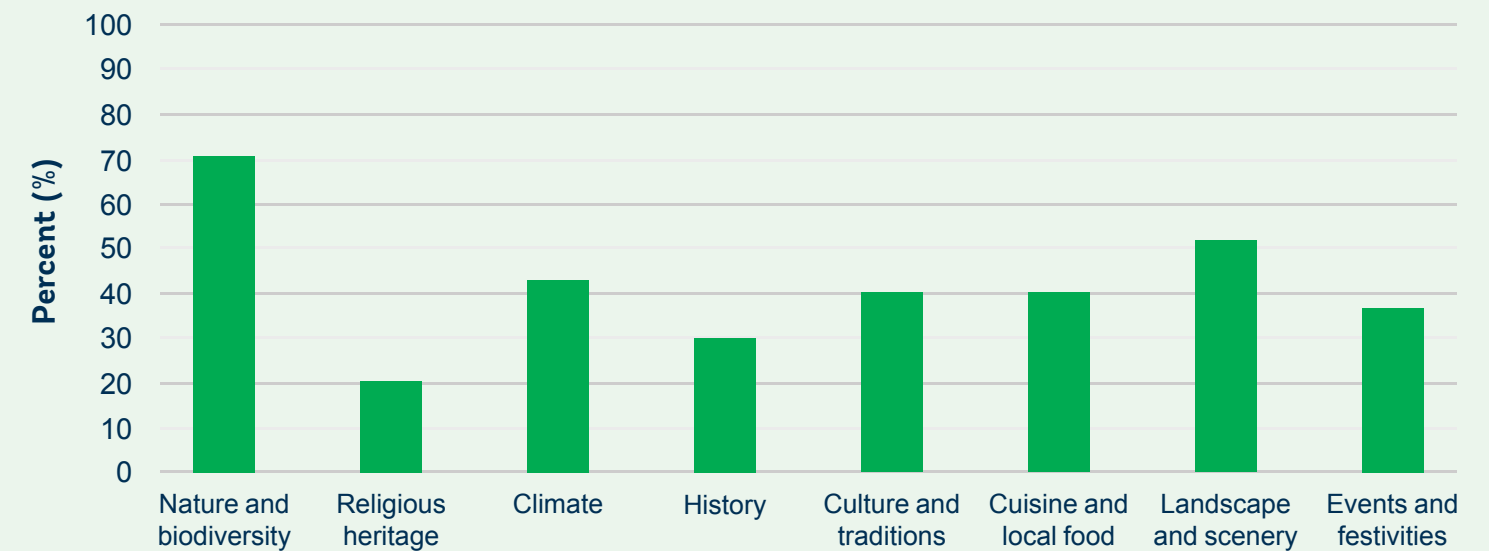
Additionally, it demonstrates that in most Lebanese provinces, recreational services (forest tourism) and forest honey (provision of NWFPs) were most important and offered the highest economic value.

Earlier studies on forest ecosystem functions and services in Lebanon have provided area-based valuations of services, such as in the Shouf Biosphere Reserve (ECODIT 2015) or the Jabal Moussa Biosphere Reserve (Karam 2016). Others have presented a TEV of forest ecosystem services in Lebanon, ranging from wood products to tourism and grazing (Merlo et al. 2005). More recent studies have confirmed the main findings and provided updates and further details.

### 4.1.4 NATURE-BASED TOURISM

Domestic rural tourism is an important sector in Lebanon. It attracts city residents and the Lebanese diaspora seeking the tranquil atmosphere of traditional villages, intermixed with agricultural lands, attractive scenery, and forests that harbor rich biodiversity. A recent study (Amidi et al. 2020) evaluated the ecosystem services of old reforested sites from the perspective of neighboring local communities. The results demonstrate the range of uses and benefits (aesthetic and touristic or recreational services) that local people attribute to the Lebanese forest landscape (Figure 16). Another study on rural tourism in Lebanon (Ghadban et al. 2017) revealed that the natural beauty and biodiversity of rural areas was one of the main drawcards for respondents (71.3 percent). Of the respondents who visited these areas, 51.4 percent mentioned the landscape and scenery.

Figure 16: Factors that attract visitors to rural areas



While the nature-based tourism sector generates revenues, it is an unorganized sector that does not contribute to forest conservation and restoration (Abou Arrage et al. 2019). This is because tour operators generally do not comply with international regulations and few professionals are specialized in the field.

Significant forest and woodland areas (40 percent) are owned by religious entities (Christian, Muslim, and Druze) and can serve as destinations for general wellbeing and

spiritual wellness. This land, or Waqf in Arabic, is another significant cultural asset of Lebanon's forests (AFDC 2019).

The cedar of Lebanon (*Cedrus libani*), and hence cedar forests, have a unique national, cultural, religious, and historical value and, ecologically, the species is regarded globally as a flagship species. The Lebanese flag features the cedar tree, which is thought to be the most symbolic of all local trees.



# National Forest Challenges

Forests in Lebanon are highly fragmented, and they are losing the ability to regenerate, causing many forest landscapes to disappear. The terrestrial ecosystem is constantly suffering from habitat loss, fragmentation, and destruction. The major causes that are responsible for this phenomenon are listed in the following paragraphs. In Lebanon, uncontrolled urbanization is the main cause of the loss, fragmentation, and destruction of terrestrial ecosystems and their habitats (MoE, UNDP, and GEF 2015). In the absence of a national database on forests, access to national data and information on forests by relevant entities remains a challenge, impacting the planning and implementation of sustainable forest management (SFM).

**Making informed decisions on the management and protection of forests becomes difficult without precise and up-to-date information.** As a result, resources may be allocated inefficiently, regulations and initiatives may be unsuccessful, and hazards like pest outbreaks and wildfires may not be adequately addressed. Without a national database, it is also difficult to track changes in forest cover and gauge the success of long-term forest management measures.

**The sections below shed light on direct and indirect drivers of forest loss and degradation in Lebanon.** These include:

- Land-use changes resulting from urban expansion and infrastructure development
- The expansion of agricultural areas
- Unregulated quarries
- Unsustainable harvesting of firewood and charcoal production
- Overgrazing
- Increased incidences of pests and diseases affecting forests due to various stresses, including climate change.

## 5.1 Drivers of deforestation and forest degradation

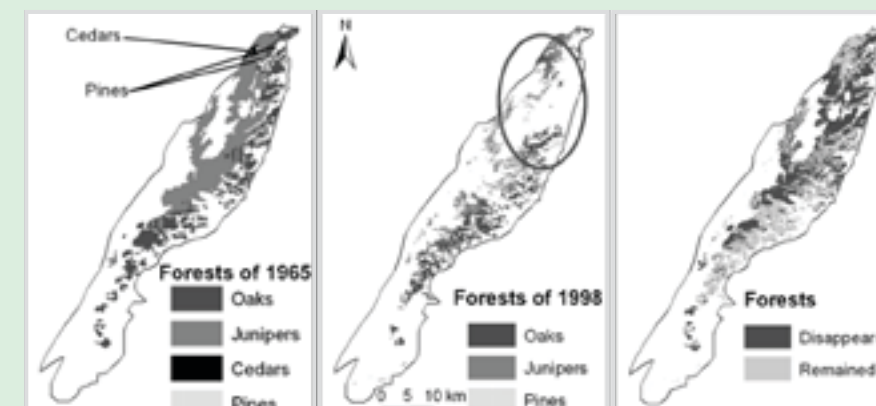
### 5.1.1 DIRECT DRIVERS

#### Urban expansion

**A recent study of changes in land use/land cover between 1984 and 2019 (Al-Shaar et al. 2021) found that vegetation cover has increased slightly over the years and that the effect of urban expansion on forests differs with topography.** While urban growth expanded into forest areas in flat lands (Bekaa, north, and south Lebanon), it did not do so in humid and fertile mountains (Mount Lebanon) and in arid mountains (Bekaa). Although revealing, these studies do not reflect the long-term impact of urban expansion on forests. In addition, when total

forest area is reported, it does not reflect forest fragmentation, which results in small forest patches that are more susceptible to external disturbances and biodiversity loss (FAO 2012). For example, Figure 17 shows how extensive and uncontrolled anthropogenic activities on the eastern flank of Mount Lebanon have led to a 50 percent decrease in total forest cover and a 50 percent increase in the number of forest patches, from 131 to 730 (Jomaa and Khater 2006).

**Figure 17:** Increase of forest fragmentation between 1965 and 1998 on the eastern flank of Mount Lebanon



**With more than half the Lebanese population living along the coast, forests along the Lebanese coastline are highly threatened by urban expansion.** In fact, anthropogenic activities in the coastal zone have led to major transformations in recorded land cover/land use. Between 1998 and 2010, large areas of grasslands, forests, agricultural lands, and sea were transformed into artificial lands<sup>10</sup> (Figure 18) (MoE, UNEP and UNDP 2013).

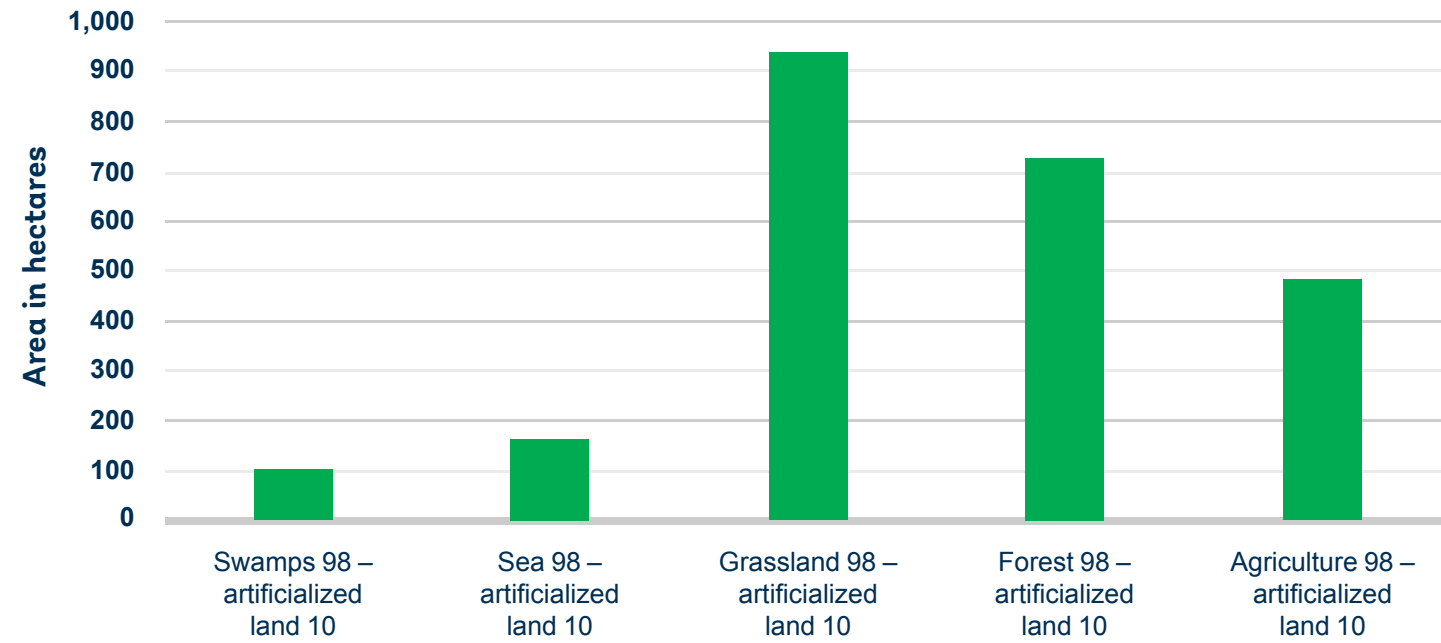


© Andrea Kutter, World Bank

<sup>10</sup> Non-built artificial zones: This category includes quarries, dumpsites, landfills, sea reclaimed land, construction sites, and urban vacant plots. Artificial green zones: This category includes sport centers and public parks.



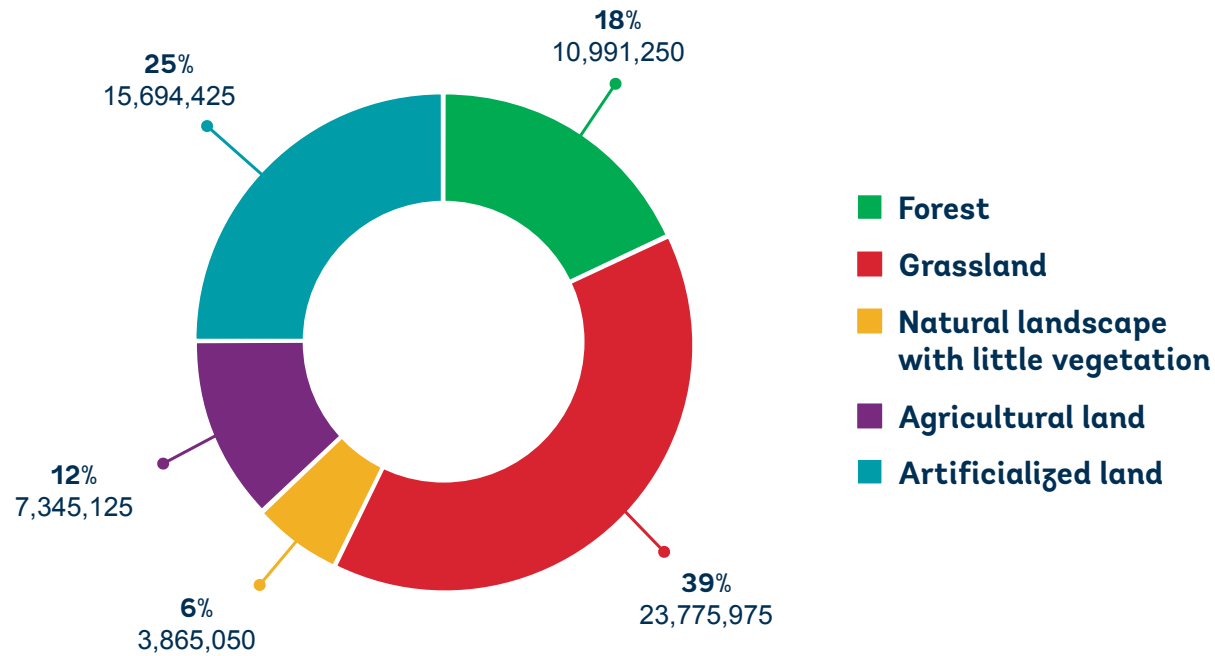
Figure 18: Extent of artificialization in the coastal zone between 1998 and 2010



### Quarries

Mapping the location of quarries in Lebanon between 1989 and 2005 shows that quarrying activities destroyed 738 ha of grasslands, 676 ha of arable lands, and 137 ha of forest area (Darwish et al. 2011). The number of quarries since then has increased exponentially: in 2021 the number recorded was 1,425. This has destroyed 6,172 ha, including 2,378 ha of grassland and 1,099 ha of forest. (Figure 19) (Mitri et al. 2021).

Figure 19: Extent (in square meters) and percentage of land-cover types affected by quarries (Source: Mitri et al. 2021)



Efforts to control quarrying have failed because such activities are extremely lucrative. This conduces to corruption at the political and public levels, which leads in turn to poor law enforcement. Quarrying activities accelerate the erosion processes and subsequent destruction of existing arable lands, modify pre-existing ecosystems, change landscape patterns and integrity, destroy natural habitat, and interrupt natural succession (Khater et al. 2003b).

### Uncontrolled fuelwood and charcoal production

The main reported economic activities in oak—and to a certain extent pine—forests, is the production of fuelwood and charcoal (FAO 2016b). These activities are causing degradation of forests and woodlands because they are associated with unsustainable, and often illegal, cutting and production methods. In some remote areas this leads to fuelwood scarcity (Figure 20).

Figure 20: Charcoal production (left) and illegal and unsustainable tree cutting (right)



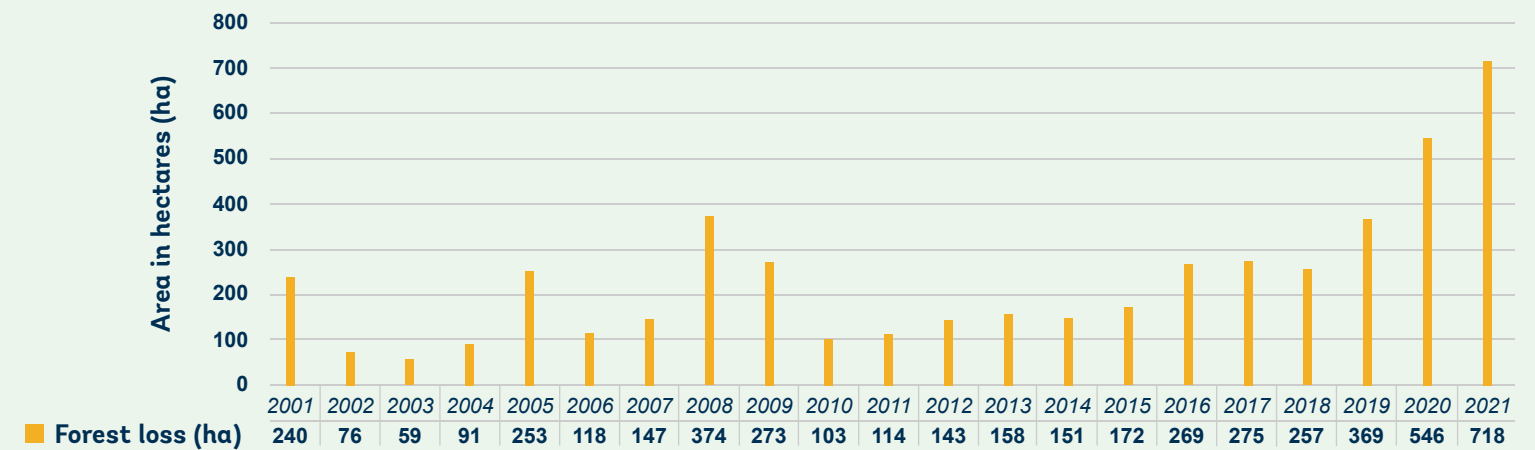
The MoA is the government authority that provides licenses for fuelwood collection and charcoal production. However, the Ministry has limited information on the yearly production of fuelwood and charcoal. National data from the archive of the

MoA (RDNRD) for the years 2007 to 2008, as well as from the MoE for the same years, showed an annual average revenue of:

- US\$986,000 from bidding for the use of forest in communal lands
- US\$23,000 from tree cutting and charcoal production licenses (that is, 450 licenses for about 6,000 tons in 2008) (Mitri 2018)

Estimates from 2010 indicated that fuelwood cutting generated US\$1,155,000, and charcoal production generated US\$9,500,000. In recent years, the dire economic situation and the increase in fuel prices has forced people—particularly poor and vulnerable communities—to rely on wood for heating and cooking, resulting in a drastic increase in the demand for fuelwood and charcoal (MoE, UNDP, UNICEF, and UNHCR 2020). An annual estimation of forest loss due to cutting activities for fuelwood, charcoal production, and other uses, sheds light on the significant negative impacts of these activities, which are leading to the loss of more than 200 ha of forest each year. This trend has peaked in the past three years in response to the multiple crises in Lebanon (Global Forest Watch 2022) (Figure 21).

Figure 21: Estimation of forest loss from 2001 to 2021 due to cutting activities (for fuelwood and other uses)



Source: Based on data from Global Forest Watch 2022 <https://www.globalforestwatch.org/>



## Fires

### Every year, 1 percent of Lebanon's forests are affected by fires.

With an average frequency of 177 forest fires per year, affecting around 1,500 ha of forested areas, fires pose a major threat to forests in Lebanon (MoE and University of Balamand (UoB) 2021). Most fires occur between April and November and affect mixed forests and needle forests, driving forest degradation and loss. For example, a large forest fire in Akkar between 28 July and 3 August 2021 destroyed 1,200 ha of pine forest (*Pinus brutia*) (FAO and MoA 2021) (Figure 22). The causes of half the forest fires are reported as unknown, while the remaining fires are associated with negligence, activity in nature, arson, and—to a lesser extent—agriculture and landfill. For example, between 2008 and 2021, the causes of forest fires were recorded as 57 percent unknown, 19 percent due to negligence, and only 1 percent due to agricultural activities (MoE and UoB 2021). Regardless of the causes of forest fires, the past three years (2019, 2020, and 2021) have been particularly damaging, owing to increasing fire frequency and severity. Between 2008 and 2021, 67 percent of forest areas have been reported destroyed (MoE and UoB 2021). The effect of forest fires will be discussed in greater detail in Chapter 7.

Figure 22: Aakar: Hermel forest fire in 2021 (Source: FAO 2021)



© Joseph Eid/AFP, The Guardian



© Hussein Malla/AP, The Guardian



© Andrea Kutter, World Bank



© Andrea Kutter, World Bank

## Pest and insect outbreaks

### Pest and insect outbreaks occur naturally in forest ecosystems.

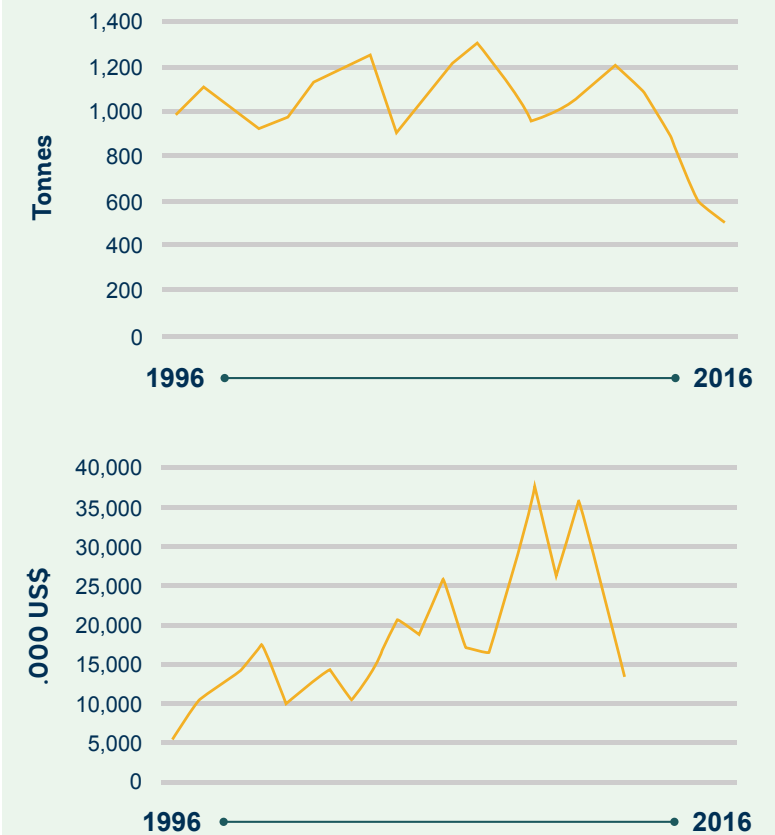
However, in Lebanon anthropogenic pressures on forests have reduced the health of trees and increased their vulnerability to infestation (MoE, UNDP, UNICEF and UNHCR 2020). Below are three recent examples of severe damage caused by insect outbreaks:

- The cedar web-spinning sawfly (*Cephalcia tannourinensis*) has damaged the Tannourine-Hadath El-Jebbeh Cedar Forest, destroying more than 600 ha of cedar. The MoA-DRDNR has responded to this threat by taking measures that have successfully controlled the spread of this insect since 2004 (Nemer and Kawar 2005). Scientists believe that outbreaks of the web-spinning sawfly are related to stress experienced by the trees due to climate change (Al Khoury et al. 2021). The resulting decline affects regeneration capacity, which can lead to forest loss (Bassil et al. 2018).
- The Western conifer seed bug (*Leptoglossus occidentalis*) is attacking stone pines (*Pinus pinea*). This insect feeds on the pine seeds while inside the cones, causing them to dry out and fall from the tree. Studies have reported that, between 2012 and 2017, cone production declined by 50 percent, while the percentage of damaged seeds increased on average from 3 percent in 2012 to 60 percent in 2017 (el Khoury et al. 2021). The resulting economic loss from this pest outbreak is reported as a decline of the net revenue of pine nuts production from US\$35 million to US\$15 million (Sattout and Faour 2017) (Figure 23). Despite its limited resources, DRDNR has succeeded in reducing *Leptoglossus occidentalis* outbreaks.

- The gypsy moth (*Lymantria dispar*) is destroying oak forests in Lebanon, infesting the oak species *Quercus calliprinos* and *Quercus infectoria* in particular (Moussa et al. 2021). In 2019, a gypsy moth outbreak in the Aamiq region damaged more than 160 ha of oak trees and, in 2020, another outbreak occurred in the Deir El Ahmar region (north Bekaa). Following a successful trial in Ammiq in 2019—which reduced the gypsy moth population by 90 percent by mass-trapping the insect with pheromone lures in different oak forests (Nemer et al. 2020)—the MoA launched a pest-management strategy using the same method. Additional biological control was applied by air-spraying *Bacillus thuringiensis* on more than 25,000 ha, covering most of the oak forests in Lebanon. However, gypsy moth is still a great threat to Lebanon's oak forests, especially as the forests are simultaneously affected by other invasive insects: the oak moth (*Thaumetopea* sp.), which causes defoliation, and the oak leaf miner (*Phyllonorycter libanotica*), which causes desiccation of leaves.

**Insect and pest outbreaks can have a negative influence on the livelihoods of those who depend on Lebanon's forests for wood, pine nuts, and honey production.** On a national scale, comprehensive management techniques for forest insect outbreaks need to be established and successfully implemented. These should involve monitoring and early detection, biological control, and chemical control.

Figure 23: Average annual production in tonnes (top) and variation of net revenue from pine-nut production in US\$ thousand (bottom) between 1996 and 2016





## Overgrazing

Overgrazing in Lebanon has been reported for many years as one of the main causes of land degradation, leading to soil erosion, loss of vegetation, and an increased risk of wildfires. In 1980, the FAO estimated rangelands to constitute 52 percent of Lebanese territory (FAO 1980). In 2008, available rangeland area was reduced to 400,000 ha—equivalent to 38 percent of Lebanon’s territory—due to erosion, agricultural expansion, and urbanization (Darwish and Faour 2008). Overgrazing leads to a decline in biodiversity, as it reduces the availability of food and habitat for wildlife. Studies have shown that overgrazing is widespread in Lebanon, particularly in the mountainous and semi-arid regions of the country, where grazing animals outnumber the carrying capacity of the available land. Considering the poor productivity of rangelands, the carrying capacity of rangeland in Lebanon does not exceed 800,000 small ruminant heads (Darwish and Faour 2008). The heads of goats and sheep in 2021 exceeds this limit and is estimated at 531,289 and 431,285 respectively (FAOSTAT 2023).

Lack of official and updated data on rangelands (including data relating to carrying capacity and livestock) restricts opportunities to ensure sustainable management of these resources. However, SLMQ (Sustainable Land Management in the Qaraoun Catchment) (MoE, UNDP, and GEF 2018) included the development of national guidelines for rangeland management. To delineate rangelands at the national level, a set of biophysical and topographic conditions were created as part of the characterization of rangelands. To improve management, and to encourage managers and practitioners to use the recommended tools and procedures, the project then included mapping possible grazing sites.

New management strategies need to address the restoration of rangelands, the development of sustainable grazing management plans, and the use of alternative land-use practices such as agroforestry. Additionally, education and awareness can help to change the attitudes and behaviors of farmers and herders, encouraging them to adopt more sustainable land-use practices.

## Political instability

Political instability has dominated Lebanon for the past several years. The ongoing political uncertainty also negatively impacts forest management and conservation, as it makes it difficult to enforce laws and regulations, and to plan and implement effective management strategies. In effect, poor governance of the forestry sector is one of the root causes of many drivers of deforestation and forest degradation. This is evidenced by the non-enforcement or ineffective implementation of forest laws, policies, forest management plans, and protected areas management. In addition, poor governance has resulted in a paucity of decisions on operational directives and guidelines for the implementation of forest management plans. Weak and inadequate human and financial capacities in turn impact the ability to implement and monitor action plans, incentivize programs and enforce laws.



### 5.1.2 INDIRECT DRIVERS

There are several indirect drivers of forest degradation in Lebanon, which are related to broader social, economic, and political factors. Therefore, addressing socioeconomic factors is important for the sustainable management and conservation of Lebanon’s forests.

## Education and awareness

Limited knowledge and cultural appreciation of natural resources in general, and forests in particular, are significant factors driving forest degradation. There is a pressing need to invest in formal education, conduct awareness campaigns, promote alternative livelihoods, and address poverty and inequality. The lack of understanding of the importance of sustainable land-use practices or the long-term consequences of certain actions often leads to engagement in activities that can result in forest degradation. Illegal logging, over-harvesting of NWFPs, and conversion of forestland to agriculture, in turn

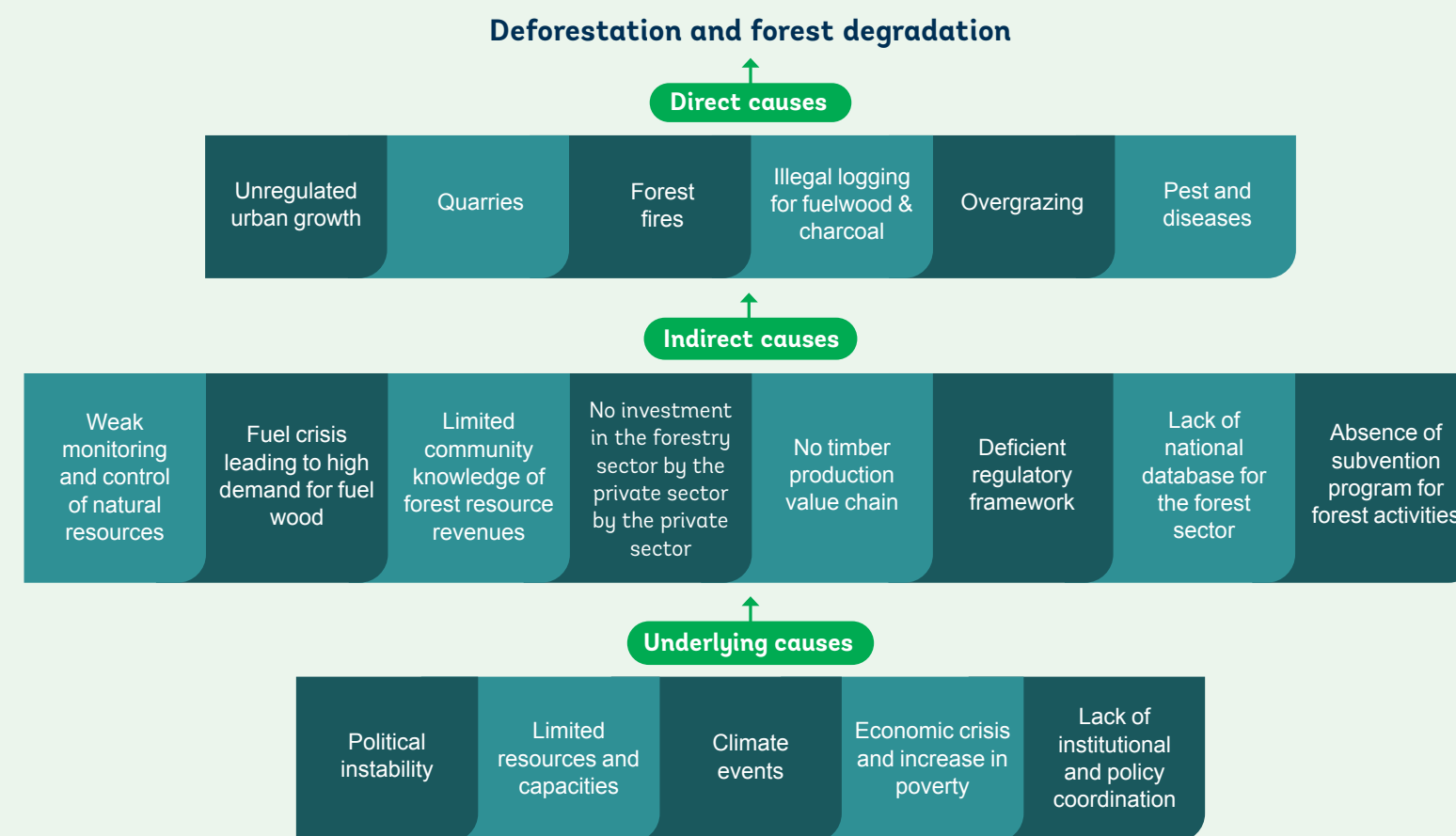
contributes to the loss of forest cover and biodiversity. In addition, limited awareness of the economic and social benefits of forests (such as carbon sequestration, water regulation, habitat provision, and recreation) and the importance of sustainable forest management practices (such as fire prevention, pest and disease management, and reforestation) may lead to actions that further aggravate forest degradation. Ignorance of the legal framework and regulations, policies, and national plans that govern the use of forest resources, can also contribute to the degradation of forests.

## Economic crises

Recently, multiple crises have threatened Lebanon’s overall development path and the sustainable development of the forest sector. The Covid-19 pandemic, the pressure on natural resources due to the influx of displaced Syrian people (Government of Lebanon and United Nations 2021), and the Beirut port explosion worsened the country’s acute and ongoing economic crisis. While biophysical indicators directly influence land and forest degradation, Lebanon has become less resistant to shocks and its adaptation

capabilities are in jeopardy (Al-Sayah et al. 2022). As a result, although forest degradation is complex and varies with location and context, it is evident that increased poverty due to the economic crisis is contributing to overgrazing, deforestation, and illegal logging, as more people revert to forest and other natural resources for survival. Hence, there is an urgent need to promote sustainable forest management and forest-resources use to address poverty and inequality.

Figure 24: Synthesis of the different direct and indirect causes and drivers of deforestation and forest degradation in Lebanon





## 5.2 Vulnerability to climate change and natural disasters

**Climate change will cause more frequent and intense drought conditions and higher temperatures in the Mediterranean** (IPCC 2014). The Fourth National Communication on Climate Change indicated that Lebanon is expected to experience an increase in temperature by 1.6 degrees Celsius to 2.2 degrees Celsius by mid-century, and by 2.2 degrees Celsius to 4.9 degrees Celsius by the end of the century, depending on the Representative Concentration Pathway (RCP) scenario. These increases are more intense than those projected in 2014, with the Bekaa Valley and coastal areas being the most affected. Precipitation is expected to decrease by 6.5 to 9 percent by mid-century and by 9 percent to 22 percent by the end of the century, which is also more severe than previous projections. Consecutive dry days and drought risks are expected to increase in all regions, with a more pronounced effect in southern and coastal areas (MoE, UNDP, and GEF 2022).

**Forest fires in Lebanon are a major consequence of changing climatic conditions.** Although the main drivers of forest fires in Lebanon are anthropogenic, climate change is aggravating the situation by creating environmental conditions in forests and woodlands that are conducive to fires. Studies have shown that extreme weather conditions, such as heatwaves, have led to a spike in fire severity and frequency. A 2014 report (Salloum and Mitri 2014) found that the occurrence of fire correlated positively with deviations in mean monthly temperatures, and negatively with deviations in mean monthly precipitation and mean monthly wind speed. In addition, an increased probability of fire outbreaks correlates with high mean temperatures and long dry seasons. The predicted increase in temperature and the expected decline in precipitation are expected to result in higher fire frequency, especially if rigorous forest fire mitigation action is not implemented according to national strategies and action plans (MoE, UNDP, and GEF 2016).

**Climate change will lead to a shift in niche distribution and habitat conditions.** A decrease in the number of cold days means that many species will not meet their chilling requirements for flowering and seed germination, and therefore for regeneration. Other influencing factors include earlier flowering; prolongation of the growth season; deficient winter hardening; decrease in snow; and other damaging winter patterns, all of which affect plant survival and reproduction. As a result, bioclimatic shifts will affect mostly those species surviving in the high-altitude zone of Lebanon (Tolba and Saab 2009). Forest species may change their distribution and geographical ranges by migrating to other habitats that meet their growth needs (AFDC 2019). The forest stands expected to be most affected by climate change are in north Lebanon (Akkar) and Hermel, due to the possible shift from a sub-humid to a semi-arid bioclimatic level (MoA 2015). Vulnerable species include *Juniperus excelsa*, *Cedrus libani*, *Abies cilicica*, *Quercus cerris* var. *pseudo-cerris*, *Fraxinus*

*ornus*, and *Ostrya carpinifolia* (AFDC 2019). Forests stressed by fragmentation, pest outbreaks, forest fires, and inappropriate practices will be most affected by climate change (AFDC 2019). Climate change will increase pest and disease outbreaks, and the spread of invasive species. Climate change can affect forest pests and the damage they do in several ways: directly, by affecting their growth, survival, reproduction, and spread; and indirectly, by changing the host's defenses and susceptibility and by impacting the interactions between pests, their environment, and other species like natural enemies, rivals, and mutualists. With respect to climate change and insect outbreaks, national adaptation remains constrained by insufficient funding (MoE, UNDP, and GEF 2016).

## 5.3 Private sector engagement

**Considering Lebanon's high rates of forest degradation and deforestation, public and private actors need to make concerted additional efforts to restore forest cover by implementing forest activities (reforestation, forest management, forest protection from insects and diseases, research, studies, and monitoring).**

**Lebanon has a dynamic research community that brings together both public and private institutions.** However, this research community is constrained by limited funding and oftentimes works in isolation from the wider society. Additionally, policy instruments show a lack of communication between the different public authorities and the leading agencies in the research community, the private sector, and civil societies. There is a need to mainstream efforts between the various concerned parties, and for various stakeholders to engage in effective dialogue in a sustainable way (MoA 2015).

**Given limited government resources and outreach, the Government of Lebanon and development partners have turned to public-private partnerships (PPPs) as a lifeline for the country's ailing economy and deteriorating infrastructure** (Democracy Reporting International (DRI) 2019). Partnerships with the private sector and local communities (Figure 25) are crucial for consolidating and expanding forest cover, alongside efforts to tap into new sources of finance, knowledge, and technology.

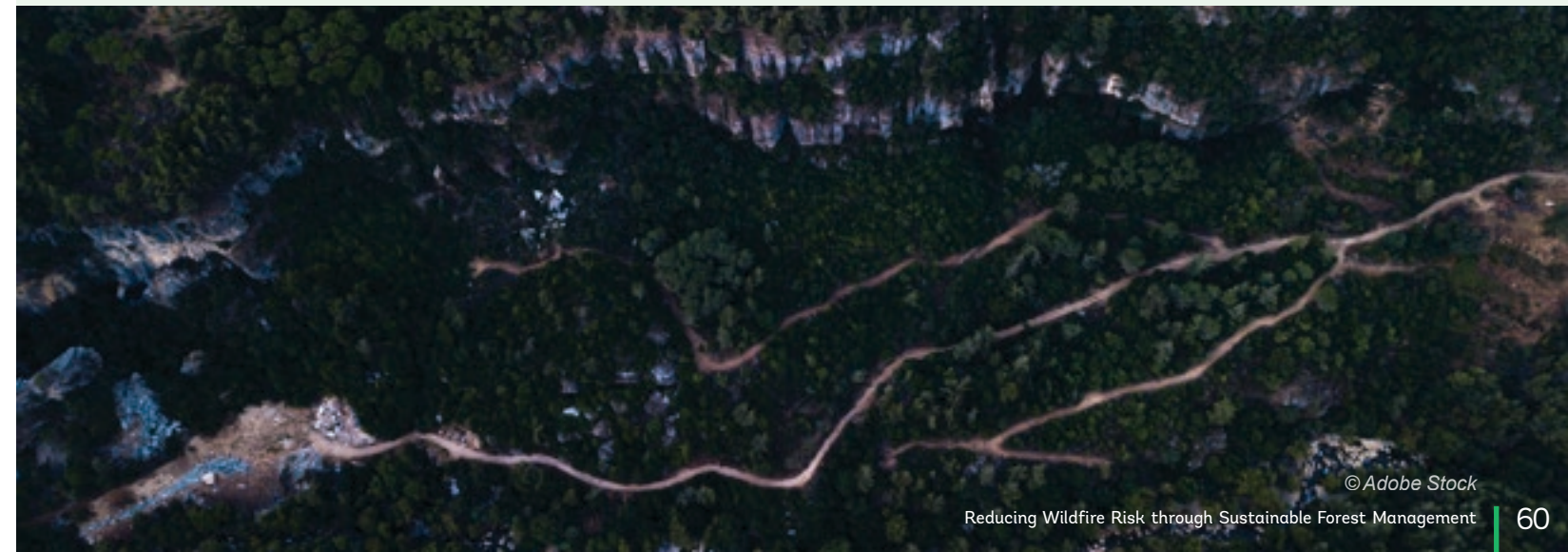


© Andrea Kutter, World Bank

Figure 25: Benefits of PPP in Lebanon (DRI 2019; MoE, UNDP, UNICEF, and UNHCR 2020)



**The NFP highlighted the importance of attracting private sector investment into the forest sector, especially to establish plantations and to develop the value chains for NWFPs and wood products** (MoA 2015). NGOs play a role in encouraging private sector companies to support reforestation activities and in introducing new economic opportunities through forestry and nature-based tourism (LRI 2021).



© Adobe Stock



**BOX 2**

## The potential for the private sector to support sustainable forest management and protection

*Involving the private sector in forest management and protection is not a new concept.* However, today the emerging trend is for private entities to engage based on sustainability principles. Increasingly, companies are engaging in sustainable forest management and protection by committing to, for example, deforestation-free value chain development of timber and non-timber forest products (Rainforest Alliance, 2023).

Many countries have public-private partnerships that aim to reduce deforestation and greenhouse gas emissions by connecting governments with private sector partners and initiatives. In some cases, private enterprises invest some of their revenue in reforestation activities as part of their corporate social responsibility (Groundviews, 2023) or to offset GHG emissions from the production of their products and associated logistics (Myers, Parra & Bedford).

Three areas need to be developed to incentivize private sector engagement in sustainable forest management and protection:

- Promoting a positive enabling environment for the private sector through supportive public policies and governance
- Encouraging financial innovation and crowding in new finance, including through results-based payments, while enhancing and unlocking trapped capital
- Engaging with supply chain companies to achieve economically, environmentally, and socially sustainable value-chain operations.

In Lebanon, multiple private firms have partnered with municipalities and local NGO partners to support efforts to restore Lebanon’s precious forest landscapes.



© Andrea Kutter, World Bank

**Lebanon participates in regional and national projects that promote PPP.** For example, the country was part of the regional project, Supporting the Implementation of Public-Private Partnerships (PPP) for the Management of Mediterranean Protected Areas, launched in 2016. The project, established under an agreement between the French Development Agency and Plan Bleu, encourages stakeholders to mobilize private sector financial and technical capacities through PPP to fund

protected areas and develop a participative management approach involving civil society. One of its goals is to promote biodiversity, conserve protected areas, and reduce poverty in and around protected areas by supporting long-term partnerships between public authorities, private sector operators (for instance in the tourism, forestry, or energy industry), and the local population (planbleu.org).

**BOX 3**

## Local PPP initiatives

*Despite the factors constraining local authorities, some municipalities have achieved several PPP success stories.* These can serve as model for future PPP projects involving local authorities (DRI 2019). The Jezzine Union of Municipalities in southern Lebanon initiated different ecofriendly projects for boosting the local economy by collaborating with the private sector on several projects that contributed to local job creation. These partnerships included eco-tourism and eco-agriculture, executed and operated by private companies.

*The projects were implemented at a regional level, as the Jezzine Union of Municipalities comprises 29 municipalities.* In most of these partnerships, the Union offered land as its share in the joint project, while the private partner invested in the execution and operation of the project. The first of these projects, La Maison de la Forêt, opened in 2012 and was followed by other similar projects. These have succeeded in developing clear business plans to attract investors (DRI 2019).

La Maison de la Forêt	Pine House	Olive Factory	Apply Factory
An eco-touristic project showcasing the forests of Bkassine. It consists of bungalows, restaurants, conference rooms and features activities such as hiking	An eco-agricultural project to boost local agricultural products, such as pine nuts and honey	An eco-agricultural project to support the local Olive Farmers Cooperative to diversify and market their olive products	A planned project to build an apple factory along the lines of the Olive Factory



© Freepik



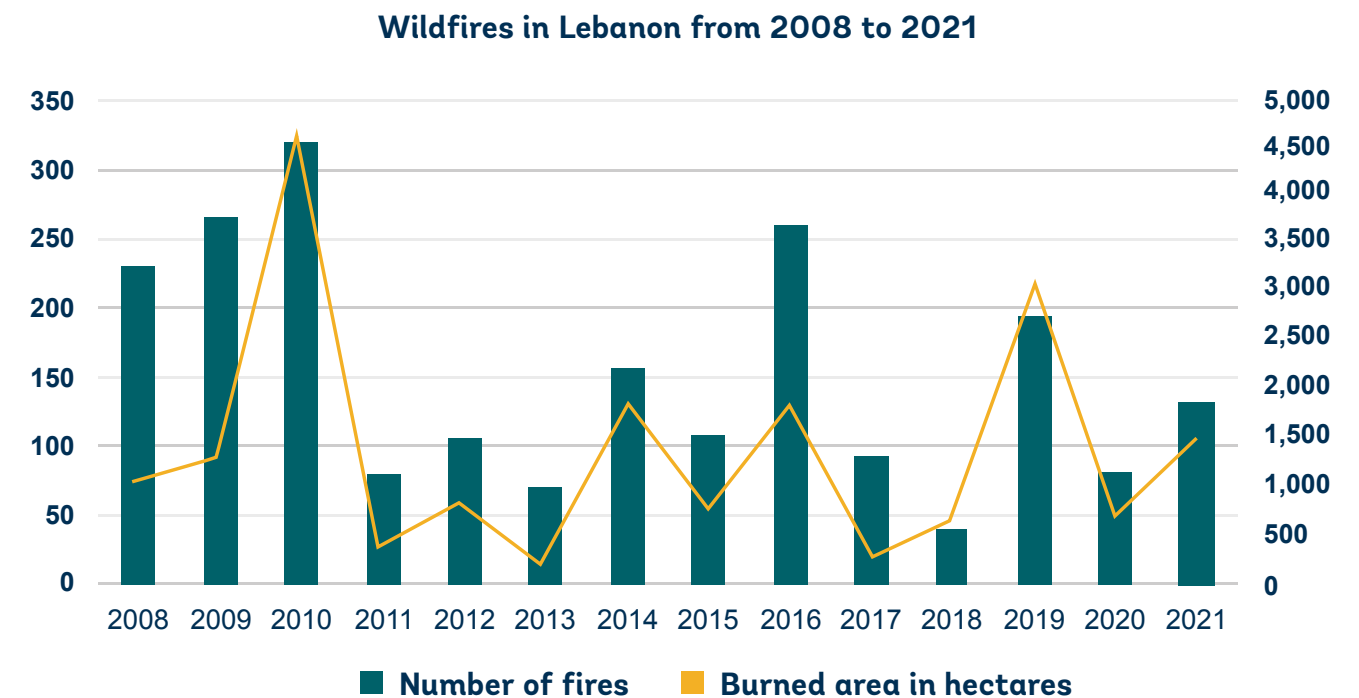
# 6 Wildfires as Drivers of Forest and Landscape Degradation in Lebanon

Data collected between 2011 and 2021 shows how the destruction caused by wildfires in Lebanon is persistent, with an average number of 177 recorded wildfires, destroying an estimated 1,500 ha—or 1 percent—of total country land area each year (Figure 26) (MoE and UoB 2021).



© Freepik

Figure 26: Number of fires and burned areas in Lebanon from 2008 to 2021 (Data source: MoE and UoB 2021)



## 6.1 Lebanon forests' vulnerability to fire

**Most forests in Lebanon are in a wildland-urban interface (WUI<sup>11</sup>).** Lebanon's WUI is characterized by an increased risk of wildfire. The growing pattern of urban development into forested lands increases the threat of forest fires to human life and economic wellbeing. The threat of wildfires driven by urban expansion is exacerbated by a drying and warming climate, which makes forest fires more severe and more frequent (Ruffault et al. 2020). Moreover, abandonment of rural areas has led to a decrease in traditional agricultural land use in many places across the country. The primary effects of this trend have been fuel accumulation and structural changes in the fuel complex. These new fuel complexes increase the probability of fire initiation and fuel continuity, and therefore promote large wildfire occurrence (Mitri et al. 2014). Intermingling of the built and natural environment; poor management of natural landscapes; and increased presence of unmanaged forest regrowth in abandoned agricultural lands, is igniting forest fires and driving forest loss (Moreira et al. 2020).

Recent maps of wildfire risks and types of landscapes where primary ignition of wildfires is recorded show that most wildfires in Lebanon occur in open, low vegetation or agricultural lands, and constitute a threat to nearby forests and woodlands (UoB 2022; Faour and Abdallah 2019) (Figure 27).

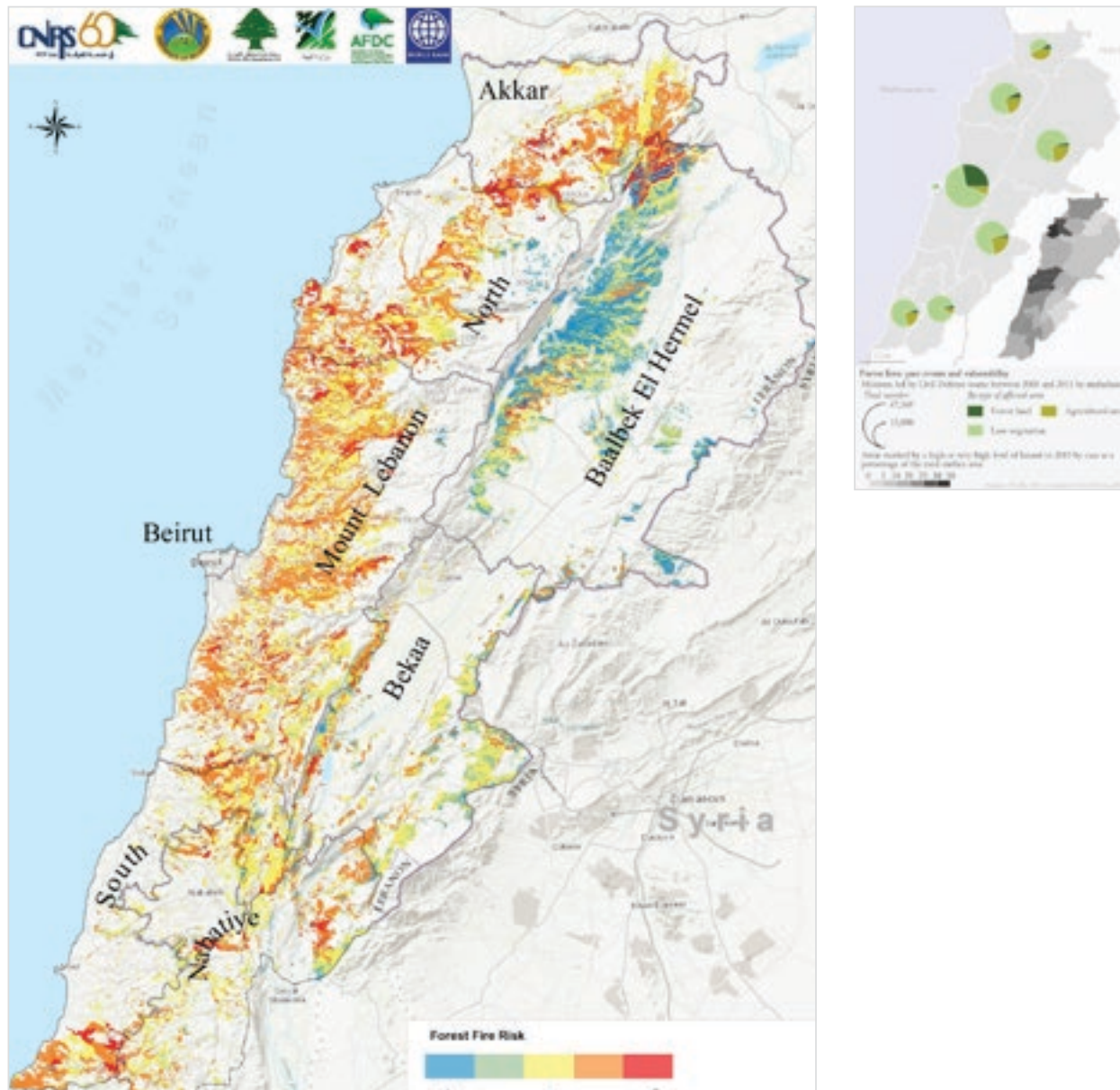


© Andrea Kutter, World Bank

11 The wildland-urban interface (WUI) is described as the area, or zone, where human developments intersect with wildland or vegetative fuels.



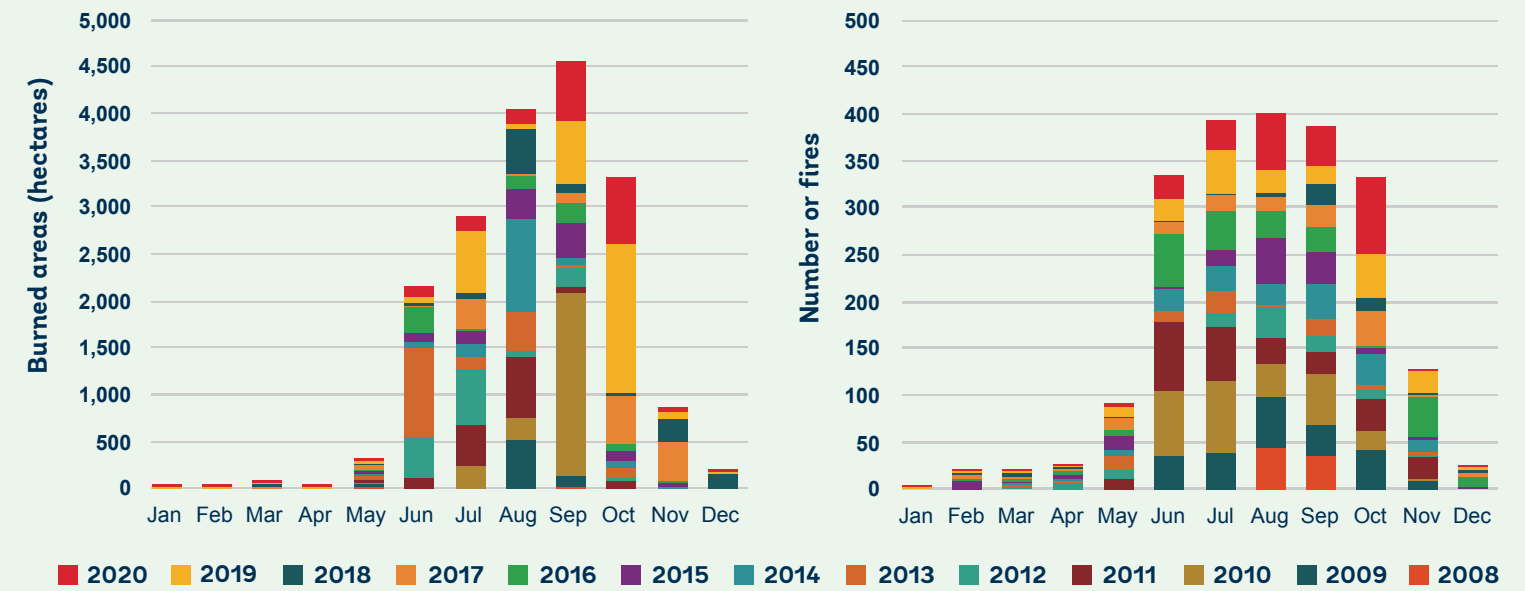
**Figure 27:** Left: Wildfire risk map for Lebanon (Source: MoE and UoB 2022); Right: Types of landscape in Lebanon where primary ignition of wildfires was recorded between 2003 and 2015 (Source: Faour and Abdallah 2019)



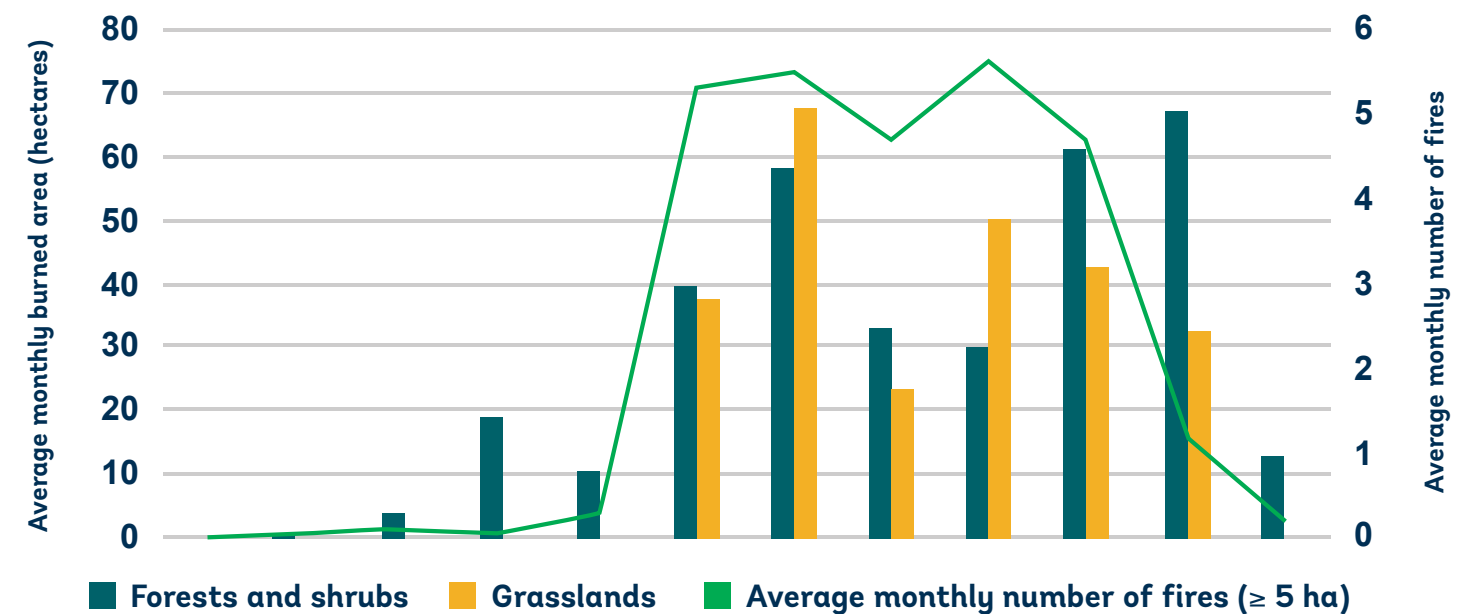
## 6.2 Lebanon's forests and wildfires

The risk of wildfires persists for several months. It becomes critical between July and September, with this period showing the highest number of burned areas and fire occurrences (Figure 28) (MoE and UoB 2021). However, the extended drought period prolongs the fire season until November, causing even greater threat to the forest. Consequently, Lebanon's seasonal fire distribution is unusual and can be described as bimodal: driven by air-relative humidity and wind speed individually, combined with rare but recurrent prolonged droughts until November (Majdalani et al. 2022). The country then experiences late wildfires until the end of October, or even November. This is rarely observed in other Mediterranean countries (Mhaweij et al. 2016). >> p67

**Figure 28:** Cumulative fire occurrences and burned area from 2008 to 2020 (MoE-UoB and Mitri 2021)



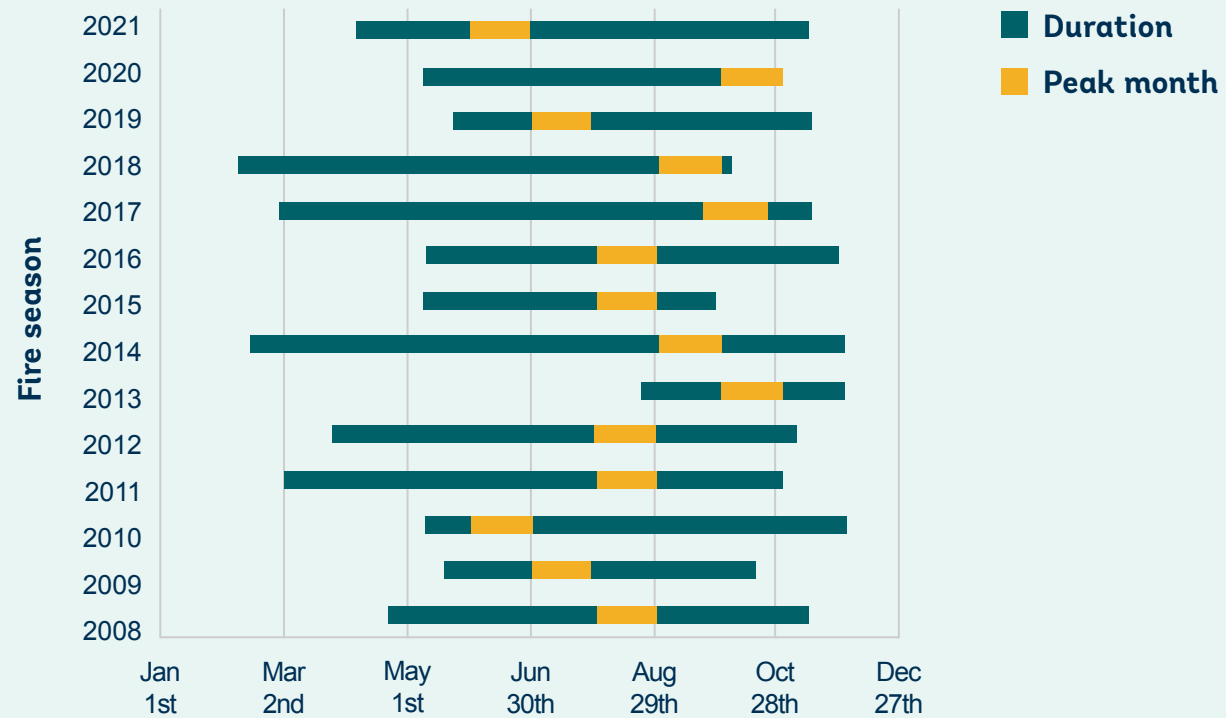
**Figure 29:** Average monthly number of fires and burned area (BA) in forests/shrublands and grasslands (Majdalani et al. 2022)



Authorities and concerned parties should align various wildfire mitigation activities and optimize resource use with wildfire risk patterns while investing in long-term management throughout the year (Figure 30) (MoE and UoB 2021).



Figure 30: Comparison in fire inter-annual seasonality (Source: Fire report UoB 2008–2021)



**The number, severity, and duration of wildfires is due to drier and warmer climate conditions** (Salloum and Mitri 2014; Lebanon Ministry of Agriculture 2014; Emergency Plan 2022; Ruffault et al. 2020). The most recent report of the Intergovernmental Panel on Climate Change (IPCC 2022) warned that, in the near future, wildfire risks in the Mediterranean are expected to worsen owing to longer heat waves and sustained extreme heat and droughts. This trend is evidenced by the number and intensity of the fires that occurred in June 2021 in Italy, Greece, Turkey, and Lebanon. Between 2001 and 2020, an average of 0.58 percent (2044 ha) of land (grassland, shrubland, and forest) burned annually in Lebanon, similar to France (0.53 percent) and Greece (0.57 percent) (Majdalani et al. 2022). Soil water deficit, soil degradation, desertification, and fire risks are all expected to increase. Climate change will directly (through environmental stress) and indirectly (through changed fire regime and higher biotic-induced tree mortality) contribute to modifying the distribution patterns of forest ecosystems (Pereira et al. 2002) and species composition. More extended dry and warm summers in the Mediterranean Basin, particularly in Lebanon, indicate longer fire seasons, combined with more frequent and severe weather events, leading to higher-intensity, larger, and more catastrophic wildfires (Moriondo et al. 2006).

### 6.3 Wildfire mitigation through sustainable forest management

**Wildfires are unavoidable episodic events.** Many forests in Lebanon are in the wildland-urban interface (WUI) and are extremely vulnerable to wildfires. It is important to approach their conservation with the understanding that wildfires are episodic and inevitable occurrences. Based on the Fire Weather Index (FWI)<sup>12</sup> system and Drought Code (DC),<sup>13</sup> (NRC 2023) in Lebanon, more than 80 percent of the variability in monthly burned area is a function of ambient temperature, relative humidity, wind speed, and precipitation (Majdalani et al. 2022). Effective forest management strategies may mitigate the impacts of climate change and ensure the long-term health and sustainability of forest landscapes of Lebanon (Plan Bleu 2019).

**Wildfires have a significant socioeconomic impact.** Nearly one third (32.9 percent) of Lebanon's land is potentially threatened by wildfires, with cascading effects on human life and economic, social, and ecological assets (Al Sayah

2023). The potential fire-induced losses can directly influence land productivity and forest health, causing rapid and direct degradation, with often irreversible damages. The total cost of restoration efforts of land degraded by wildfires may be greater than the cost of protecting the forest and preventing fire occurrence. Furthermore, land degradation increases susceptibility to fires, and fire outbreaks aggravate land degradation. There is an urgent need to shift from reactive actions to proactive approaches, where simultaneous prevention of fire outbreaks and land degradation is guaranteed to stop the land degradation-wildfire cycles. The damage wildfires cause decreases the value of forests, estimated in 2005 at 4,770 euros per hectare (Sattout et al. 2005). Masri et al. (2006) estimates financial losses following forest fires in fruit pine, wild pine, and broadleaf forests, to be US\$114,330/ha, US\$21,700/ha and US\$5,812/ha, respectively.

**Sustainable forest management is an essential long-term strategy to avoid degradation, including mitigating wildfire risks.** Adopting an integrated forest management strategy and action plan to mitigate wildfires is a long-term process, but is constantly disrupted by the urgent challenges of wildfire suppression actions, which have immediate consequences and high media visibility. In addition, the priorities of an integrated forest management approach to mitigate wildfires may be perceived differently and challenged by members of civil society. For example, some residents may be reluctant to accept grazing restrictions or prescribed burning near built areas; some may favor establishing forest plantations; and some residents may be unwilling to address biomass management around their residences for aesthetic, privacy, or environmental comfort reasons (Francisco Moreira et al. 2020).

**Rural and land abandonment, especially during and after the civil war, left agricultural lands unmanaged and forest regrowth unchecked.** As a result, woody plants grew into continuous and highly flammable layers that took over agricultural land, terraces, and grazing lands.

**Afforestation efforts with no provision for long-term management, increases wood biomass and thus the risk of wildfires.** The impressive afforestation efforts carried out on public land during the 1960s and 1970s (Green Plan of Lebanon) were stopped due to the outbreak of the civil war and were not followed up with forest management strategy or silviculture practices. Moreover, most of the recent reforestation and afforestation activities are supported by development partners through projects. Hence, there are no budget provisions for activities that include future fire-risk management after planting; nor do development partners follow up with forest management plans, especially after the project ends.

**Competition and lack of coordination between relevant governmental and nongovernmental institutions have led to reactive short-term actions to mitigate wildfire risks, rather than adoption of long-term forest management actions.**

The lack of coordination between responsible institutions has reduced the government's capacity to intervene effectively and reduce wildfire risks. Fire management has been based on spontaneous, unplanned decisions and actions during and after big fire incidences and has focused mainly on providing limited resources for fire suppression (tools, aircraft, vehicles, and so on) rather than addressing the structural causes of forest fires (land ownership structure; forest and land management; social cohesion; and the enforcement of laws and regulations). Controlled grazing is an effective tool for forest fire risk mitigation. The abandonment of traditional rural lifestyles and the expansion of rural towns has led to a decline in agropastoral activities and a decrease in grazing land accessibility. In addition, political and economic instability has led to the abandonment of rural lands. All these conditions have resulted in land absenteeism, which has led to spontaneous and uncontrolled growth of forests and woodlands with highly flammable forest litter. Considering that all forest fires in Lebanon—intentional or unintentional—are caused by people, the integration of grazing to reduce forests' vulnerability to fires is an option worth considering. There is an obvious benefit to developing a program because sheep and goat dairy and meat products are highly valued. Targeted grazing is a proactive approach used to manage fire risk in forests. This practice involves strategically deploying livestock, such as goats or sheep, to graze in specific areas prone to wildfires. General guidelines for forest grazing were presented in the National Guidelines for Rangelands Management in Lebanon (UNDP and MoE 2018). Controlled grazing in Lebanon should be encouraged through a national strategy and awareness campaign. Especially if properly timed and controlled, grazing may reduce the accumulation of fire fuel, while creating a new value and relevance to traditional pastoralism.

**Prescribed or controlled burning management is not practiced in Lebanon and its implementation requires strict regulations and community buy-in.** The Lebanese Forest Code of 1949 limits and prohibits the burning of plant material near forests (Article 106). Despite its advantages of reducing fire risk at low cost, prescribed burning in Lebanon is complicated by proximity to towns and villages, agricultural lands, and other private property, and significant restrictions regarding smoke management, liability issues, and safety. Moreover, prescribed burning is not well understood at the community level and permission to burn plant material may be perceived as contradicting calls to prevent forest fires. Prescribed burning can help reduce fire risk and, simultaneously, avoid uncontrolled burning. However, its application depends on legal and social issues and concerns that need to be addressed. In addition, prescribed burning requires well-trained personnel and depends on weather conditions. Accordingly, any future practice of prescribed burning will require further research and planning before institutionalization and adoption (Antoun et al. 2013).

<sup>12</sup> The Fire Weather Index (FWI) is a meteorologically based index used worldwide to estimate fire danger. It consists of different components that account for the effects of fuel moisture and wind on fire behavior and spread. The higher the FWI is, the more favorable the meteorological conditions to trigger a wildfire.

<sup>13</sup> The Drought Code (DC) is a numeric rating of the average moisture content of deep, compact organic layers. This code is a useful indicator of seasonal drought effects on forest fuels and the amount of smoldering in deep duff layers and large logs. <https://cwfis.cfs.nrcan.gc.ca/background/summary/fwj>.



### 6.3.1 NATIONAL FOREST FIRE MANAGEMENT STRATEGY (NFFMS)

*A National Forest Fire Management Strategy (NFFMS) was drafted after major fire events in Lebanon in 2007, when more than 200 fires were detected in less than 24 hours.* However, the implementation of the NFFMS remains weak. Very few actions were taken to implement the NFFMS endorsed by the Council of Ministers in 2009 (Decision No.52/2009). Lack of implementation is due to the absence of a legal and organizational framework and an action plan. Furthermore, the NFFMS did not address the problem of overlapping duties between the ministries (Elissar 2012) and no dedicated funding for the implementation was allocated. Instead, fire-related responsibilities and competencies continue to be dispersed across various agencies and sector ministries (Agriculture, Environment, Economy, and Interior), contributing to the problem. The lack of coordination is still a significant hurdle, despite the introduction of different strategic instruments (legislation, regulation, planning). Recent revisions to the NFFMS (2023) are expected to overcome identified weaknesses and provide clarity regarding the role and responsibilities of each stakeholder institution.

*Despite challenges, local authorities, communities, and private actors communicate efficiently on wildfire risks.* Many entities are using tools and technologies to determine wildfire risks in Lebanon. However, the Capacity Needs Assessment report revealed that the fire danger index map indicating the fire danger estimation daily, to allow decision-makers to allocate resources on the territory at risk, has not resulted in proper decision-making and dissemination processes. Moreover, most of the municipalities and local communities do not have adequate knowledge to access and read early warning messages based on the fire danger index, and to act accordingly (Capacity Needs Assessment).



© Freepik

*Regulations protecting conifer trees have contributed to wildfires.* Between 2008 and 2021, some distinct regional patterns emerged, suggesting that wild pine forests accounted for 41 percent of all forest areas burned from 2008 to 2021. The proximity of pine trees (which are highly susceptible to fires) to other species has increased the risk of fires affecting large-scale forests with mixed species. Consequently, it is imperative to implement mitigation, prevention, and preparedness actions that will make forests less prone to fires (such as building fire breaks, pruning, reducing fuel, and providing water outlets). These measures have not been implemented to date. In addition, development and implementation of sustainable management plans, especially for *Pinus brutia* forests near—or mixed with—*Pinus brutia* species, is of the utmost importance.

*Communication and coordination between institutions with competing mandates, roles, and responsibilities must not be limited to the senior management levels of these institutions. This can reduce their effectiveness and forestall collective efforts towards a consistent path and action plan for wildfire management.* A recent example is the Emergency Coordination Plan for Fire Preparedness, Risk Reduction and Awareness in Lebanon 2022 (MoE 2022), led by the MoE. This targets hotspot villages and aims to decrease the number of fires and burned areas by establishing local first responder groups. Although the activities in this plan are of great national value and the plan encourages collaboration among civil society players, communication between ministries was carried out only at the higher level. The plan was not successful in creating an operational partnership with the MoA at the regional level, especially since its local field offices remain marginally involved.

*Forest governance in Lebanon is complex and hampered by several factors.* The success and effectiveness of a national forest management strategy requires good forest governance. To achieve this, there needs to be coordination between different institutions and agencies, the adoption of common goals and programs, and agreement on roles and responsibilities. As discussed above, forest governance is currently hindered by political and institutional instability, lack of leadership on forest management (including wildfire management), and limited capacity for sustainable forest management as a foundational approach to wildfire management.

*The absence of a dedicated funding source for addressing fire risks and events compromises collective fire-related actions.* A clear funding plan identifying all the supporting funding instruments (national and international), and strengthening the application of fire-management activities, will reinforce the forest sector in Lebanon. In the absence of a budget line and an efficient and effective disbursement mechanism to address wildfires, the MoE has initiated the development of a framework for a National Forest Fire Emergency Fund (NFFEF) to address fire risks and actual events in a timely and impact-oriented manner. The objective of the NFFEF is to provide financial support for efficiently managing and combating wildfires in Lebanon.

# 7 Opportunity Areas for Sustainable Forest Landscape Management and Addressing Fire Risks in Lebanon

Lebanon's forests and forest landscapes are under significant pressure. This has increased their vulnerability, and compromised their contribution to the economy, society, and the environment.

© Shutterstock



Some of the core threats and challenges include decline in forest cover and quality due to forest degradation and deforestation; unsustainable forest resources usage; policy and governance failures; and land-use conflicts. In addition, almost 50 percent of Lebanon's forests are on privately owned land. This chapter discusses the opportunities for sustaining Lebanon's forests and forest landscapes and strengthening the forest sector by supporting sustainable forest management, including fire risk management. The opportunity areas address the gaps and weaknesses discussed in the previous chapters.

The following opportunity areas are discussed:



### Improving governance and local capacity to bolster resilience and ensure sustainable forest management

- a. Enhancing governance within—and collaboration between—public institutions
- b. Engaging communities in sustainable forest management and wildfire mitigation
- c. Involving private landowners



### Acting to improve data and information access on forest fires



### Supporting industries for value-addition of wood and non-wood forest products

- a. Wood production, fuelwood and charcoal
- b. Non-wood forest products (NWFP)



### Promoting nature-based tourism



### Supporting forest ecosystem restoration to reduce fragmentation and minimize fire risks.

Overall, the implementation of the proposed actions would protect Lebanon's forest landscapes and the robustness of the forest sector. The proposed interventions are consistent with the various national plans and strategies above, specifically the National Forest Program (NFP) and the National Forest Fire Emergency Plan. The sustainability and success of each opportunity area described below is entirely dependent on adequate budget provisions. This should include a national budget, an emergency fund, revenues, bonds, a national forest fund, and credit lines.

## 7.1 Improving governance and local capacities

### 7.1.1 ENHANCE GOVERNANCE WITHIN AND COLLABORATION BETWEEN PUBLIC INSTITUTIONS

Forest governance and regulations are essential for ensuring the protection and sustainable management of forests and the long-term provision of their ecological, economic, and social benefits. Effective forest governance provides a framework for decision-making, planning, and implementation of forest-related policies and programs. It also ensures the participation of stakeholders such as local communities and civil society, in decision-making processes.

In Lebanon, forests are primarily under the authority of two key ministries: the MoA and the MoE, established in their nascent forms in 1920 and 1981, respectively. Given its sixty-year head start, the MoA is well-staffed, with field officers and personnel tackling forest management and conservation. The MoE—with a broad mandate 'to be "responsible for the environment of Lebanon"'—was initially conceived to set regulations and standards. However, this is not possible without a staff base that has access to relevant knowledge and can exercise influence on matters pertaining to forest conservation and fire mitigation. As a result, the understaffed MoE has adopted a collaborative strategy, reaching out to communities through partnerships with NGOs and academic institutions, or through project-funded personnel.

Today, the MoA and the MoE face the same economic and political crisis. This weakens their abilities to enforce regulations or implement forest governance and policies from their different perspectives. As a result, there is an increase in illegal logging, forest degradation, and wildfire outbreaks. More importantly, the lack of clarity regarding the roles and responsibilities of the two ministries is leading to redundancy and inefficiency, and is hampering the implementation of effective forest governance.

Regardless of the above, both the MoA and the MoE have taken steps to improve forest governance in Lebanon, by unilaterally or collaboratively developing a national forest program, a national fire management strategy, community-based forest management approaches, and fire emergency plans. These efforts provide a foundation upon which further improvements can be made to strengthen forest governance in Lebanon—for example, by creating a formal coordination mechanism and defining clear roles and responsibilities of involved entities. By continuing to build on these initiatives and by fostering greater collaboration between public institutions and local communities, Lebanon can make significant strides towards achieving more sustainable forest management practices and enhancing resilience to forest fire challenges.

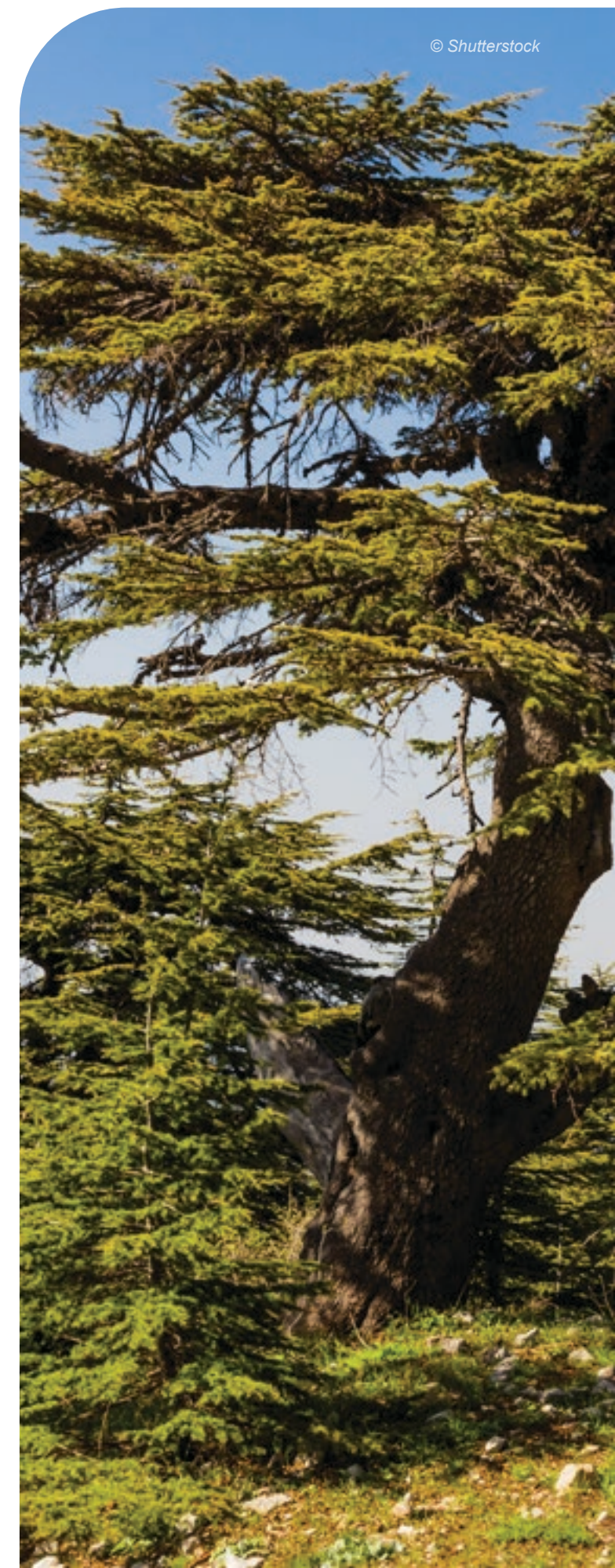
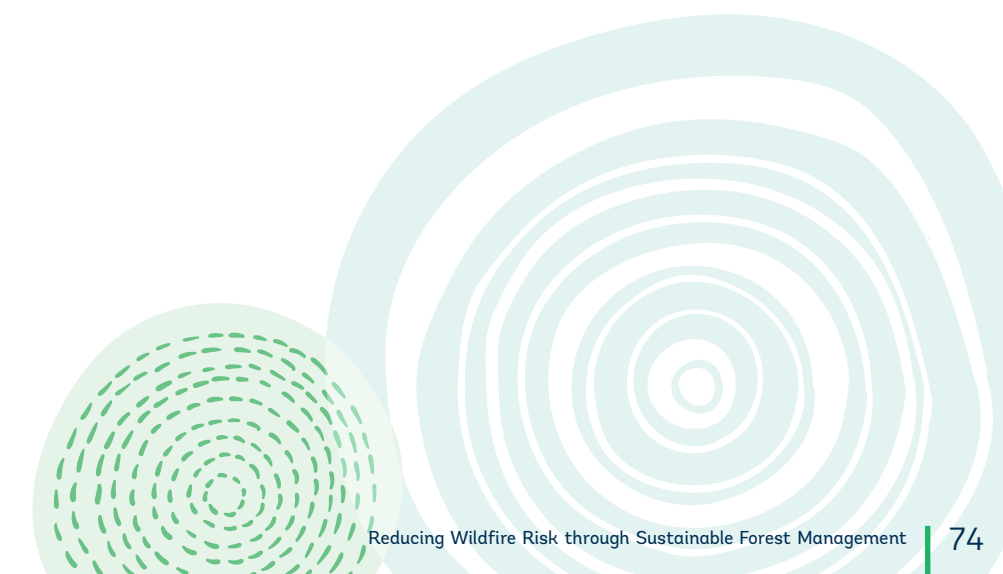




Table 4: Action required on forest governance

Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
<p>Create and formalize a multi-sectoral “Government Forest Mechanism” of public sector employees concerned with forest landscapes</p> <p>Develop communication tools—such as email lists, messaging apps, or regular meetings—to ensure that employees can break “departmental” silos and engage with peers</p>	<p>Once-off, then repeated regularly</p> <p>Lead agencies: MoA, MoE, DRM Unit and other government entities</p>	<p>Alerts government employees to the latest developments and keeps them informed of projects, laws, and upcoming events and opportunities, leading to better collaboration, effective communication, and knowledge-sharing</p>	<p>Activates institutional and human resources to deal with forest fire mitigation. Enhances information-sharing to ensure closer engagement on ways to prevent forest fires</p>
<p>Set up working sessions for Government Forest Mechanism members, to establish and discuss their roles and responsibilities, and identify the key issues related to coordination</p>	<p>Once-off, then repeated regularly</p> <p>Lead agency: MoA</p>	<p>Establishes better relationships among employees, thereby promoting greater collaboration and coordination on forest management</p>	<p>Ensures that stakeholders discuss their respective roles and responsibilities regarding forest fires, and identify key issues related to effective coordination</p>
<p>Establish mechanisms to ensure regular review of policies and legislation as these evolve, to guarantee consistency and coherence as revisions are made to respond to changed circumstances</p>	<p>Once-off, then repeated regularly</p> <p>Lead agencies: MoA and MoE</p>	<p>Ensures that all institutions are working together towards a common goal to sustain forest and natural resources and promote efficient use of resources</p> <p>Prevents duplication of efforts and so ensures effective responses to any changed circumstances</p> <p>Ensures that best management practices are incorporated and effectively implemented</p>	<p>Identifies gaps and weaknesses in the current system, and sets out a successful forest fire management strategy based on a clear, proactive policy</p> <p>Ensures that this policy can be put into practice through comprehensive and efficient laws and regulations</p>
<p>Provide members of the Government Forest Mechanism with training and capacity-building opportunities regarding forest governance and coordination</p>	<p>Continuous</p> <p>Lead agencies: MoA and DRM Unit</p>	<p>Strengthens governance systems related to Sustainable Forest Management</p>	<p>Strengthens institutional and technical capacities for the integrated management of forest fires</p>

Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
<p>Establish a task force within the Government Forest Mechanism to tackle wildfire management and coordinate national fire activities</p>	<p>Once-off, then repeated regularly</p> <p>Lead agency: DRM Unit</p>	<p>Brings together experts and decision-makers for better communication, cooperation, and collaboration</p>	<p>Enhances development of national fire management policies, strategies, and plans, oversee their implementation, and evaluates their effectiveness</p>
<p>Develop a comprehensive national monitoring and evaluation system to track the progress of forest and wildfire management efforts by various organizations over time</p>	<p>Once-off, then updated regularly</p> <p>Lead agency: Lebanese National Council for Scientific Research (LNCSR)</p>	<p>Enhances monitoring and tracking of forest-related activities, identifies successes and challenges, and informs future planning efforts</p>	<p>Tracks the progress of wildfire management efforts over time, and ensures that efforts are effective, efficient, sustainable, and reduce the risk and impact of wildfires</p>
<p>Develop long-term funding and resource strategies</p> <p>Include relevant lines for the MoA and MoE in the national budget that support the continuity and development of community-based forest management (including the use of sustainable practices, as well as wildfire prevention and suppression efforts)</p> <p>Seek additional resources from international partners and from the private sector</p>	<p>Once-off, then updated as required</p> <p>Lead agency: MoF</p>	<p>Encourages initiatives on national and local levels to develop long-term plans for sustainable forest practices.</p> <p>Enables governmental institutions to achieve long-term goals and apply innovative practices</p>	<p>Improves the effectiveness of wildfire prevention and supports capacity-building in local communities</p> <p>Ensures that local initiatives have the skills and resources needed to implement effective fire management practices and respond to wildfires</p>





## 7.1.2 COMMUNITY ENGAGEMENT IN SUSTAINABLE FOREST MANAGEMENT AND WILDFIRE MITIGATION

*Communities in Lebanon are represented by multiple stakeholders with diverse local influences, depending on the town or village dynamic, its regional location, and its sectarian context.*

At the same time that forests are overexploited by communities and wildfires are threatening livelihoods, residents are faced with inefficient and dysfunctional public institutions. This is the result of years of political instability in governance. “Abandoned” to their own fate, residents are taking the initiative—despite limited resources—to organize themselves and shift toward development and implementation of local solutions for forest protection and wildfire management. This is to ensure that local communities are able to improve their preparedness for wildfires, respond efficiently to local crises, and prevent wildfires. There are a few success stories of local mobilization. Recent examples include the impact of the MoE National Fire Emergency Plan of 2022, which resulted in collaboration with local community groups around fire-risk-reduction activities. Such case studies should be documented and could be readily scaled up, considering the Lebanon context and its limitations. This is especially important as diverse individual, economic, and social-political factors mean that many communities are not yet engaged in forest and wildfire management. The catastrophic fire events in Lebanon in recent years have highlighted just how vulnerable communities continue to be. They also foreground an urgent need to understand the factors limiting community engagement and to replicate local successful initiatives.

Figure 31: Local community structure



Source: Khaled Taleb

Table 5: Action required on community engagement

Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
<p>Mainstream basic knowledge in sustainable forest management and fire mitigation</p> <p>Co-produce, with engaged local stakeholders, a set of digital forest videos that teach basic, economical practices in sustainable forest management and fire mitigation, and disseminate the videos through social media, schools, scouts, and local civil society groups</p>	<p>Continuous</p> <p>Lead agencies: Municipalities</p>	<p>Reconnects residents with forests</p>	<p>Combines traditional and new knowledge, leading to more effective understanding of the causes of wildfires and ways to mitigate them</p>
<p>Establish a local volunteer program</p> <p>Enroll, train, and involve residents and youth in basic practices such as clearing of herbaceous biomass near village residences and along paths</p>	<p>Once-off, then repeated regularly</p> <p>Lead agencies: Municipalities</p>	<p>Ensures that more people are actively protecting the natural resources in their area, leading to better forest management</p>	<p>Ensures that more people are actively reducing the risk of wildfires and improving the effectiveness of fire response and suppression efforts</p>
<p>Conduct a needs assessment to identify the current knowledge and skills of local communities regarding forest management</p>	<p>Regular assessments every year</p> <p>Lead agency: MoA</p>	<p>Facilitates better understanding of the areas where training is needed</p>	<p>Allows for assessment of local knowledge and skills relating to forest fires management</p>
<p>Organize an exchange program, where communities can share stories and communicate their experience in forest management practices and forest fire mitigation</p>	<p>Continuous</p> <p>Lead agency: Municipalities Union</p>	<p>Decentralizes knowledge, and knowledge-sharing increases local technical knowledge and capacity</p>	<p>Encourages peer-teaching towards more fire-resilient communities</p>
<p>Co-develop—with local and regional experts and engaged stakeholders—training materials relevant to each forest type and community and their needs</p>	<p>Once-off, then updated as required</p> <p>Lead agency: MoA</p>	<p>Encourages participation of local people in training programs by dovetailing training to their needs—this will have a positive impact on planning and application of forest management plans</p>	<p>Allows for better understanding of fire impact in relation to forest type, resulting in better planning and appropriate action</p>



Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
Develop community forest management plans that consider local needs, priorities, and resources	Once-off, then repeated/ updated as required Lead agency: MoA	Environmental impact: Promotes protection/ conservation of forests and sustainable use of natural resources and services Economic impact: Increases forests' value and enhances forest protection by creating employment opportunities and income for local people (through forest-based enterprises such as eco-tourism, non-wood-forest-product harvesting, and so on)  Social impact: Involves communities in decision-making, so that they feel invested in and responsible for protecting and maintaining their local forest	Prioritizes sustainable practices that protect forests from fire, reduce fire impacts, and ensure forests' long-term health
Build a strong regional and international partnership program for knowledge exchanges on forest and wildfire management	Once-off, then updated as required Lead agencies: MoA and MoE	Provides resources for research, education, and training, and for implementing new, sustainable forest-management practices	Provides resources for research, education, and training; implementing new forest fire management practices; and responding to wildfires

### 7.1.3 INVOLVEMENT OF PRIVATE LANDOWNERS

**Given the considerable proportion of forest landscapes under private ownership, it is imperative to devise strategies that support private landowners' interests in conserving forested land.** Such strategies should involve positive and holistic approaches that provide support at various levels—including information and training, financial incentives, and promotion and support of forest-based entrepreneurship activities. It is worth noting that promoting the conservation and sustainable use of privately owned forests is complicated in cases of absenteeism. In such situations, strategies should be devised to protect the community. Local authorities should act by implementing local policies to ensure that abandoned forests do not become a liability to the community and that landowners are held accountable for the imminent threat of fire.

**Such strategies (once-off, then updated as required, with the MoA and MoE as Lead Agencies) should:**

- Encourage the interaction and collaboration of the different forest owners, and strengthen the network of stakeholders involved in forest management, protection, and fire-risk management.
- Develop positive and holistic approaches that offer support at various levels, including information and training, financial incentives, and promotion and support of forest-based entrepreneurship activities.
- Consolidate and improve perceptions about risk within the whole community, through the application of participatory approaches (including the public, local authorities, and forest owners).

- Develop regional forest-management support for private forest owners, so that they have all the necessary support and knowledge to sustainably manage their forest and protect it from fires.
- Promote the conservation and sustainable use of privately owned forests through adequate strategies and national plans.
- Implement local policies to ensure that abandoned private forests do not become a liability and threaten the community, and apply common protection measures to any area at risk.
- Develop monitoring tools to ensure the effectiveness of any measure taken regarding private forest ownership.

## 7.2 Actions to improve data and information access on forest fires

**Lebanon's forest landscapes are highly vulnerable to fires, and climate change will aggravate this situation.** Currently, data and information on fire risks, actual events, and post-fire activities, are fragmented and not readily accessible to all relevant stakeholders. The development of an Integrated Forest Fire Information Management System (IFFMS) would provide a common and accessible platform on fire data and information, with the following considerations:

- Consolidate all information systems sustained by the government under one server.
- Assign one government entity the responsibility of managing the data and IT infrastructure.

- Provide each institution with operational autonomy in relation to its specific data.
- Collect geospatial data on socioeconomic activities in forest areas.
- Develop and update, on a regular basis, a localized and interactive fire-prediction map.
- Consider and assess the potential use of wireless sensors networks.
- Incorporate field observations into forest fire damage-mapping.
- Identify, train, and include more stakeholders in data collection (including communities); and
- Connect external systems into one main consolidated system.

A road map, including terms of reference for the development of an IFFMS, was developed as part of the World Bank Technical Assistance project and is available.

## 7.3 Supporting industries for value-addition of wood and non-wood forest products

### 7.3.1 WOOD PRODUCTION AND FUELWOOD

**Historically, wood production—particularly of cedar, fir, and pine tree species—has been an important economic activity in Lebanon.** The wood of these species is highly valued for fuel and other purposes, for example in the construction and furniture-making industries. However, overexploitation and unsustainable management practices in the past have together led to a decline in the availability of these tree species. This has produced negative economic and environmental impacts and, as a result, harvesting of cedar is now prohibited.

**In recent years, the Lebanese government and other stakeholders have been working to promote sustainable timber production through various initiatives.** One of the key initiatives is the National Reforestation Strategy, which aims to increase forest cover and promote sustainable forest management practices. The strategy includes measures such as tree planting, forest protection, and research into alternative timber species. In addition to the National Reforestation Strategy, other initiatives have been developed to promote sustainable timber production in Lebanon. These include the establishment of forest-management plans and guidelines which outline the objectives and strategies for managing specific forest areas, and support licensing for wood harvesting. This ensures that timber products are produced in a socially and environmentally responsible manner (FAO and UNDP).

**Despite these efforts, challenges to sustainable timber production in Lebanon remain.** One of the main challenges is forest owners' and managers' inadequate understanding or awareness of sustainable forest management practices, including harvesting at sustainable levels. This has led to continued overexploitation of forest resources and degradation of forest ecosystems. There is also a pressing need to increase investment in the development of value chains for timber products, to increase their value and generate more income for local communities.



© Freepik



**Table 6:** Action required on wood-based industries (wood production, fuelwood and charcoal)

Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
Feasibility analysis for developing a sustainable wood-based industry	Once-off, then updated as required Lead agency: MoA	A sustainable wood-based industry can ensure that forests are valued, and forest resources are sustainably used in addition to creating new income resources	Reduce fuel loads and promote forest protection and reforestation
Provide training and capacity-building opportunities for forest owners, managers, and local communities, on sustainable forest management practices	Continuous Lead agency: MoA	Training and capacity-building opportunities can ensure that forests are valued and protected over the long term	Increase knowledge to reduce fuel loads and promote forest protection and reforestation
Strengthen the legal and regulatory framework for sustainable use of forests by the wood-based industries sector, including the development of clear policies and guidelines	Once-off, then updated as required Lead agency: MoA	Help ensure the conservation and sustainable management of forest resources and promote responsible and sustainable timber production	Promote the establishment of firebreaks, early warning systems, and effective response mechanisms
Develop a subsidized distribution plan for seedlings, and technical assistance and financial incentives to encourage municipalities, farmers, and private landowners to plant more trees dedicated for wood and fuelwood on their properties	Once-off, then updated as required, with monitoring and evaluation Lead agency: MoA	Increase forests' contribution to the national economy and carbon sequestration, enhance control measures, and reduce illegal cutting	Help reduce the risk of wildfires through sustainable management of the forest and creation of fuel breaks
Build on community forest management plans and develop forest operational management plans for all forests outside protected areas, including sustainable harvesting levels and fire mitigation measures	Once-off, then updated as required, with monitoring and evaluation Lead agency: MoA	Ensure that forests outside protected areas are managed sustainably and any activity is based on sustainable criteria	Improve integration of fire mitigation measures into the forest management plan
Provide financial and technical support to small-scale, wood-based-industry entrepreneurs, to adopt sustainable forest-management practices and improve their productivity and profitability	Continuous Lead agency: MoA	Enhance forest management and wood production	Improve forest management to facilitate fire reduction and mitigation

### 7.3.2 NON-WOOD FOREST PRODUCTS

**Non-wood forest products (NWFPs) are an important part of Lebanon's natural resource base and play a crucial role in supporting the livelihoods of rural communities.** In Lebanon, these products include medicinal and aromatic plants, laurels, pine nuts, carob products, and honey. NWFPs are essential for the local economy, as they provide an important source of income for rural communities, particularly in areas where agriculture is challenging. NWFPs also contribute to the preservation of Lebanon's unique natural heritage and support the country's food security. These products are typically collected and sold to local and international markets by rural communities, generating income and employment opportunities.

**However, the unsustainable exploitation of NWFPs in Lebanon can lead to biodiversity loss and ecological degradation.** Overharvesting, particularly of medicinal and aromatic plants, can lead to a decline in their populations and loss of important genetic diversity. Additionally, the lack of regulation and enforcement of laws related to the collection and trade of NWFPs in Lebanon can lead to exploitation, particularly of vulnerable communities. The absence of a comprehensive strategy for the sustainable management of NWFPs can also limit their potential benefits and contribute to the overexploitation of these resources.

**Despite the challenges, sustainable management of NWFPs in Lebanon is crucial for their continued availability and for the preservation of the country's natural heritage.**

A comprehensive strategy for the sustainable management of these resources should include measures such as the promotion of sustainable harvesting practices, the regulation of trade, and the support of local communities' involvement in the management of forest resources. Additionally, awareness-raising campaigns can help promote the value of NWFPs and the importance of their sustainable use for the benefit of both people and the environment.



**Addressing these challenges requires a comprehensive and coordinated action plan that involves various stakeholders—including government agencies, NGOs, the private sector, and local communities.** To address these challenges and to promote NWFPs in Lebanon, the following actions can be taken:

**Table 7:** Action required on non-wood forest products (NWFPs)

Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
Generate awareness of the importance of NWFPs and their role in forest sustainability, by publishing harvesting guides, organizing training sessions for local communities and collectors, and expanding licensing programs to different NWFP species	Once-off, then updated/repeated as required Lead agency: MoA	Increases forest value and improves livelihoods, while promoting sustainable harvesting of NWFPs, thereby helping to ensure long-term sustainability of the forest ecosystem	Creates a culture of respect for the forest and its resources, which can reduce the incidence of accidental or intentional fires
Conduct a feasibility analysis for updating and developing new value chains for NWFPs	Once-off, then updated as required Lead agency: MoA	Increases forest value and improves livelihoods, while promoting sustainable use of NWFPs	Develops new income sources from NWFPs, which can help local communities to mitigate forest fire
Launch local initiatives related to NWFPs, such as community gardens and farmers' markets	Continuous Lead agencies: Municipalities	Creates an economic incentive to conserve and restore forests, and promote the sustainable use of NWFPs	Generates revenues for municipalities to enhance their capacity for forest fire mitigation



Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
Develop a national and international market strategy for NWFPs	Once-off, then updated as required, with monitoring and evaluation Lead agency: MoA	Creates economic opportunities for forest products and promotes sustainable harvesting practices	Promotes the use of NWFPs, which can reduce the accumulation of combustible materials and the risk of forest fires
Establish seed banks and nurseries for NWFPs, to preserve and propagate plant species	Once-off, with follow-up and continuous maintenance Lead agencies: MoA and the Lebanese Agricultural Research Institute (LARI)	Promotes the conservation and restoration of forest ecosystems through the propagation of NWFPs	Reduces the demand for wood and charcoal as fuel sources, thereby reducing the risk of forest fires caused by human activities
Identify priorities and invest in research related to NWFPs, such as management strategies that consider their ecological role and economic potential	Continuous Lead agencies: LARI and Universities	Provides a scientific basis for policy development and promotes sustainable practices	Encourages research related to fire prevention and management
Expand policies that support the sustainable use and conservation of NWFPs, such as promoting the certification of sustainably harvested NWFP and creating incentives for their production and use	Once-off, then updated as required, with monitoring and evaluation Lead agency: MoA	Promotes the sustainable use and conservation of NWFPs, which can promote long-term sustainability	Reduces the accumulation of combustible materials through sustainable harvesting practices, and discourages the intentional or accidental use of fire in forest management practices

## 7.4 Supporting nature-based tourism

**Nature-based tourism is a significant contributor to the country's tourism industry and economy.** Lebanon's forest landscapes are home to diverse wildlife and vegetation, making them an ideal destination for eco-tourists seeking to explore and appreciate nature. The forests provide a range of activities, including hiking, camping, birdwatching, and nature photography.

**Nature-based tourism has the potential to contribute to local economies and provide local job opportunities.** However, access to natural and forest landscapes by tourists and tour operators rarely benefits rural landowners and communities. Instead, the primary beneficiaries are city-based operators. It is imperative that access to natural landscapes and forests recognizes local ownership of these landscapes and

provides the necessary incentive schemes in terms of access and hospitality jobs to encourage rural dwellers to retain the naturalness of their lands. Nature-based tourism provides an opportunity to experience the local culture and traditional ways of life of the communities living in and around the forests.

**On the other hand, nature-based tourism is limited by lack of infrastructure, such as proper roads, paths, and signage, which can deter tourists from visiting Lebanon's forests.** Insufficient planning and management can result in overuse and damage to the natural resources of the forests, leading to degradation and negatively impacting the tourism industry. Climate change is also a significant challenge, as it affects forest biodiversity, habitats, and landscapes. Additionally, the lack of awareness of the value and importance of nature-based tourism limits the industry's potential growth and impact. Despite the challenges, nature-based tourism in Lebanon's forests remains a promising industry that can generate significant benefits for the environment, economy, and local communities, if managed sustainably.

**Addressing these challenges requires a concerted effort from the government, local communities, and nature-based tourism operators.** This includes developing and implementing sustainable nature-based tourism strategies and practices, investing in infrastructure, increasing public awareness and education, and promoting conservation and climate-change mitigation measures.

Table 8: Action required on nature-based tourism

Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
Develop campsites, lodges, and other accommodation options that are eco-friendly and sustainable	Continuous Lead agencies: Individuals/entrepreneurs	Reduces impact on the forest, which means less disruption to the ecosystem, helping to preserve the forest and its biodiversity  Reduces the need to harvest new resources, as eco-friendly accommodation typically uses sustainable materials (such as reclaimed wood or recycled materials)	Reduces the risk of forest fires spreading, as eco-friendly accommodation often also incorporates fire-resistant materials and design features
Spread the word: Visitors who have had positive experiences in the forest can share their experiences with others and encourage them to visit	Continuous Lead agency: MoT	Increases forests' value and improves livelihoods, as well as encouraging sustainable harvesting of NWFPs and thereby promoting long-term sustainability of the forest ecosystem	Increases public awareness, which can help to protect and preserve forest ecosystems
Set guidelines for tourism-related infrastructure such as trails, visitor centers, and rest areas in forest landscapes, and organize training to support responsible tourism and provide information to visitors about forest conservation	Once-off, then updated as required Lead agency: MoT	Improves understanding of the current infrastructure and how to identify areas for improvement without affecting forests	Improved nature-based tourism infrastructure means better access to remote areas to aid firefighting efforts, while information on fire safety and designated areas for activities that pose a fire risk can help reduce the risk of forest wildfires
Conduct local municipal planning of nature-based tourism activities that showcase the forest's natural beauty and biodiversity (such as guided hikes, wildlife watching, and educational tours) and develop an interactive crowdsourcing app.	Once-off, then updated/repeated as required Lead agency: MoT	Nature-based tourism activities can provide economic incentives for forest conservation and promote responsible land use	Visitor education on fire safety and nature-based tourism activities can help reduce the risk of forest wildfires



Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
Initiate “voluntourism” forest management practices, such as thinning and pruning, to reduce the risk of wildfires and promote forest health	Continuous Lead agencies: NGOs	Promotes forest health and thereby reduce the risk of wildfires	Reduces the fuel load in forests and therefore the risk of wildfires
Develop tour operators’ capacity to prevent visitors from overusing or damaging natural resources, and promote sustainable tourism practices	Continuous Lead agency: MoE	Protects natural resources from depletion and degradation, and helps to reduce the impact of tourism on forests	Helps to prevent forest fires caused by human agency
Support local communities by providing training, and create employment opportunities related to forest activities (such as organized hiking trails and birdwatching)	Continuous Lead agency: MoE	Encourages the involvement of local communities in the conservation of natural resources and sustainable forest management	Involves local communities in training and helps create awareness about fire safety measures and the importance of fire prevention
Develop marketing materials that highlight the unique natural and cultural features of the forests	Continuous Lead agencies: MoT and MoE	Promotes responsible tourism practices and encourages visitors to appreciate the natural beauty of forests without causing harm	May indirectly reduce the risk of forest fires by promoting responsible behavior
Promote collaborative partnerships between local communities with conservation organizations and government agencies, to encourage sustainable land use and protect forest eco-systems	Continuous Lead agencies: MoA and municipalities	Collaborative partnerships can help protect and preserve forest ecosystems for future generations	Collaborative partnerships can lead to more effective fire prevention and management measures
Develop a nature-based tourism strategy and action plan, including regulations	Once-off, then updated/ repeated as required Lead agency: MoT	Provides a framework for developing sustainable nature-based tourism opportunities based on responsible land use and forest conservation	Fire safety regulations can help reduce the risk of forest wildfires

## 7.5 Supporting forest ecosystem restoration to reduce fragmentation and fire risks

**Forest ecosystem restoration can yield multiple benefits, by conserving biodiversity, supporting climate resilience and carbon sequestration, and reducing fire risks by restoring degraded forests to their more natural state.** This is of particular importance for Lebanon, as forests are highly fragmented and degraded. Reducing fire risks can also positively impact the socioeconomic fabric of Lebanon’s rural landscapes, and thereby strengthen local communities. Measures to prevent catastrophic fires include increasing community awareness of the immense value of Lebanon’s forest landscapes.

**Lebanon’s National Forest Program (NFP) 2015–2025 supports the restoration of degraded lands and the increase of forest cover to meet the ecological, social, and economic needs of sustainable forest management.** The implementation of the NFP requires dedicated resources, institutional capacities, and the collaboration of various state and non-state actors.

**Table 9:** Action required on nature-based tourism

Action	Frequency and arrangements	Impact on forest sustainability	Impact on fire mitigation
Develop and prioritize actions to reduce forest fragmentation and fire risks	Once-off, then updated/ repeated as required Lead agencies: MoA and MoE	<p><b>Environmental impact:</b></p> <ul style="list-style-type: none"> <li>Prioritizes restoration actions to reduce forest fragmentation and reverse land degradation</li> <li>Incentivizes private landowners to proactively manage forest and trees on their properties</li> <li>Supports forest operational plans that encourage restoration efforts with endemic, climate-resilient species</li> </ul> <p><b>Economic impact:</b> Increases forests’ value and enhances forest protection</p> <p><b>Social impact:</b> Empowers local communities to manage public forest landscapes, based on an agreed management plan, so that they have a vested interest in protecting and maintaining their local forest</p>	<p>Introduces fire-prevention measures in fire hotspots</p> <p>Undertakes forest restoration efforts as agreed in the NFP 2015–2025 and the 2023 National Forest Fire Emergency, to help reduce the risk of wildfires</p>
Design and operate the National Forest Monitoring System (NFMS)	Once-off, then updated/ repeated as required Lead agency: MoA	<p>Encourages restoration efforts by offering guidelines for sustainable harvesting levels for wood and NWFPs (that is, annual allowable cutting and harvesting levels)</p> <p>Monitors deforestation and forest degradation regularly</p> <p>Upscales forest restoration efforts, as agreed in the NFP 2015–2025 and the 2023 National Forest Fire Emergency Management Plan</p>	<p>Contributes to wildfire prevention by:</p> <p>Providing technical guidance and institutional/capacity support to the institutional setups at subnational and local levels</p> <ul style="list-style-type: none"> <li>Coordinating the collection of subnational-level information</li> <li>Upscaling forest restoration efforts, as agreed in the NFP 2015–2025 and the 2023 National Forest Fire Emergency Management Plan</li> </ul>



# References

- Abi-Saleh, B. and S. Safi. 1988. "Carte de la végétation du Liban." *Ecologia Mediterranea* 14(1): 123–141.
- Abou Arrage, J. and S.A. Hady. 2019. "Nature-Based Tourism and Sustainability: Practices of the Lebanese Nature-Based Operators." *Менаџмент у Хотелијерству и Туризму* 7(1): 11–23.
- AFDC (Association for Forests Development and Conservation). 2019. *State of Lebanon's Forests*. Jdeideh: AFDC.
- Al Hajal, A. 2021. Thesis: "Exploring Forest Fire Mitigation Practices and Regulations in Lebanon." Beirut: University of Beirut.
- Al Khoury, C., G. Nemer, R. Humber, N. El-Hachem, J. Guillot, R. Chehab, E. Noujeim, Y. El Khoury, W. Skaff, N. Estephan, and N. Nemer. 2021. Bioexploration and Phylogenetic Placement of Entomopathogenic Fungi of the Genus *Beauveria* in Soils of Lebanon Cedar Forests. *Journal of Fungi* 7(11). <https://doi.org/10.3390/jof7110924>.
- Al-Qaddi, N., F. Vessella, J. Stephan, D. Al-Eisawi, and B. Schirone. 2017. "Current and Future Suitable Areas of Kermes Oak (*Quercus coccifera* L.) in the Levant Under Climate Change." *Regional Environmental Change* 17: 143–156.
- Al-Sayah, M. J., R. der Sarkissian, and C. Abdallah. 2022. Review of Recent Events in Lebanon (2011–2020) and Their Effect on Land Degradation. [www.gltm.net](http://www.gltm.net).
- Al Sayah, M., D. Soto, R. Nedjai, K. Selouane, N. Ziv, and P. Sohounou. 2023. "On the use of remote sensing and modeling techniques for urban heat detection, an operational study." 2023 Joint Urban Remote Sensing Event (JURSE), Heraklion, Greece 1–5. <https://doi.org/10.1109/JURSE57346.2023.10144167>.
- Al-Shaar, W. and O. Bonin. 2021. "Factors Behind the Dynamics of Land Use Evolution: Case of Lebanon." *SN Applied Sciences* 3(6): 677.
- Amidi, J., J.M. Stephan, and E. Maatouk. 2020. "Reforestation for Environmental Services as Valued by Local Communities: A Case Study from Lebanon." *Forestry Economics Review* 2(1): 97–115.
- Bassil, S., S. Kattar, R.M. Navarro-Cerrillo, M.A. Navarrete Poyatos, N. Nemer, and G. Palacios Rodriguez. 2018. "Stand Structure and Regeneration of *Cedrus libani* (A. Rich) in Tannourine Cedar Forest Reserve (Lebanon) Affected by Cedar Web-Spinning Sawfly (*Cephalcia tannourinensis*, Hymenoptera: Pamphiliidae)." *iForest* 11(2): 300–307. <https://doi.org/10.3832/for2502-011>.
- Bellefontaine, R., S. Petit, M. Pain-Orcet, P. Deleporte, and J-G. Bertault. 2002. *Trees Outside Forests: Towards Better Awareness* Vol. 35. FAO Conservation Guide.
- CDR (Council for Development and Reconstruction) and ECODIT. 2005. *National Physical Master Plan of the Lebanese Territory*. Beirut: CDR.
- Chouchani, B. 1972. "Le Liban: Contribution a son etude climatique et phytogeographique." *Mémoire Du Doctorat Du 3ème Cycle*. Toulouse: Université de Toulouse.
- Christodoulakis, N. S. 1992. "Structural Diversity and Adaptations in Some Mediterranean Evergreen Sclerophyllous Species." *Environmental and Experimental Botany* 32(3): 295–305.
- Croitoru, L. and L. Liagre. 2013. Contribution of Forests to a Green Economy in the Middle East and North Africa Region. <https://www.researchgate.net/publication/269992265>.
- Darwish, T. and G. Faour. 2008. "Rangeland Degradation in Two Watersheds of Lebanon." *In Lebanese Science Journal* Vol. 9 (1).
- Darwish, T., C. Khater, I. Jomaa, R. Stehouwer, A. Shaban, and M. Hamzé. 2011. "Environmental Impact of Quarries on Natural Resources in Lebanon." *Land Degradation & Development* 22(3): 345–358.
- DRI (Democracy Reporting International). 2019. "Lebanon's Progress on Public-Private Partnership and the Role of Local Authorities." Briefing Paper, December 2019, DRI, Berlin.
- ECODIT. 2015. *Enhancing Sustainable Livelihood and Promoting Community Management of Shouf Biosphere Reserve*, by Nizar Hani. Report, Beirut.
- ECODIT and MoE. 2011. *State and Trends of the Lebanese Environment*. Report, Beirut.
- El Khoury, Y., E. Noujeim, G. Bubici, E. Tarasco, C. al Khoury, and N. Nemer. 2021. "Potential Factors Behind the Decline of *Pinus pinea* Nut Production in Mediterranean Pine Forests." *Forests* 12(9). <https://doi.org/10.3390/f12091167>.
- Elissar, H. 2012. *A Case Study on Lebanon's National Strategy for Forest Fire Management*. Report, Issam Fares Institute for Public Policy and International Affairs, American University of Beirut, Beirut.
- Fakhoury, R., and R. Al Achkar. 2020. "National Energy Efficiency and Renewable Energy Action for Lebanon." *Improving Energy Efficiency in Commercial Buildings and Smart Communities: Proceedings of the 10th International Conference IEECB&SC'18*: 33–43.
- Fanack Water. 2022. *Shared Water Resources in Lebanon*. Available at: <https://water.fanack.com/lebanon/shared-water-resources-in-lebanon/>.
- FAO (Food and Agriculture Organization of the United Nations). 2010. *Global Forest Resources Assessment 2010: Lebanon Country Report*.
- FAO. 2012. *Country Study on Status of Land Tenure, Planning and Management in Oriental Near East Countries: Case Study of Lebanon*.
- FAO. 2015. *Lebanon Water Sector Review*. Retrieved from <http://www.fao.org/3/a-i4183e.pdf>.
- FAO. 2015. *Global Forest Resources Assessment 2015: How Are the World's Forests Changing?*
- FAO. 2016a. *Smart Adaptation of Forest Landscapes in Mountain Areas (SALMA)*. In GCP/LEB/027/SCF.
- FAO. 2016b. *The State of Lebanon's Biodiversity for Food and Agriculture*.
- FAO. 2020a. *Reforestation and Afforestation in Lebanon*. Briefing Note.
- FAO. 2020b. *Global Forest Resources Assessment 2020. Main Report*.
- FAO and MoA (Ministry of Agriculture). 2005. *Lebanon Forest Resources Assessment 2005*.
- Faour, G., and C. Abdallah. 2018. *Land Use/Cover Map of Lebanon 1:20,000*.
- FOASTAT. 2023. *Food and agriculture data*. Accessed July 28, 2023. Retrieved from <https://www.fao.org/faostat/en/#home>.
- Ghabayen, S. M. and Y. Mosleh. 2020. "The Role of Forests in Sustainable Water Resources Management: A Review." *Arabian Journal of Geosciences* 13(3): 1-11.
- Ghadban, S., M. Shames, J.A. Arrage, and A.A. Fayyad. 2017. "Rural Tourism in Lebanon: What Does the Market Reveal?" *Revue Management et Avenir* 6: 165–185.
- GIZ (German Agency for International Cooperation) and MoA (Ministry of Agriculture). 2016. *Analyse de la chain de valeur du caroubier au Liban*.
- Gloss, L., E. Myron, and H. Ahmed. 2019. *International Outlook for Privately Protected Areas Country Profile: Lebanon*. <http://www.fao.org/countryprofiles/index/en/?iso3=LBN>.
- Government of Lebanon and United Nations. 2021. *Lebanon Crisis Response Plan 2017-2021 (2021 update)*. Government of Lebanon and United Nations. 2021. *Lebanon Crisis Response Plan 2017-2021 (2021 update)*. [https://lebanon.un.org/sites/default/files/2021-03/LCRP\\_2021%20Update\\_FINAL\\_v1.pdf](https://lebanon.un.org/sites/default/files/2021-03/LCRP_2021%20Update_FINAL_v1.pdf)
- Groundviews. 2023. *Saving Forests with Corporate and Social Responsibility*. <https://groundviews.org/2023/03/21/saving-forests-with-corporate-and-public-responsibility/>
- Hamade, K. 2016. *Non-Wood Forest Product Value Chains in Lebanon*. Beirut: FAO.
- IDAL (Investment Development Authority of Lebanon). 2017. *Olive Oil Industry in Lebanon. Fact Sheet*, IDAL, Beirut.
- ILO (International Labour Organization) and FAO. 2020. "Skills Development for Inclusive Growth in the Lebanese Agriculture Sector." Policy Brief. In *Skills Development for Inclusive Growth in the Lebanese Agriculture Sector - Policy Brief*. <https://doi.org/10.4060/cb2457en>.
- IPCC (The United Nations Intergovernmental Panel on Climate Change). 2014. *Climate Change 2014. Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to The Fifth Assessment Report of the United Nations Intergovernmental Panel on Climate Change*, IPCC, Geneva.
- IPCC. 2022. *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to The Sixth Assessment Report of the United Nations Intergovernmental Panel on Climate Change*, IPCC, Geneva.
- IUCN. 2023. *IUCN Green List Al Shouf Cedar Nature Reserve*. <https://iucngreenlist.org/sites/al-shouf-cedar-nature-reserve/>.
- Jazi, M., and E. Antoun. 2014. *Firewise: Best Practice guidelines for wildfire risk management at the local level*. <https://api.lri-lb.org/Content/uploads/resourcepublications/Firewise--Lebanon.pdf>.





- Jomaa, I. and C. Khater. 2006. Contribution to the Characterization of Forest Fragmentation on the Eastern Flank of Mount Lebanon over 33 Years. *Climate Smart Agriculture: Enhancing Adaptive Capacity of the Rural Communities in Lebanon (AgriCAL)*. IFAD (International Fund for Agriculture Development)-Funded Project Improving Coastal Land Degradation Monitoring in Lebanon and Syria LIFE TCY/00/INT/00069/MED. <https://www.researchgate.net/publication/237714549>.
- Karam, B. 2016. "Estimation de la valeur économique et sociale des services rendus par les écosystèmes forestiers méditerranéens, Biosphère de Jabal Moussa, Liban." *Plan Bleu, Valbonne*.
- Lebanese Customs. 2018. Lebanese custom data vol. 2018. <http://www.customs.gov.lb/>.
- LRI (Lebanon Reforestation Initiative). 2019. *Outplanting Monitoring Report - PHASE II. Technical Report, Jdeideh*.
- LRI. 2021. *Mapping and Valuing Forest Ecosystem Services in Lebanon*. Jdeideh: LRI.
- Majdalani, G., N. Koutsias, G. Faour, J. Adjizian-Gerard, and F. Mouillot. 2022. "Fire Regime Analysis in Lebanon (2001–2020): Combining Remote Sensing Data in a Scarcely Documented Area." *Fire* 5(5). <https://doi.org/10.3390/fire5050141>.
- Makhzoumi, J. and G. Pungetti. 1999. *Ecological Design and Planning: The Mediterranean Context*. London: Spon Press.
- Makki, M. H., F. Abd-El-Khalick, and S. Boujaoude. 2003. "Lebanese Secondary School Students' Environmental Knowledge and Attitudes." *Environmental Education Research* 9(1):21–33. <https://doi.org/10.1080/13504620303468>.
- Mantero, G., D. Morresi, R. Marzano, R. Motta, D. J. Mladenhoff, and M. Garbarino. 2020. "The influence of land abandonment on forest disturbance regimes: a global review." *Landscape Ecology* 35(12): 2723–2744. <https://doi.org/10.1007/S10980-020-01147-W>.
- Masri, T., C. Khater, N. Masri, and C. Zeidan. 2006. "Regeneration capability and economic losses after fire in Mediterranean forests-Lebanon." *Lebanese Science Journal* 7(1). [https://www.researchgate.net/publication/228881018\\_Regeneration\\_capability\\_and\\_economic\\_losses\\_after\\_fire\\_in\\_Mediterranean\\_forests-Lebanon](https://www.researchgate.net/publication/228881018_Regeneration_capability_and_economic_losses_after_fire_in_Mediterranean_forests-Lebanon).
- Merlo, M., L. Croitoru, et al. 2005. *Valuing Mediterranean Forests: Towards Total Economic Value*. Wallingford: Cabi.
- MEW (Ministry of Energy and Water). 2016. *National Water Sector Strategy (NWSS)*. Retrieved from <http://www.energyandwater.gov.lb>.
- MEW (Ministry of Energy and Water). 2022. *Updated National Water Sector Strategy 2020–2035*. Retrieved from <https://www.cdr.gov.lb/getmedia/9cd1d221-df10-424a-ac31-0f0699200df5/Long-Summary-Updated-NWSS-MoEW-2020-En.pdf.aspx>.
- Mhawej, M., G. Faour, C. Abdallah, and J. Gerard. 2016. "Towards an establishment of a wildfire risk system in a Mediterranean country." *Ecological Informatics* 32. <https://doi.org/10.1016/j.ecoinf.2016.02.003>.
- Mitri, G. 2016a. *Lebanon's National Blueprint For a Sustainable Forest Biomass: Promoting Renewable Energy and Forest Stewardship*. CEDRO-UNDP (United Nations Development Programme).
- Mitri, G. 2016b. *Lebanon's National Blueprint for a Sustainable Forest Biomass: Promoting Renewable Energy and Forest Stewardship*. CEDRO-UNDP.
- Mitri, G. 2018. *National Forest Management Guidelines 2018*.
- Mitri, G., E. Antoun, M. Jazzi, and D. McWethy. 2014. *Managing Wildfire Risk in Lebanon*. Balamand: University of Balamand (UoB).
- Mitri, G., G. Nasrallah, and M. Nader. 2021. "Spatial Distribution and Landscape Impact Analysis of Quarries and Waste Dumpsites." *Environment, Development and Sustainability* 23(8): 12302–12325. <https://doi.org/10.1007/s10668-020-01169-z>.
- Mitri, G., K. Gebrael, and M. Nader. 2022. "Investigating the potential impact of climatic conditions on fire occurrence in Lebanon." *Advances in Forest Fire Research 2022*. [https://www.researchgate.net/publication/364761998\\_Investigating\\_the\\_potential\\_impact\\_of\\_climatic\\_conditions\\_on\\_fire\\_occurrence\\_in\\_Lebanon](https://www.researchgate.net/publication/364761998_Investigating_the_potential_impact_of_climatic_conditions_on_fire_occurrence_in_Lebanon).
- MoA (Ministry of Agriculture). 2015. *Lebanon National Forest Program 2015-2025*.
- MoA-FAO. 2010. *Agricultural Census*.
- MoE-ECODIT. 2002. *Lebanon State of the Environment Report (SOER) 2001*.
- MoE-UNDP. 2011. *Lebanon's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC)*. [www.moe.gov.lb/Climatechange](http://www.moe.gov.lb/Climatechange).
- MoE-UNDP-GEF (Global Environment Facility). 2015. *Lebanon's Fifth National Report to the Convention on Biological Diversity*.
- MoE-UNDP-GEF. 2016. *Lebanon's Third National Communication to the UNFCCC*.
- MoE-UNDP-GEF. 2018. *Sustainable Land Management in the Qaraoun Catchment (SLMQ) Project*.
- MoE-UNDP-GEF. 2022. *Lebanon's Fourth National Communication to the UNFCCC*.
- MoE-UNDP-UNICEF-UNHCR (United Nations High Commission for Refugees). 2020. *Lebanon State of the Environment and Future Outlook: Turning the Crises into Opportunities*.
- MoE-UNEP-GEF. 2016. *Lebanon's National Biodiversity Strategy and Action Plan*. [www.moe.gov.lb](http://www.moe.gov.lb).
- MoE-UNEP-UNDP. 2013. *Environmental Resources Monitoring in Lebanon (ERML) Project: "Analysis of the Current Land Use and Socioeconomic Activities in the Coastal Zone"*.
- Moreira, F., D. Ascoli, et al. 2019. "Wildfire management in Mediterranean-type regions: paradigm change needed." *Environmental Research Letters* 15(1): 011001. <https://doi.org/10.1088/1748-9326/AB541E>.
- Moriondo, M., P. Good, R. Durao, M. Bindi, C. Giannakopoulos, and J. Corte-Real. 2006. "Potential Impact of Climate Change on Fire Risk in the Mediterranean Area." *Climate Research* 31(1): 85–95. <http://www.jstor.org/stable/24869265>.
- MoT (Ministry of Transport). 2015. *Rural Tourism Strategy*.
- Moussa, Z., E. Choueiri, and A. Hanna. 2021. "New Invasive Insects Associated With Oak Forests in Lebanon." *Arab Journal of Plant Protection* 39(2): 164–172. <https://doi.org/10.22268/AJPP-039.2.164172>.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. Da Fonseca, and J. Kent. 2000. "Biodiversity Hotspots For Conservation Priorities." *Nature*. 403(6772): 853–858.
- Myers, J.E., Parra, M.A., & Bedford, C. 2021. *How Carbon Offsetting Can Build a Forest*. *Standord Social Innovation Review*. [https://ssir.org/articles/entry/how\\_carbon\\_offsetting\\_can\\_build\\_a\\_forest](https://ssir.org/articles/entry/how_carbon_offsetting_can_build_a_forest)
- Nabbout, R., M. El Riachy, et al. 2018. "Assessment of Ancient Carob Germplasm of Lebanon By Morphological Traits." *American Pomological Society* 72(4): 260–278.
- Nemer, N. M. and N. S. Kawar. 2005. *Monitoring of the New Cedar Web-Spinning Sawfly, Cephalcia Tannourinensis n.sp. in Cedar Forests of Lebanon*. <https://www.researchgate.net/publication/274896369>.
- Plan Bleu. 2019. *State of Mediterranean Forests 2018*. FAO.
- NRC (Natural Resources Canada). 2023. *Canadian Forest Fire Weather Index (FWI) System*. <https://cwfis.cfs.nrcan.gc.ca/background/summary/fwi>.
- Rainforest Alliance. 2023. *Rainforest Alliance Tools for Deforestation-free Supply Chains*. <https://www.rainforest-alliance.org/business/certification/rainforest-alliance-tools-to-promote-deforestation-free-supply-chains/>
- Saad, S., M. Ghandour, M. Brouche, and A. Mourtada. 2020. "Establishment of a Sustainable Energy Action Plan: Case Study of a Municipality in Lebanon." *5th International Conference on Renewable Energies for Developing Countries (REDEC)*: 1–6.
- Saba, R. 2019. "Watershed Management in Lebanon: A Case Study of the Qaraoun Lake Watershed." *Water* 11(8): 1597.
- Salloum, L. and G. Mitri. 2014. "Assessment of the Temporal Pattern of Fire Activity and Weather Variability in Lebanon." *International Journal of Wildland Fire* 23(4): 503–509.
- Sattout E. 2014. *Economic Values of Forest Ecosystems Services in Lebanon*, GIZ Silva Mediterranean Collaborative Partnership on Mediterranean Forests.
- Sattout, E. and G. Faour. 2017. *Insights on the Value Chain and Management Practices of Stone Pine Forests in Lebanon*.
- Sattout, E. J. and M. Abboud. 2007. "National Capacity Self-Assessment for Global Environmental Management." *Thematic Biodiversity Profile. National Self-Assessment for Global Management*. Beirut: GEF/UNDP/MoE.
- Shaban, A. 2021. *Rivers of Lebanon: Significant Water Resources under Threats*. IntechOpen. <https://doi.org/10.5772/intechopen.94152>.
- Stephan, J. 2013. "Socioeconomic Impact Assessment." *In Safeguarding and Restoring Lebanon's Woodland Resources*. Project.
- Talhok, S. N., M. Itani, and M. Al-Zein. 2018. "Biodiversity in Lebanon." *In Global Biodiversity*. Apple Academic Press: 259–306
- Tolba, M. K. and N.W. Saab. 2009. *Arab Environment: Climate Change*. Beirut: Arab Forum for Environment and Development.
- UNCCD (United Nations Convention to Combat Desertification) and MoA. 2018. *National Report on Land Degradation Neutrality*.



UNDP (United Nations Development Programme). 2017. ISMOE II. <https://www.undp.org/lebanon/projects/institutional-strengthening-ministry-environment-phase-ii>.

UNDP. 2018. Lebanon State of the Environment Report. Retrieved from [http://www.lb.undp.org/content/lebanon/en/home/library/environment\\_energy/sustainability/lebanon-state-of-the-environment-report.html](http://www.lb.undp.org/content/lebanon/en/home/library/environment_energy/sustainability/lebanon-state-of-the-environment-report.html).

UNDP. 2019. Sustainable Biomass Production for Energy in Lebanon.

UNEP (United Nations Environment Programme). 2016. "Ecosystem-Based Adaptation for Water Resources Management: A Guide for Decision-Makers." Retrieved from <https://www.unep.org/resources/report/ecosystem-based-adaptation-water-resources-management-guide-decision-makers>.

UNEP. 2015. The Role of Forests in a Green Economy Transformation in Africa.

UNEP. 2012. The Role and Contribution of Montane Forests and Related Ecosystem Services to the Kenyan Economy.

UNESCO (United Nations Educational, Scientific and Cultural Organization) and UNEP. 1992. Changing Minds, Earthwise: A Selection of Articles, 1976-1991, from Connect (UNESCO Environmental Education Newsletter).

ESCWA (United Nations Economic and Social Commission for Western Asia). 2018. Climate Change Vulnerability Assessment of Water Resources in Lebanon. Retrieved from <https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/climate-change-vulnerability-assessment-water-resources-lebanon-en.pdf>.

USAID (United States Agency for International Development). 2013. Honey Value Chain Assessment. Final Report, Washington, DC.

World Bank. 2021. Lebanon Economic Monitor: Lebanon Sinking (To the Top 3). Report, The World Bank, Washington, DC.

World Bank. 2022a. Climate Change Knowledge Portal: Lebanon. <https://climateknowledgeportal.worldbank.org/country/lebanon/climate-data-historical>.

World Bank. 2022b. World Development Indicators: Forest rents (% of GDP). Accessed July 28, 2023. Retrieved from <http://databank.worldbank.org/data/reports.aspx?source=2&type=metadata&series=NY.GDP.FRST.RT.ZS>.

World Bank. 2023. Lebanon Overview: Development news, research, data. <https://www.worldbank.org/en/country/lebanon>.

WRI (World Resources Institute). 2021. Forests and Climate Change.

Zohary, M. 1973. Geobotanical Foundations of the Middle East. Stuttgart: Fischer.

# Annexes

## Annex 1: Bioclimatic zones of Lebanon

### BIO-CLIMATE

**Thermo-Med. (<500 m)**

### SUBSTRATE/FOREST HABITAT TYPE

Limestone: Carb-Lentisk Scrub, Pine woodlands, Evergreen oak woodlands, Mixed oak-pine woodlands  
Marl and marly-limestone: Pine forest, Mixed conifer forest, Cypress forest  
Sandstone: Pine forests

**Eu-MEd. (500–1,000 m)**

Limestone: Evergreen oak forests, Mixed oak-pine forests, Deciduous oak forests  
Marl & marly-limestone: Mixed conifer forests, Pine forests, Cypress forests  
Sandstone: Pine forests

**Supra-Med.(1,000–1,500 m)**

Limestone: Evergreen oak forests, Mixed oak and juniper forests, Deciduous oak forests,  
Hophornbeam mixed forests  
Sandstone: Stone pine forests, Deciduous oak forests

**Mountain-Med (1,600–1,900 m)**

Mixed conifer, Mixed conifer/oak forests, Oak forests, Juniper woodlands

**Oro-Med (>1,900 m)**

Juniper woodlands

**Steppe non-forest**

Hammada scrub

**Steppe-Med.(900–1,500 m)**

Evergreen oak forests

**Steppe-Supra-Med. (1,500–1,800 m)**

Mixed oak forests

**Steppe. Mountain-Med.(1,800–2,400 m)**

Juniper forests

**Steppe-Oro-Med (> 2,400 m)**

Juniper woodlands

**Riparian forests**

Lowland Plane tree forests

Plane tree and alder forests

Sandstone: Alder forests



## Annex 2: Examples of Lebanese environmental NGOs and their field of activity (State of the Environment Report 2020)

NGO Name	Field of Activity	Achievements
Association for Forests Development and Conservation (AFDC) (established 1995) <a href="http://www.afdc.org.lb/">www.afdc.org.lb/</a>	Promotes community-based forest management and conservation, including fire prevention  Raises awareness and builds capacity in support of national efforts to improve environmental management	CoM approved a MoU between MoE and AFDC to develop and implement an action plan for forest fire prevention and landscape restoration (Decision 138 dated 2007/10/27)  Working in collaboration with the IUCN, in May 2009 AFDC released the long-awaited <i>Lebanon's National Strategy for Forest Fire Management: Building Partnerships</i>  In 2019, AFDC—in collaboration with MoA, MoE, UNCCD, UNEP, UNDP, the LDN Global Mechanism, the GEF and the IUCN—published the <i>Integration of Lebanon's Land Degradation Targets within the National Action Program (NAP) to Combat Desertification</i>
Association pour la Protection des Sites et An-ciennes De-meures au Liban (APSAD) (established 1960) <a href="http://www.apsad.net">www.apsad.net</a>	Promotes protection and restoration of ancient buildings that carry historical and/or unique architectural value  Lobbies for promulgating laws and regulations protecting architectural heritage	Active since 1962 in the restoration and rehabilitation of traditional Lebanese houses (historical façades), old souks, khans, and old streets (Jbeil, Jounieh, Bikfaya, Zouk Mikhael, Deir El Kamar)  Lobbied for protecting a historical building in Sodeco (Beirut) and converting it into a museum (Beit Beirut)
Friends of the Cedars of Bcharre Committee (established 1986) <a href="http://www.cedarfriends.org">www.cedarfriends.org</a>	Charged by the MoT to oversee and manage the ancient cedar grove of Bcharre (Arz el Rab, a World Heritage Site)  Implements increasingly larger and bolder reforestation activities in the area of Bcharre	The organization manages its own plant nursery (located in Bcharre) and transplants approximately 12,000–10,000 seedlings per year, mostly cedars, to restore the cedar mantle overlooking Qadisha Valley
Friends of Nature (established 1972) <a href="https://f-o-n.org/">https://f-o-n.org/</a>	Works on the protection of the natural heritage of Lebanon in all its aspects, from research to implementation, through developing and executing a diversity of tools: i) conserves assets and landscapes ii) reduces threats iii) spreads awareness and advocacy iv) engages youth and communities v) promotes nature-based tourism and rural development	Pioneered nature conservation prior to the Convention on Biological Diversity in the creation of the first two nature reserves through community engagement and precedent-setting legislation  Provided the preambles and documentation for the creation of the Ministry of Environment and supported its continued status as a separate ministry  Supported the establishment of many sister NGOs, protected many forests and landscapes from fires, garbage, infestations, logging, quarrying, and other threats  Established an archetypal artificial reef garden for marine ecosystem restoration  Fosters in-situ conservation of endemic plants

NGO Name	Field of Activity	Achievements
Jouzour Loubnan (established 2008) <a href="http://www.jouzourloubnan.org/">www.jouzourloubnan.org/</a>	Participates in the restoration of Lebanese woodland  Promotes sustainable forestation in arid regions	Designed and launched eight consecutive national awareness campaigns  Planted more than 350,000 native trees in more than 20 areas across Lebanon  Created a seed bank lab
Lebanon Mountain Trail Association (LMTA) (established 2007) <a href="http://www.lebanontrail.org">www.lebanontrail.org</a>	Develops, maintains, and promotes the Lebanon Mountain Trail, a 440-kilometer path that crosses 75 towns and villages  Protects the natural, cultural, and architectural heritage and landmarks near the trail  Enhances economic opportunities by promoting responsible tourism	Prepared and updated a complete set of communication material, including brochures and maps  Attracts more than 30,000 visitors on the trail every year  Organizes an annual walk-through spanning 30 days  Co-sponsored the production of a coffee-table book, A Million Steps  Organizes training for local guides  Lobbies MoT for recognition of local guesthouses and MoE for protection of trail corridor
Lebanon Reforestation Initiative (LRI) (established 2011) <a href="http://www.lri-lb.org">www.lri-lb.org</a>	Preserves and manages forests by supporting local governments and communities	Projects include the ecological rehabilitation as part of the Sustainable Land Management in the Qaraoun Catchment (SLMQ) (Bekaa), the Forest and Landscape Restoration Mecnamism to combat land degradation, as well as various reforestation activities all over the territory (Bakka, Mchaa' Keserwan, Sfireh, Taran, Btormaz, Yammouneh, Dahr El Ahmar, Mdoukha)
Mada (established 2000) <a href="http://www.Mada.org.lb">www.Mada.org.lb</a>	Reinforces the relationship between local communities and their natural environment for the satisfaction of their subsistence needs, especially in Aakkar, Donnieh and Hermel	In 2006, Mada defined a pilot zone (about 270 square kilometers) stretching from Brissa to Qbaiyat, and signed cooperation protocols with the municipalities of Qbaiyat, Hrar, Michmich, and Fnaideq to formulate a regional action plan to promote and enhance the natural resources of the area  The organization also conducted studies on flora and avifauna and will soon extend them to fauna  The proposed national park is today embedded in the NPMLPT (Decree 2366 dated 2009/06/20), along with six others
Society for the Protection of Nature in Lebanon (SPNL) (established 1983) <a href="http://www.spnl.org/">www.spnl.org/</a>	Dedicated to causes that protect species, conserve sites, improve lives, educate the youth, and unite people around the HIMA	SPNL advocated the establishment of protected areas and the Hima community-based conservation approach that has been prevalent in the Arabic region for more than 1,500 years  As a member of the World Conservation Union (IUCN), SPNL has helped develop the first biodiversity project in Lebanon, known as the Protected Areas Project  SPNL has established the Environment Information Center (EIC) that serves as a key resource for the provision of environmental information to students, teachers, and researchers in this field



