PROGRAMME

The Water-Energy-Food-Ecosystems Nexus in the Mediterranean

A Rapid Assessment

NEXUS

gef

UN environment programme

Mediterranean Action Plan
Barcelona Convention

Global Water Partnership Mediterranean

2.2
Mediterranean Coastal Zones: Managing the Water-Food-Energy and Ecosystem NEXUS

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The co-authors are solely responsible for the content and arguments employed in this document, which do not necessarily reflect the views of the partner institutions or the focus countries.

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LIST OF ABBREVIATIONS

ADA	Austrian Development Agency
AKBN	National Agency of Natural Resources
ALPEX	Albanian Power Exchange
AMBU	Water Resources Management Agency
ARC	Agricultural Research Centre
BCM	Billion cubic metres
CBD	Convention on Biological Diversity
CNRE	National Water Resources Centre
CSEC	Water and Climate Council
EAO	Egyptian Agricultural Organisation
EBSAP	Egyptian Biodiversity Strategy and Action Plan
EDCO	Electricity Distribution Company
EDL	Electricité du Liban
EEAA	Egyptian Environmental Affairs Agency
EGA	Environmental General Authority
EIA	Environmental impact assessments
EMRC	Energy and Minerals Regulatory Commission
EQA	Environment Quality Authority
ESMF	Environmental and Social Management Framework
EU	European Union
FRSU	Floating storage and regasification unit
GDP	Gross domestic product
GDRS	General Directorate of Rural Services
GEF	Global Environment Facility
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GWA	General Water Authority
HPP	Hydropower plants
IDA	International Development Association
IFAD	International Fund for Agricultural Development

IPMG	Integrated Policy Management Group
IWRM	Integrated Water Resources Management
JEDCO	Jordan Enterprise Development Corporation
JEF	Jordan Environment Fund
JMP	Joint Monitoring Programme
JVA	Jordan Valley Authority
LRA	Litani River Authority
LULUCF	Land use, land-use change and forestry
MAFWM	Ministry of Agriculture, Forestry and Water Management
MALR	Ministry of Agriculture and Land Reclamation
MASEN	Moroccan Agency for Sustainable Energy
MCM	Million cubic metres
MENR	Ministry of Energy and Natural Resources
MFTER	Ministry of Foreign Trade and Economic Relations
MIE	Ministry of Infrastructure and Energy
MoEW	Ministry of Energy and Water
MTE	Ministry of Tourism and Environment
MTEDD	Ministry of Energy Transition and Sustainable Development
MWI	Ministry of Water and Irrigation
MWRI	Ministry of Water Resources and Irrigation
NAF	National Agency of Forests
NAP	National Adaptation Plans
NAPA	National Agency of Protected Areas
NARC	National Agricultural Research Centre
NBSAP	National Biodiversity Strategy and Action Plan
NCEJ	National Center for Environmental Justice
NDC	Nationally Determined Contributions
NEA	National Environmental Agency
NECP	National Energy and Climate Plan
NEPCO	National Electric Power Company
NOC	National Oil Corporation
NRC	National Research Centre
NRSDS	National Rural Sector Development Strategy
NSCC	National Strategy for Climate Change

NREAP	National Renewable Energy Action Plan
NSPW	National Sectoral Programme on Water
NVS	National Vision and Strategy
NWC	National Water Council
NWSAS	North-Western Sahara Aquifer System
ONEE	National Office of Electricity and Water
OSHEE	Universal Service Provider
PMU	Programme Management Unit
PV	Photovoltaic
PWA	Palestinian Water Authority
RBMP	River Basin Management Plans
RDID	Regional Directorates of Irrigation and Drainage
RES	Renewable energy sources
SDG	Sustainable Development Goals
SIE	Energy Investment Company
SNDA	National Sanitation Development Plan
SNTE	National Ecological Transition Strategy
SPAN	Strategy and National Action Plan for the Sustainable Use of Biological Diversity
STEG	Tunisian Company for Electricity and Gas
TTA	Tanger-Tétouan-Al
UfM	Union for the Mediterranean
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WAJ	Water Authority of Jordan
WEFE	Water-Energy-Food and Ecosystems
WES	Water and Environment Support
WHO	World Health Organization
WRC	Water Regulatory Council
WSS	Water supply and sanitation
WWTP	Wastewater treatment plant

1 BACKGROUND AND SCOPE OF THE REPORT

The Report *The Water-Energy-Food-Ecosystems Nexus in the Mediterranean – A Rapid Assessment* was prepared in 2023–2024 in the context of the **Regional Nexus Dialogue Process in the Mediterranean** (Regional Dialogue) initiated under the "Mediterranean Coastal Zones: Managing the Water-Energy-Food and Ecosystems Nexus" project, executed by Global Water Partnership – Mediterranean (GWP-Med). The latter is the Child Project 2.2 of the "Mediterranean Sea Programme: Enhancing Environmental Security" (MedProgramme) funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme through its Mediterranean Action Plan (UNEP/MAP).

The Union for the Mediterranean (UfM) in the framework of its activities on the Water-Energy-Food and Ecosystems (WEFE) Nexus and the Sustainable Blue Economy, and the European Commission, through the Water and Environment Support (WES) project, joined forces with GWP-Med and UNEP/MAP.

This Regional Dialogue is part of a multi-stakeholder process that aims to enhance awareness and develop capacities of policy-makers, institutions and practitioners related to the opportunities of the WEFE Nexus approach, and to foster a coordinated approach in the Mediterranean for an integrated natural resources management implemented in the source-to-sea continuum. Overall, the multi-stakeholder dialogue process will lead to the development of a community of practice and commitments by Mediterranean countries, aiming to address a number of issues related to water, food, and energy security as well as to the preservation of ecosystems across the basins, coastal areas and the large marine ecosystem of the Mediterranean Sea.

The commitments will be described in the "WEFE Nexus Strategy in the Mediterranean source-to-sea continuum", currently under development. The Strategy will be anchored to the UfM and the Barcelona Convention political process, while the Regional Dialogue will enable consultation with the stakeholders.

The present **rapid assessment** is a key input in this multi-stakeholder process, enabling dialogue and interaction. Its scope focuses on governance aspects, and in each country provides a snapshot of policy and institutional settings related to the WEFE Nexus, while also providing an overview and rapid assessment of the status, challenges and trends related to the Nexus "elements".

The rapid assessment complements two parallel related activities in the Mediterranean:

- The *Special Report on the Climate-Water-Energy-Food-Ecosystems Nexus* that is under preparation by the Mediterranean Experts on Climate and Environmental Change (MedECC)[1]. This report will identify the physical and human drivers of changes of the WEFE Nexus and related impacts, review related measures and solutions, discuss the links between the WEFE Nexus and the Sustainable Development Goals (SDGs), and will review regional initiatives and research options.
- The activities of UfM in partnership with the European Union (EU) on "Applying a WEFE Nexus Approach to Water Finance and Investments".

This work collectively provides a baseline on the WEFE Nexus in the Mediterranean against which progress in the areas covered by the assessments, will be measured.

The rapid assessment was initially prepared for the nine beneficiary countries of the MedProgramme, namely Albania, Algeria, Bosnia and Herzegovina, Egypt, Lebanon, Libya, Montenegro, Morocco and Tunisia. GWP-Med secured additional funding from the GWP that allowed expanding the rapid assessment to also cover Jordan, Mauritania, Palestine and Türkiye.

The content of this rapid assessment was primarily based on desk studies drawing on available information acquired by the end of 2023, as well as of individual consultations with key stakeholders. In this regard the assessment should be considered as a snapshot, and subject to an update in the future to capture developments and progress.

1 MedECC is an open and independent international scientific expert network founded in 2015 to provide support to decision-makers, stakeholders, and the general public with the best available scientific knowledge on climate and environmental change, and the current and future associated risks in the Mediterranean basin. It is supported by UNEP/MAP and UfM. More info: www.medecc.org.

2 INTRODUCTION AND KEY FINDINGS

2.1 Water-energy-food-ecosystems: interlinkages and the Nexus approach

Strong and complex interlinkages exist in the management of water, energy, food and ecosystems. The socio-economic and governance sectors, and the related natural systems, do not operate in isolation, but are heavily cross-dependent. As an example, agriculture is the largest consumer of freshwater resources, while energy generation is also highly dependent on water for extraction of fossil fuels, hydropower, cooling thermal power plants, biofuel crops, etc. At the same time, both the food and water sectors are energy intensive: around a quarter of total energy consumption is related to food production and supply, while up to 30% of the operating costs of water and wastewater utilities are energy-related, including desalination.

In order to meet sustainable development objectives and enable social stability, we need to ensure water, energy and food security, while preserving the health of natural systems. For the latter to be enabled, it is critical that natural resources are managed in an integrated, efficient, equitable and climate-resilient manner.

However, trade-offs exist among the WEFE elements posing challenges for an overall effective response. Seeking to address one sector's challenges and risks in isolation may undermine meeting other sectors' objectives.

At the same time, sectoral governance and management settings remain unsuitable for coordinated and effective responses. Formal institutional cooperation, wherever it exists, does not necessarily lead to integrated policy-making and investment planning. Overlapping responsibilities and competing mandates are also often observed both "horizontally" (across sectors) and "vertically" (between local and central authorities). Sectoral policy frameworks in the Mediterranean countries largely do not address other sectors' considerations.

Further to the aforementioned sectoral disconnects, there are additional disconnects in governance, policy development, and planning among basin, coastal and marine areas. These spatial-level disconnects create an additional layer of management failures across the source-to-sea continuum, resulting in upstream/downstream adverse effects and impacts on the natural and anthropogenic environment.

The application of systems thinking in policy development and management is an appropriate means to seek solutions.

The WEFE Nexus approach is essentially about moving beyond a traditional sectoral or fragmented thinking, and adopting an integrated and coordinated approach across the WEFE sectors for the management of natural resources, by reconciling the potentially conflicting interests of different sectors and stakeholders that may

compete for the same scarce resources, while at the same time capturing cross-sectoral synergies and efficiencies.

In the Mediterranean area, adopting and implementing the WEFE Nexus approach, combined with source-to-sea management considerations, has the potential to provide multiple benefits to society, by supporting:

- the adoption of sustainable socio-economic practices that contribute to addressing the triple planetary crisis of biodiversity loss, climate change and pollution;
- enhanced resilience of natural and socio-economic systems and their adaptation to expected risks of climate change;
- the achievement of global policy goals, such as the SDGs, as well as EU policy objectives outlined in the European Green Deal, goals related to green energy transition, circular economy and healthy living;
- regional cooperation, social cohesion, conflict prevention and peace-building; and
- economic development, by supporting job creation, promoting innovation, enabling investments opportunities and investment risk management, while fostering regional economic integration, including by promoting Circular and Blue Economy.

2.2 Drivers of change and key challenges in the management of natural resources in the Mediterranean

Across the Mediterranean, the availability and quality of natural resources are under increasing pressure, posing related security risks. Such challenges are amplified by current and future ecological drivers (predominantly climate change), as well as social drivers (such as population growth, lifestyle changes, urbanisation, migration, industrialisation and war).

It is important to note from the onset that significant differences and variations exist among countries around the Mediterranean regarding their natural conditions, the availability of natural resources and the risks from climate change, as well as on economic development, governance, demographic trends and socio-economic issues. Further variances in are also evident at the subnational level, with urban and/or coastal areas facing stronger challenges and pressures.

Climate change

The Mediterranean region has been identified as a global "hot spot" for climate change, given that the observed rates of change are higher than global trends for many climatic variables, notably the increase in mean annual temperatures. An extensive review of the scientific findings and projections regarding climate change in the Mediterranean is provided in the First Mediterranean Assessment Report (*Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future* – MAR1[2]), published in 2020 by the independent international scientific expert network MedECC.

MAR1 projects that future warming in the Mediterranean region will be 25% faster than the global mean. Effects are expected to be more pronounced during summers, with temperatures increasing at a rate 40% faster than the global mean.

Significant changes are projected in terms of precipitation patterns, even in the scenario of restricting global temperature increase to 2°C. Average summer rainfall is expected to decrease by 10–15% in most of Southern Europe, and by as much as 30% in Türkiye; the frequency and

2 MedECC (2020): *Climate and Environmental Change in the Mediterranean Basin: Current Situation and Risks for the Future. First Mediterranean Assessment Report*, Marseille.

duration of droughts may double in parts of North Africa. In parallel, the projected increased intensity and frequency of precipitation extremes, in combination with inadequate flood management systems and practices, will exacerbate the risk of flooding in most of the Mediterranean Basin.

As a consequence of increased temperatures and drought events, the frequency of large, severe forest fires is expected to increase. Projected changes and fluctuations in temperature and precipitation have the potential to cause disruptions in ecosystems and trigger modifications in species distribution, including population decline or even extinction of certain species, as well as increased risks of invasive species establishment. The absorption of carbon dioxide (CO_2) by the sea will result in increasing sea water acidification, adding pressure on ecosystems.

Depending on scenarios and projections, sea level is expected to rise between 40 cm and 100 cm by 2100.

Socio-economic realities

The Mediterranean region's population has grown by 259 million inhabitants (+84%) in the past 50 years, reaching 542 million people in 2020. A total of 85% of this increase occurred in the Mediterranean's southern and eastern shores, which now host some 60% of the whole region's population. The total population is expected to increase by more than 100 million until 2050, predominantly in the southern regions[3].

Population growth in the southern and eastern Mediterranean countries is expected to develop through urban growth, mainly in coastal areas, leading to an urban population share of 75% by 2050, up from 48% in 1960. Beyond this internal rural-urban migration, significant migration movements occur towards Europe, mainly from North African countries.

The Mediterranean is also a global tourism hotspot, holding 30% of global tourist arrivals. The number of international tourists in the region grew from 58 million in 1970 to 349 million in 2015, and is expected to grow to 500 million by 2030.

These two drivers, climate change and socio-economic trends, are the fundamental external drivers that will largely define the realities of the region. They are increasingly putting significant and interlinked pressures and challenges in the region's sustainable development, of course with important variations across countries. Such challenges often lead to threats to the security of supply of resources related to all elements of the WEFE Nexus: scarcity of water resources and pressures on their quality threaten water security; dependence on imported fuels with high price fluctuations and ambitious climate commitments affect energy security; the combined factors of water scarcity, land degradation and high import dependence threaten food security; and agricultural and urban expansion, pollution, and infrastructure development lead to increased biodiversity loss affecting ecosystems' security.

Related findings are outlined in the sections below.

Water security

The Mediterranean region is one of the most water-scarce regions in the world, with the challenge being more severe in its southern and eastern shores.

The increasing frequency and intensity of droughts as a result of climate change, coupled with population growth and unsustainable practices in the management of water resources, directly threaten water security in most countries, often leading to conflicts among users (e.g. agriculture and urban/touristic development). Overconsumption of groundwater resources and salination of coastal aquifers further aggravate the challenge.

3 Intergovernmental Panel on Climate Change (2022): *Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cross-Chapter Paper 4: Mediterranean Region, Cambridge and New York.

In parallel, climate change predictions, especially in the case of the three countries in the Western Balkans, indicate an increase in the frequency, intensity and duration of heavy rains, increasing the likelihood of floods as well as their destructive nature.

Water stress can be assessed and quantified using the SDG 6.4.2 indicator "Freshwater withdrawal as % of available freshwater resources". Based on this data, four of the countries assessed (Algeria, Egypt, Jordan and Libya) face critical water stress with withdrawal rates over 100%, while Tunisia with 98.1% faces high but very close to critical water stress. Lebanon and Morocco face medium water stress. Palestine and Türkiye face low water stress. Albania, Bosnia and Herzegovina, Montenegro, and Mauritania face no stress[4]. The categorisation follows FAO's related taxonomy: low stress 25–50% withdrawal; medium stress 50–75% withdrawal; high stress 75–100% withdrawal; critical stress over 100% withdrawal.

In terms of water supply, access to basic drinking water services (SDG indicator 1.4.1) is almost universal in all countries. Regarding access to safely managed drinking water services (SDG indicator 6.1.1), the countries assessed have rates of 71–87%, with the exception of Lebanon (48%). No related data is available for Egypt, Libya and Mauritania.

The situation is more challenging in terms of access to modern sanitation services, where again some regional variance is evident. Using the SDG 6.2.1 indicator (population % using safely managed sanitation) this is a particularly key challenge in Lebanon, Algeria and Libya (16–22%) but also in Bosnia and Herzegovina, Montenegro, and Albania (39–48%) while less so in Egypt, Palestine, Türkiye, Tunisia and Jordan (67–82%). No related data is available for Mauritania[5].

	Albania	Algeria	Bosnia and Herzegovina	Egypt	Jordan	Lebanon	Libya	Mauritania	Montenegro	Morocco	Palestine	Tunisia	Türkiye
Population % using a safely managed drinking water service	71.0%	71.0%	87.0%	N/A	86.0%	48.0%	N/A	N/A	85.0%	75.0%	80.0%	74.0%	N/A
Population % using safely managed sanitation	48.0%	18.0%	40.0%	67.0%	82.0%	16.0%	22.0%	N/A	45.0%	61.0%	67.0%	81.0%	78.0%
Freshwater withdrawal as % of available freshwater resources	4.7%	137.9%	2.0%	141.2%	104.3%	58.8%	817.0%	13.2%	N/A	50.8%	47.0%	98.1%	45.7%

4 United Nations Department of Economic and Social Affairs (UN DESA): Sustainable Development Goals indicators website, https://unstats.un.org/sdgs.

5 UN DESA: Sustainable Development Goals indicators website, https://unstats.un.org/sdgs.

Food security

Agriculture is the major consumer of water in the Region typically using over 70% of total water withdrawals, with the exceptions of Jordan, Lebanon and Palestine (40–50%)[6].

Therefore, decreasing water availability together with increased heat stress can lead to a decrease in crop yields and threaten food security, especially in arid and semi-arid regions. This is compounded by the low agricultural productivity and increasing population growth in the region.

Food security is further highly vulnerable to external uncertainties as countries in the region, particularly in the Eastern and Southern Mediterranean, are significant importers of food.

Looking into the key category of cereals, and according to the Food and Agriculture Organization of the United Nations (FAO), Jordan, Libya, Lebanon and Montenegro import more than 88% of the cereals they consume, followed by Algeria, Tunisia, Morocco, Egypt, Albania, and Bosnia and Herzegovina. Türkiye stands out for importing just 8% of its cereal consumption[7].

Agriculture is a key economic sector in most countries with the sector's share of the gross domestic product (GDP) of 4.1–6.3% in Lebanon, Bosnia and Herzegovina, Jordan, Türkiye, and Montenegro; 8.4–12.2% in Palestine, Tunisia, Egypt, Morocco and Algeria; and 17.7–18.6% in Albania and Mauritania. No related data was available for Libya[8].

	Albania	Algeria	Bosnia and Herzegovina	Egypt	Jordan	Lebanon	Libya	Mauritania	Montenegro	Morocco	Palestine	Tunisia	Türkiye
Cereal import dependency ratio	38.0%	70.0%	31.0%	48.0%	100.0%	93.0%	94.0%	N/A	88.0%	49.0%	N/A	63.0%	8.0%
Agriculture as % of GDP	17.7%	12.2%	5.0%	11.4%	5.2%	4.1%	N/A	18.6%	6.3%	12.0%	8.4%	10.1%	5.5%

6 FAO (2022): *The State of Land and Water Resources for Food and Agriculture in the Near East and North Africa Region: Summary Report*, Cairo.

7 FAO: FAOSTAT website, https://www.fao.org/faostat.

8 UN DESA: Sustainable Development Goals indicators website, https://unstats.un.org/sdgs.

Energy security

Access to electricity is not an issue in the region. All countries assessed have a 100% share of population with access to electricity (SDG indicator 7.1.1) with the exception of Libya (70% overall, 100% in urban areas) and Mauritania (48% overall, 90% in urban areas)[9].

A key challenge for nearly all Mediterranean countries, except Algeria, Egypt and Libya, is that they rely on imported energy to cover their increasing domestic demand and are therefore vulnerable to energy price fluctuations and geopolitical uncertainties. The situation is more critical in Morocco, Jordan and Lebanon, which import 91–98% of the energy they consume[10]. No related data was available for Mauritania and Palestine. The latest information available and used here (World Bank Data Indicators) is from 2014–2015 and may be quite dated.

Regarding policies to move away from fossil fuels towards a zero-carbon future, significant discrepancies exist among the countries assessed. In terms of the share of renewable energy sources (RES) in total final energy consumption (SDG indicator 7.2), as fossil fuel-producing countries Algeria, Libya and Egypt rank very low, with RES shares of 0.1, 3.1 and 6.5% respectively. Lebanon also ranks low with 6.7%, followed by Morocco, Jordan, Tunisia, Türkiye and Palestine with shares of 10.9–13.9%. Mauritania has a RES share of 23.8% mainly due to biomass use, while the three Western Balkan countries fare better mainly due to hydropower and also increasing wind and solar shares (Bosnia and Herzegovina at 37.7, Montenegro at 39.6 and Albania at 44.6%)[11].

	Albania	Algeria	Bosnia and Herzegovina	Egypt	Jordan	Lebanon	Libya	Mauritania	Montenegro	Morocco	Palestine	Tunisia	Türkiye
Energy imports, net (% of energy use)	14.0%	-177.0%	23.0%	-7.0%	97.0%	98.0%	-103.0%	N/A	28.0%	91.0%	N/A	36.0%	75.0%
Share of RES in total final energy consumption	44.6%	0.1%	37.7%	6.5%	11.0%	6.7%	3.1%	23.8%	39.6%	10.9%	13.9%	12.9%	13.7%

9 UN DESA: Sustainable Development Goals indicators website, https://unstats.un.org/sdgs.

10 World Bank Group: Energy imports, net (% of energy use) website, https://data.worldbank.org/indicator/EG.IMP.CONS.ZS

11 UN DESA: Sustainable Development Goals indicators website, https://unstats.un.org/sdgs.

Ecosystems and biodiversity under threat

The Mediterranean region is a global biodiversity hotspot. However, ecosystems and habitats are under threat, mainly from overexploitation and land conversion from agricultural, urban and touristic development, as well as from land degradation, deforestation, pollution and invasive alien species.

Climate change is increasingly a major force driving the dynamics of ecosystems, and has the potential to significantly disturb ecological interactions and trigger modifications in species distribution. Such examples include climate change-related impacts on water resources in wetlands and riparian ecosystems; increase in the intensity of temperature and climatic extremes; desertification and land degradation; increase in the severity of wildfires; invasion of non-indigenous species at sea and on land; and ocean acidification.

The degradation of ecosystems and reduction in biodiversity can lead to a decline in the provision of ecosystem services, such as decrease in soil fertility and agricultural productivity, effects on carbon sequestration and water filtration etc. Specifically regarding land degradation, the proportion of land that is degraded over total land area (SDG indicator 15.3.1) is a challenge especially in Jordan, Mauritania, Türkiye and Lebanon, where the share of degraded land ranges from 10.8 to 25.6%. Albania fares well with just 3.6% degraded land, while the other countries have shares between 5.0 and 6.8%.

Policies to protect ecosystems and conserve biodiversity are increasingly being implemented across the region. A key metric in this regard harmonised across countries is the share of freshwater Key Biodiversity Areas (KBAs) that have been given protected status (SDG indicator 15.1.2). Mauritania, Türkiye and Lebanon are falling behind under this metric, protecting 0–9% of their freshwater KBAs. Bosnia and Herzegovina are leading with 100% and 96.6% respectively, followed by Algeria (78.9%) and Morocco (71.2%). A further key metric is the proportion of land that is degraded over total land area (SDG indicator 15.3.1), which shows that the issue is more pressing in Jordan, Mauritania and Türkiye.

	Albania	Algeria	Bosnia and Herzegovina	Egypt	Jordan	Lebanon	Libya	Mauritania	Montenegro	Morocco	Palestine	Tunisia	Türkiye
% of protected freshwater KBAs	96.6%	78.9%	100.0%	28.5%	18.7%	9.0%	N/A	0.0%	49.2%	71.2%	N/A	43.4%	4.2%
% of land that is degraded over total land area	3.6%	5.0%	6.8%	6.4%	25.6%	10.8%	1.5%	13.6%	6.7%	5.0%	N/A	6.1%	13.4%

2.3 Rapid assessment of the WEFE Nexus in the Mediterranean – a summary

2.3.1 Key interlinkages across the WEFE elements

The Mediterranean region overall faces critical challenges in all WEFE elements. Its southern and eastern areas are among the most water-scarce regions in the world, while water quality degradation remains a major concern. The region is highly dependent on food imports, while agricultural productivity is threatened by water scarcity and the impacts of climate change. Almost all countries are highly dependent on fossil fuel imports, while utilisation of renewable energy remains low. And marine and terrestrial ecosystems are under acute pressure, due to land-use changes, pollution and the impacts of climate change. The key drivers of change in the region are climate change, population growth, urbanisation and economic development.

Key conflicts and trade-offs across the WEFE elements include:

- Water scarcity, together with increasing temperatures and frequency of droughts, creates challenges in the availability of water resources for increasing irrigation demand, and leads to reduced agricultural yields.
- The projected decline in precipitation and stream-flows will negatively impact hydropower generation, while combined with increasing water temperatures will reduce the available capacity of water-cooled thermoelectric and nuclear plants. At the same time, excessive water withdrawals for energy production can negatively affect water availability and ecosystems.
- Increasing demand for irrigation, water supply and sanitation (WSS) services, and desalination leads to increase in energy demand.
- Increasing demand for agricultural land can lead to land degradation and habitat loss. Increasing irrigation needs can threaten fossil and renewable groundwater and wetlands.
- Changes in the hydrological cycle, coupled with deterioration of water quality and degradation of wetlands, affects riparian and coastal ecosystems and migratory corridors.
- Development of renewable energy can negatively affect riparian ecosystems, migratory species and water connectivity, and potentially competition with food production in terms of land and water resources.

The promotion of integrated and coordinated practices under a WEFE Nexus approach can capture synergies and emerging opportunities across the WEFE elements.

- Water efficiency is energy efficiency. Adopting efficient water management practices, addressing leakages etc., mean that less energy will be required for pumping, distribution and treatment. Also, addressing non-revenue water issues will increase the financial sustainability of water utilities and capacity to invest. On-site installation of renewables in wastewater treatment plants reduces fossil fuel use and reduces utility costs.
- Energy efficiency and promotion of non-hydro renewables is water efficiency, as fewer hydropower plants will be required, and withdrawals for cooling of thermal plants will be reduced. Installing floating solar panels on reservoirs reduces evapotranspiration and increases power output, while avoiding potential land conflicts. Using renewable energy for desalination rather than fossil fuels also assists in meeting energy and climate objectives.
- Efficient and sustainable agricultural and irrigation practices (including precision agriculture, crop diversification and agroecology, as well as optimising food trade, reducing food

waste and promoting sustainable diets) can increase yields while minimising water and energy consumption and reducing pollution. Efficiencies across sectors are enhanced with the installation of solar panels on farms (agrovoltaics) and on irrigation canals and reservoirs.

- Addressing land degradation and forest loss and related erosion can protect ecosystems and agricultural lands and reduce sedimentation.

- Expanding protected areas, implementing sustainable management plans and ensuring environmental impact assessments (EIAs) for infrastructure development can protect vulnerable ecosystems from harmful siting of renewable energy installations and/or expansion of agricultural and water infrastructure.

2.3.2 Integration in policy-making and management practices

There is a growing recognition across the Mediterranean that the integrated WEFE Nexus approaches provide for innovative and effective policy development and implementation, and sustainable management of natural resources and socio-economic activities, away from the traditional "silo" sectoral approaches.

The rapid assessment has identified significant advancements that have taken place in many Mediterranean countries in the past decade. These include, for example, the establishment of inter-ministerial coordination bodies, the integration of water and biodiversity targets in agriculture and rural development plans, the consideration of a range of Nexus sectors in climate strategies and plans, etc.

Key drivers for such increasing integration and coordination include the understanding from countries of the related benefits, but crucially also the emergence of international processes.

The United Nations Agenda 2030 has assisted countries in increased efforts to meet the SDGs, efforts that are of evident cross-sectoral nature. At the same time, the United Nations Framework Convention on Climate Change (UNFCCC) process has required countries to develop national climate strategic documents in the form of Nationally Determined Contributions (NDCs) that set mid- and long-term energy and climate targets for individual sectors, as well as National Adaptation Plans (NAPs) that identify climate vulnerabilities and risks and related adaptation needs across sectors, and outline strategies, plans and measures to address them. Particularly in the case of the Western Balkan countries, the prospects of EU accession have been the key driver towards enhanced ambition of sustainable development policies, while also promoting increased integration and coordination across sectoral policies and management practices.

However, and despite recent advances, the coherent policy-making, coordinated institutional settings, and integrated approaches and practices that are necessary to address the region's challenges and take into account the complex relationships between water, energy, food and ecosystems, are still lacking.

- In most cases, sectoral strategies and plans do not analyse interactions across sectors or identify trade-offs and synergies, and lack consideration of the needs of other sectors.

- Typically, the needs of ecosystems are given the least priority when sectors are competing for scarce resources. The recognition of the value of ecosystem services needs to be enhanced.

- There exist provisions for formal institutional cooperation at country level; however, these do not necessarily translating into policy integration.

- Overlapping responsibilities and competing objectives among local and central governments and sectoral authorities were also identified.

- Variations exist in the North-South and East-West interfaces, not only in terms of climatic conditions and availability of resources, but also in socio-economic and cultural terms.

- Lack of complete, harmonised and disaggregated data, and access to them, as well as of expanded and modernised monitoring systems, is a key barrier to informed decision-making.

- Stakeholder engagement both horizontally (across sectors) and vertically (across administrative levels) is crucial for promoting dialogue, ensuring different considerations are addressed and enhancing political legitimacy and local ownership of interventions.

- Bridging gaps at the science-policy-society interface, developing capacities of stakeholders and related tools, raising public awareness, and exchange of knowledge and experience, are key dimensions for effective policy development, decision-making and implementation of the WEFE Nexus approach.

- Limited available financial resources are universally mentioned as a key barrier. Prioritising public spending for coordinated and efficient investments with cross-sectoral benefits, shifting funds from harmful subsidies to reward positive practices, and mainstreaming existing and emerging cross-sectoral international funding sources towards Nexus projects, can assist in bridging the financing gap.

- Innovative technical solutions with benefits across sectors are increasingly being piloted usually with the support of international donors. Such demonstration applications need to be mainstreamed and upscaled through creating necessary institutional and legal frameworks and processes for planning and financing, supporting national and local capacities to prepare schemes and proposals and creating market conditions and mechanisms attractive for public and private investment.

3 ALBANIA

Summary

3.1 Introduction

Albania is characterised by a diverse climate that varies by region due to its geographical diversity. Along its Adriatic and Ionian coastlines, the climate is Mediterranean, with mild, wet winters, and hot, dry summers. Inland areas experience a more continental climate, with colder winters and warmer summers. Albania's mountains and forests are home to various species of flora and fauna, making it an ecologically diverse country.

Albania's population is approximately 2.8 million people, with a low fertility rate of 1.49 children born per woman. The country has experienced emigration, which has had demographic and economic implications.

Albania is blessed with rich water resources, but also very prone to flooding. Water pollution, inefficient water use and aging infrastructure contribute to concerns around water quality and availability. Sustainable water management practices and infrastructure upgrades are essential for ensuring a stable supply of freshwater.

Agriculture plays a significant role in Albania's economy (17.7% of GDP[12]), providing employment and livelihoods for many. However, the sector faces challenges related to land fragmentation, outdated farming practices and limited access to modern technology. Enhancing agricultural productivity and sustainability is crucial for food security and economic development.

Albania relies almost entirely on hydropower for electricity generation, which accounts for 98% of domestic production[13]. However, this makes it highly dependent on annually fluctuating rainfall patterns. Diversifying its RES and improving energy infrastructure are vital steps towards a sustainable energy future.

Modelled climate projections from CMIP5 multiple-model ensembles under the high emissions scenario (RCP8.5) show an increase of the average annual temperature of 1.2–4.4°C by 2100, relative to a 1986–2005 baseline[14]. The most significant temperature increases are projected to take place during the summer, and even more so in the coastal areas. The number of hot days is projected to increase, and heatwaves to become more frequent and severe.

Albania is already experiencing a reduction in total annual precipitation, with the largest decreases observed in coastal areas (up to 20%). All future scenarios considered in the revised Albanian NDC (2021) indicate further reductions in annual precipitation. There is however a strong seasonality in the overall decrease in precipitation. Albania's National Communication to the UNFCCC[15] projects decreases in total precipitation by up to -8.5% (-41.9% for the summer period) by 2050; and by up to -18.1% (-50.4% for the summer period) by 2100. These changes will affect the hydrology of watersheds – including run-off patterns, namely its reduction in spring and a shift of maximum values towards winter months – and the size and thickness of snowpack.

3.2 Water resources management

3.2.1 Current status and trends

The national average perennial volume of water discharged within a year is 39.22 billion m^3/year, of which 95% is discharged into the Adriatic Sea and only 5% into the Ionian Sea[16]. The whole territory is crossed by eight main rivers: Drin, Buna, Mati, Ishmi, Erzeni, Shkumbini, Semani and Vjosa. The basins of the Buna and Drin rivers are considered as a single river basin.

12 FAO (2023): *Statistical Yearbook: World Food and Agriculture 2023*, Rome.

13 International Energy Agency (IEA): Energy system of Albania website, https://www.iea.org/countries/albania.

14 World Bank Group (2021): *Climate Risk Country Profile: Albania*, Washington, DC.

15 Albania (2022): *The Fourth National Communication of Albania on Climate Change*, Tirana.

16 Albania (2022): *The Fourth National Communication of Albania on Climate Change*, Tirana.

Lakes occupy 4% of the territory. There are three large lakes, Lake Shkodra, Lake Ohrid and Lake Prespa, and 247 small lakes.

The Drin-Buna River basin is the largest Albanian river basin, stretching over the Shkodra, Kukës and Dibra districts (Albanian part). The main water bodies of this transboundary hydrological system are Lake Prespa, Lake Ohrid, Lake Shkodra, the Drin and Buna rivers (which discharge an average volume of 680 m^3/s), and three artificial reservoirs that were created in the late 1960s and early 1970s for hydropower generation.

The Mati River basin covers an area of about 2,993 km^2 over the Lezha District, and is formed by two tributaries: the Fani river originating from the northeast, and the Mati River flowing from Martansh in Bulqizë district to the artificial lake of Ulza. The main cities in this basin include Rrëshen, Laç, Lezhë and Burrel.

The Ishem River passes through the central part of the country. Its catchment area is 673 km^2 covering the Tirana and Durrës municipalities. The total length of the main stream is 74 km.

The Erzen is a river in central Albania. The length of Erzen is 109 km, while the catchment area is 760 km^2, including the southern Tirana municipality and eastern Durrës municipality. The river passes through the city of Tirana, only a few kilometres from its southern end.

The Shkumbini River basin contains only the Shkumbini River, some minor tributaries and small irrigation reservoirs used for agricultural purposes. It stretches over the Elbasan District, where 75% of the population has piped water supply systems in or outside their dwelling. The Semani River basin contains four rivers (Semani, Osum, Devoll and Gjanica) and stretches over the districts of Berat, Fier, Elbasan and Korça, where 88% of the population has piped water supplies in or outside the dwelling. The Vjosa River basin is the second-largest river system in the country, flowing through Vlorë and Gjirokastër districts. The main water bodies contained are the Vjosa, Drino and Shushicë rivers, Butrinti Lake, and the Narta and Orikumi lagoons.

Albania is a flood-prone country. It ranks highest among all European countries in terms of overall disaster risk, due to very high exposure to extreme weather and climate-related events[17]. It is estimated that, on average, 50,000 people are affected by floods every year, and the annual negative impact on GDP is about US$ 200 million[18]. All climate scenarios project an increase in the frequency and severity of riverine floods, due to an intensification of heavy precipitation in winter months and ensuing snow melt in spring. Flooding affects 130,000 ha of land and is generally pluvial in origin, occurring from November to March, when the country receives about 80–85% of its annual precipitation. The largest floods have appeared in the low-lying western area of the country. Urban development in floodplains in recent decades has led to increased damage caused by flooding.

At the same time, Albania already has among the highest levels of total drought severity per decade in Europe, and will face increasing drought risk due to the impacts of climate change[19]. The probability of droughts is projected to increase by 20%, potentially leading to 23 more drought days per year in the north, and 14 more drought days per year in the south of Albania.

Albania faces significant challenges regarding water pollution, impacting both surface and groundwater sources. A major culprit is the lack of proper wastewater treatment leading to untreated sewage discharge directly into rivers and the Adriatic and Ionian Seas. Industrial waste, particularly from mining (chromium, nickel and

17 United Nations Office for Disaster Risk Reduction (UNDRR) (2014): *Historical Collection of Disaster Loss Data in Albania*, Geneva.

18 World Bank Group (2019): *Albania Systematic Country Diagnostic: 2019 Update*, Washington, DC.

19 European Environment Agency (2017): *Climate Change, Impacts and Vulnerability in Europe 2016: An Indicator-Based Report*, Luxembourg.

copper) and old factories, as well as agricultural run-off from excessive use of fertilisers and pesticides in agriculture, contribute to water pollution. Erosion, especially high in Albania compared to elsewhere in southeast Europe, washes away these contaminants into water bodies. Uncontrolled dumping of solid waste near rivers further exacerbates the problem.

The monitoring of the water quality of rivers in Albania is conducted by the National Environment Agency, which operates different stations located throughout Albania. The water quality is classified as poor to bad for the Ishmi, Shkumbini and Semani rivers and good for the Drini, Buna and Vjosa rivers.

The bathing waters along the Adriatic Sea coast are monitored by the Institute of Public Health.

Despite the ambitious objectives set out in the WSS National Strategy, water supply coverage remains broadly the same at 76.1%, with higher coverage of water supply in urban areas. Sewerage coverage has increased slightly to 51.5%, and only in urban areas. Access to WSS services in rural areas of the country is still low. Furthermore, wastewater collection and treatment are at a low level, and will need significant improvements in the future. Non-revenue water remains at very high levels (63.7% in 2019).

Water utilities are facing significant challenges to their financial sustainability and have accumulated debts of over €100 million. The situation is also due to the high consumption of electrical energy, including for production and water supply, and wastewater treatment services.

3.2.2 Policy framework

The strategic policy framework in the water sector in Albania, is fully oriented towards transposition of EU legislation, with concrete steps already taken in this direction. However, alignment remains incomplete.

With the support of the Austrian Development Agency (ADA) and the EU, Albania is working on the transposition of all the EU directives related to water, in order to have a complete framework for water resources management in the country. Two new draft laws have been finalised, respectively the Law on Water Resources and the Law on Marine Strategy of Albania, which are in the process of approval by the Council of Ministers.

The main strategic document for the management of water resources in Albania is the Integrated Water Resources Management (IWRM) Strategy (2018), which serves as the umbrella document on integrated management of water resources at national scale. It defines five strategic objectives related to water quantity, water quality, water risk, water information/data and water governance. It is noted that the achievement of the strategy's objectives is strongly dependent on data availability/reliability and management/ governance of processes.

The National Sectoral Programme on Water (NSPW) was prepared in 2017, but has not been officially adopted. It defines the vision, objectives and goals of the water sector for a period of 13 years (2018–2030). This is the main framework that regulates and orients the water sector for the planned period and includes the main governance measures, identified studies and categorisation of infrastructure projects. The main goals of the NSPW are:

- Orientation of investments towards national objectives;
- Improvement of the planning process;
- Increase of investments in the sector;
- Increase of the revenues generated by the sector; and
- Continuous and effective monitoring, as well as the preservation of environmental balances.

Albania's IWRM Strategy acknowledges the need to reconcile various sectoral uses for water, and the NSPW aligns its objectives to responsibilities and budgets of different sectors. However, the two documents do not necessarily fully capture synergies with the perspectives of each sector, and a need exists to bridging this gap through enhanced understanding of the complex and dynamic relationship between water, energy, food/land use and ecosystems, and improved coordination on policy and management aspects.

Currently, two River Basin Management Plans (RBMPs), for the Drin-Buna and Seman rivers, have been approved and are being implemented. The RBMPs for the Ishem and Erzen rivers have been approved by the Council of Ministers, and their implementation began in 2024. The RBMP for the Mati River is currently in the process of preliminary approval from the National Water Council.

The key strategic document concerning the WSS sector for the next decade is the National Strategy of the Water Supply and Sewerage Sector 2023–2030, which was prepared in order to present the sector's vision, mission, policy goal and action plans in Albania in a clear, specific, quantitative and timely manner. The strategy is accompanied by an action plan that foresees the implementation of a significant number of 'hard' infrastructure investments that will contribute to increasing access to improved water supply systems, the collection and removal of polluted waters, wastewater treatment plants, and the improvement of the quality of drinking water.

3.2.3 Institutional framework

The main institutions for the administration and management of the water resources in Albania are the following:

The National Water Council (NWC) is the central executive inter-ministerial body responsible for integrated water resources planning and management. It is chaired by the Prime Minister and consists of the ministers of the line ministries relevant to the administration of water resources (Ministry of Environment and Tourism, Ministry of Infrastructure and Energy, Ministry of Agriculture and Rural Development, Ministry of Finance and Economy, Ministry of Defence, Ministry of Health and Social Protection).

The Water Resources Management Agency (AMBU) is the executive body of the NWC, responsible also for the monitoring of the implementation of the management plans of water basins.

The National Environmental Agency (NEA) is responsible for the monitoring and assessment of water quality and the preparation of the annual national report on environmental status.

Specifically regarding the WSS sector, it is organised into two levels, with the central Government responsible for sectoral strategies, policy development and financing through the Ministry of Infrastructure and Energy (MIE), while local governments are in charge of service delivery. The key national institution in the WSS sector is the National Agency for Water Supply and Sewerage and Waste Infrastructure, which acts as budgetary unit under the MIE. Its main tasks and responsibilities include analysing, identifying and drafting policies, strategies and action plans for water supply and sewerage services, and waste management.

At the cross-sectoral level, within the framework of the integrated planning system, the Integrated Policy Management Group (IPMG) on Integrated Water Management has been set up. Its functions are performed by the NWC, with AMBU being its technical secretariat. Two thematic groups exist under this IPMG: "Water resources management" headed by AMBU, and "Reforms in the water supply and sewerage sector" headed by the MIE.

River Basin Councils (RBCs), one for each river basin, are responsible for the integrated management of water resources at the local level to ensure the most rational conservation, development, equitable distribution and protection

of water resources, within the boundaries of the water basin.

River Basin Administration Offices (RBAOs) are subordinate to AMBU and cover the functions of technical secretariat of the respective RBCs. There are four RBAOs, one for the Drin-Buna rivers, one for the Erzen, Ishem and Mati rivers, one for the Seman and Shkumbini rivers, and one for the Vjosa River.

3.3 Agriculture and land use

3.3.1 Current status and trends

In Albania, agriculture provides 43% of employment and 19% of GDP. Of the total agricultural area of 695,000 ha (24% of the area of the country), 80% is under private ownership and 20% is under state ownership. Two-thirds of all cultivated land in Albania is located on its coastal zone[20].

The average farm size is 1.26 ha, but is divided in average into 4.7 parcels, which means that the average family farm size is only 0.27 ha.

Agriculture is the largest contributor of nitrogen pollution to groundwater and many surfaces water bodies, as nitrogen fertilisers and manure are used on arable crops to increase yields and productivity.

The main crops in Albania are vegetables, fruit trees and vineyards, grains and olive groves.

Albania is a net importer of agricultural and food products. The future of food consumption patterns in the country and any related environmental and health problems will be tied to a series of drivers, including preferences for locally grown food and traditional products.

The complexity of irrigation and drainage infrastructure is one of the main factors that directly impacts the sustainable growth of agricultural production in the country. Albania is a country rich in water resources, with abundant average annual rainfall. However, due to water resources' distribution, it is necessary to ensure an optimal balance of the water regime, through irrigation during the summer season and drainage, especially during the winter period. Irrigation uses approximately only 1 billion m^3 of water per year. Since only about 20% of annual average rainfall occurs during the summer months, irrigation is indispensable. Drainage and flood protection become indispensable during the winter months.

Out of the 360,000 ha of agricultural lands that have been equipped for irrigation, currently, only around 50% have actual operational infrastructure, due to breakage and damage during recent decades. The main irrigation infrastructure includes 25,000 km of irrigation canals (of which 2,000 km are main irrigation canals) and 626 irrigation dams (reservoirs). Around 410 of them have significant technical damages and are in urgent need of attention for safety reasons and water availability. There are 640 irrigation pumping stations (300 of which are in serious need of rehabilitation), and a number of pumping stations serving as drainage infrastructure.

20 Albania Ministry of Agriculture and Rural Development (2019): *National Strategy for Irrigation, and Drainage 2019-2031 and Action Plan*, Tirana.

3.3.2 Policy framework

The key strategic documents related to the food and agriculture sector include the following.

The new Strategy for Agriculture, Rural Development and Fisheries 2021–2027. It is guided by the objectives of the EU's Common Agricultural Policy and aligned with European Green Deal.

The National Strategy for Irrigation and Drainage presents the action plan and financing scheme for the period 2019–2031.

The Law no. 24/2017 "On Irrigation and Drainage Administration", defines the Ministry of Agriculture and Rural Development as the main body responsible for irrigation and drainage administration policies, and defines the duties of the Regional Directorates of Irrigation and Drainage (RDIDs), municipalities and the Water Users Organisation as implementers of these policies.

3.3.3 Institutional framework

The Ministry of Agriculture and Rural Development is responsible for designing national policies in irrigation and drainage, regular monitoring of the RDIDs, proposing the establishment of new RDIDs, monitoring the operational performance of irrigation and drainage infrastructure, and protecting the main infrastructure from floods in case of heavy natural events.

An RDID operates and maintains the main irrigation drainage and flood protection infrastructure, to ensure the required amount of water and preventing floods.

Municipalities are responsible for the operation, maintenance and rehabilitation of the rest of the infrastructure on their property, which includes the primary irrigation canals, secondary and third irrigation canals, secondary and third drainage canals, the irrigation reservoirs, and pumping stations, as well as water intake works for irrigation schemes, which are supplied with water from rivers and streams.

The Agricultural and Rural Development Agency aims to support Albanian entrepreneurs in the agriculture and food sector, preparing the institution to benefit from EU and other donors' funding.

Regional Agencies for Agricultural Extension Services aim to support and provide advisory services to the farmers (regional level) by developing and using the technologies in the agriculture sector.

Agricultural Technology Transfer Centres (ATTCs) (Shkodra, Fushë-kruja, Lushnja, Vlora and Korça) are responsible for the identification, testing, adaptation and introduction of agricultural practices, methods and materials (inputs). Moreover, they are responsible for the preparation of technological packages for the main agricultural crops and animal breeding. Additionally, the ATTCs aim to conduct research and testing of agricultural farms about the problems raised by the farmers in respective regions. Also, they deliver training for agricultural specialists, farmers, students of agricultural sciences and other interested subjects.

Water Users Organisations, as the lowest level of administration, play an important role in the use and maintenance of irrigation schemes within their irrigation service area, and the provision of irrigation water to their members.

3.4 Energy

3.4.1 Current status and trends

Albania is among the world leaders in terms of the share of renewable energy in electricity generation, as it relies almost entirely on hydropower, which in 2022 accounted for 97.7% of domestically generated electricity

(the remaining 2.3% came from solar plants)[21]. As hydropower output depends on fluctuating rainfall patterns, Albania often imports up to one third of its electricity consumption from neighbouring countries. The high share of hydropower for electricity generation means that Albania performs well in terms of greenhouse gas (GHG) emissions, and has the lowest per capita CO_2 emissions in Europe with 1.5 tCO_2/c, compared to an EU average of 6.1 tCO_2/c. In relation to economic output, however, Albania's GHG emissions (0.27 tCO_2 per unit of GDP) remain above the EU average (0.16 tCO_2 per unit of GDP).

A total of 83.7% of hydropower generation comes from large hydropower plants (HPPs). The largest are located on the Drin River, with a total installed capacity of about 1400 MW. Other smaller HPPs with a total capacity of 240 MW are located on the Devoll River. Two HPPs with a total installed capacity of 27.5 MW are located on the Bistrica River[22].

The remaining 16.3% of hydropower comes from small, privately owned HPPs (<15 MW) which are designed as river run-off plants and, in some cases, include a small dam and reservoir. However, despite the fact that they can affect land use and natural habitats (especially regarding migratory fish), small HPPs often do not undergo a full EIA.

Although Albania has considerable wind energy potential, no wind power capacity was built in the country up to 2022. Solar energy is an important primary energy source for Albania that has not yet been fully exploited. However, in recent years, there is a strong interest from the private sector to invest in the construction of photovoltaic (PV) plants for electricity generation.

Albania, in line with the EU ambition, has pledged climate neutrality by 2050, both at the UNFCCC COP26 and in the Sofia Declaration of the Leaders of the Western Balkans. According to its updated NDC, Albania aims to decrease emissions by 20.9% by 2030 compared to the business-as-usual scenario[23].

Albania had a 39% share of renewable energy in total final energy consumption for 2022, and aims to increase this share to 52% by 2030.

3.4.2 Policy framework

The National Energy Strategy for Albania 2018–2030 is the core strategic document for the country's energy sector. It consists of five main pillars, related to decarbonisation, energy security, internal energy market, energy efficiency, research, innovation and competition. Under this strategy, the Albanian Government has established and committed to meeting the following long-term strategic objectives:

- Improving the reliability and security of energy supply;
- Developing the domestic primary energy sources in a sustainable and competitive manner;
- Improving the cost-effectiveness of energy supply systems;
- Achieving the targets for RES and energy efficiency;
- Developing a least-cost and sustainable policy for residential heating and cooling;
- Integrating the Albanian power and natural gas markets with regional Energy Community and European markets; and
- Achieving the NDC targets for GHG emission reductions.

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21 IEA: Energy system of Albania website, https://www.iea.org/countries/albania.

22 AKBN (2019): *Hydro-Energetic Potential of Albania*, Tirana.

23 Albania (2022): *Albania Revised NDC*, Tirana.

Albania was also the first Western Balkan country to adopt its National Energy and Climate Plan (NECP) in December 2021. The NECP is based on the National Energy Strategy and on Albania's updated NDC that was prepared in view of UNFCCC COP26 in 2021. It sets specific targets and measures regarding GHG emission reductions, renewable energies, and energy intensities and efficiency.

Dedicated National Action Plans have been developed and updated regarding energy efficiency and renewable energy, defining related targets and measures.

3.4.3 Institutional framework

The MIE is responsible for developing energy policy and the mid- and long-term strategies for the energy sector. The MIE plays a key role in developing the legislation governing the energy sector, and leads the policy and legislative reforms to align Albanian policy and regulation with the EU's energy acquis.

The Energy Regulatory Authority is an independent public body responsible for the regulation of activities in the electricity and natural gas sectors. It is the competent body for issuing licences for carrying out electricity generation, transmission, distribution, supply and trade of electricity.

The National Agency of Natural Resources (AKBN) is a public agency subordinate to the MIE. AKBN's mission includes the development, supervision of rational use of natural resources, according to the Government's policy, and monitoring of their post-exploitation in mining, petroleum and energy.

The Agency for Energy Efficiency is established as a public budgetary institution subordinated to MIE. Its duties and responsibilities include the development of secondary legislation and programmes to promote energy efficiency, the development and monitoring of the National Energy Efficiency Action Plan, the monitoring of progress in improving energy efficiency, and attesting to and certifying the energy auditors and managers.

The Albanian Power Corporation KESH remains the dominant electricity generator in Albania, generating around two thirds of domestic power. It is still largely regulated under public service obligations because a major part of the production is allocated to the Universal Service Provider (OSHEE) for the supply of retail customers.

The Transmission System Operator owns and operates the transmission network at 110 kV and above, and is responsible for the balancing of the system through the procurement of balancing and ancillary services.

OSHEE owns the electricity power distribution system below 110 kV. OSHEE is a legal entity that includes both the Distribution System Operator carrying out the distribution service, and the Universal Service Provider carrying out the activity of supply of tariff customers. Today, OSHEE is also designated by the Government as a temporary renewable energy operator with the obligation of purchasing the electricity produced by RES power producers benefiting from a long-term public-private agreements and a feed-in tariff.

The Albanian Power Exchange (ALPEX) is a new company established according to the provisions of the Albanian Power Sector Law and Albanian Electricity Market Model. It is responsible to perform the organised day-ahead and intra-day electricity market in Albania and Kosovo[24].

24 References to Kosovo shall be understood to be in the context of the United Nations Security Council Resolution 1244 (1999).

3.5 Environmental protection

3.5.1 Current status and trends

Although a small country, Albania is very rich in biological diversity. The extraordinary diversity of ecosystems and habitats includes 3,200 host plants, 2,350 non-host plants and 15,600 species of conifers and non-conifers[25], most of which are threatened at the global or European level. Albania has recently made significant progress in expanding the network of protected areas from 5.2% of the country's territory in 2005, to 18% in 2020. Most of them are defined in the natural monument category, and most are small.

According to Albania's Institute of Statistics or INSTAT, in 2019 the forest and pasture of Albania covers a total area of 1,740,307 ha and 60.5% of the total area of the country. In 2019, forests covered an area of 1,051,843 (ha), representing 60.4% of the forest and pasture land.

Wood has been a traditional source of fuel, used primarily in the household sector for heating purposes. The usage of fuelwood and cutting of trees has negatively impacted the forestry sector of Albania. Illegal cutting has been one of the main problems in this sector, and it has not only reduced the volume of wood timber in the Albanian forests, but has damaged the well-being of forests, preventing their normal growth and development. It is estimated that wood logging, often unauthorised, has led to a widespread problem of forest degradation, with an estimated 20% of forest areas having been lost in the past 25 years, which drove the Government to impose a 10-year moratorium on logging in 2016 (with exceptions for firewood for local populations, to avoid jeopardising the energy security of rural and/or low-income households).

According to the Strategic Policy Paper for Biodiversity Protection, the main threats to biodiversity are industrial development, urbanisation, illegal hunting, fisheries, land erosion, energy and mining, transport and tourism, and other sectors that have an impact on biodiversity. The main factors of biodiversity loss are anthropogenic activities: deforestation and desertification of arable land, as well as the destruction of meadows and pastures, have had a major impact on habitat changes in the recent past. Road construction and changes in water flow or the construction of dams, construction of pipelines, pollution from various origins, fires, diseases, and climate change are and will be the reasons for the degradation and fragmentation of habitats in Albania.

3.5.2 Policy framework

The Strategic Policy Paper for Biodiversity Protection identifies the main areas of work, specifically increasing the surface of protected areas, drafting management plans and their implementation; completing the legal framework in accordance with EU acquis on nature and environment, elimination of illegal logging and hunting, and implementation of the legal framework, as well as the activities of capacity-building and implementation of action plans for the endangered species and habitats.

The Policy Paper for Forests underlines the importance of forests in four aspects: forests for people, considering the importance of forests as source for release of O_2 and absorption of CO_2; forests for development, considering the contribution of forests in the country development through securing the wood for construction, space heating and resin production; forests for food, considering the forest as an important source of alimental products such as forest fruits, medical herbs and controlled hunting; and forests for nature, considering a number of positive effects that forests have on the air temperature at global and local level, and preservation of biodiversity and protection of land.

25 Albania MTE (2019): *Sixth National Report to the Convention on Biological Diversity of the Republic of Albania*, Tirana.

3.5.3 Institutional framework

The Ministry of Tourism and Environment (MTE) has overall responsibility for the development and implementation of environmental protection policies, specifically for air, waste, chemicals, climate change, and forests, protected areas and biodiversity. The MTE is the responsible authority representing Albania for several international conventions, treaties and protocols regarding the environment. Based on the Law on Strategic Environmental Assessment, the MTE has competencies for approving the strategic environmental assessments for any territorial or sectoral plan or strategy developed by the central and local authorities. The MTE, with the support of the NEA, is responsible for issuing environmental permits (in categories A and B), monitoring environmental legislation enforcement and compliance, and controlling permitted activities.

The NEA is a key public entity subordinate to the MTE with important responsibilities in the environment. It is a central public institution under the authority of the Minister, and exercises its jurisdiction throughout the territory of Albania. For carrying out its duties and responsibilities, the NEA has 12 Regional Environmental Agencies, which are subordinate to it.

The National Agency of Protected Areas (NAPA) is a public entity subordinate to the MTE with responsibilities for the administration and control of protected areas in the entire country. NAPA is responsible for preparation of the management plans for each area, which are approved by the MTE, in consultation with the line ministries, municipalities, the interested public, civil society and private owners, whose properties lie within the territory of the protected area.

The National Agency of Forests (NAF) is a new public agency established in 2019 and subordinate to the MTE. NAF is responsible to monitor and assess the condition of forests and to organise activities on inventory and research, and on drafting of documents for forest management. NAF has a central headquarters and four regional agencies.

The daily management of protected areas is delegated to 12 Regional Administrations of Protected Areas as part of NAPA.

Local authorities (municipalities) are responsible for ownership and management of forest areas under their administrative jurisdiction. Municipalities are also responsible for issuing authorisations for utilisation of the forest area under their ownership and management.

3.6 Rapid assessment of the WEFE Nexus in Albania

3.6.1 Key interlinkages across the WEFE elements

A detailed Phase I Nexus assessment for Albania was prepared by GWP-Med in 2020–2022 in the frame of the ADA-funded Southeastern Europe Nexus Project. More details and the assessment report are available here.

Key interlinkages across sectors that were identified include the following:

- The planned increase in the coverage of sanitation services will increase energy demand in the WSS sector. The high level of non-revenue water, together with difficulties in raising tariffs, challenge the financial sustainability of water utilities which face high energy costs. Measures for increasing energy efficiency, locating on-site renewable energy (e.g. biogas), addressing non-revenue water issues and utilising nature-based solutions can help address these challenges.

- The vast majority of Albania's domestic power generation comes from HPPs. The timing of water releases from HPP reservoirs strongly affects flooding events downstream. Enhanced coordination of HPP operators with early warning systems can significantly reduce damages from small to medium flooding events with insignificant reductions in power output.

- The urgent need to rehabilitate the country's aged irrigation and drainage infrastructure will increase the sector's energy consumption. Measures to increase water and energy efficiency, as well as to install renewable energy on reservoirs, channels and farms, are required in that regard.

- The further development of the country's hydropower potential, especially in small untapped rivers, can threaten riparian ecosystems and migratory species. Reducing related incentives and enhancing the permitting and EIA frameworks can mitigate impacts.

- Deforestation and other human-caused interventions have increased land degradation and erosion. Coupled with interventions on riverbeds (uncontrolled removal of inert materials), this has led to increased sedimentation often affecting irrigation reservoirs. Nature-based solutions, including reforestation and sediment barriers/tanks, can assist towards addressing these challenges.

3.6.2 Integration in policy-making and management practices

Albania has made concrete steps in enhancing cross-sectoral coordination in policy-making and management practices.

- The prospect of EU integration and related requirements have been instrumental in enhanced coordination across sectors. Albania is advancing on the transposition of all the EU directives; however, alignment remains incomplete.

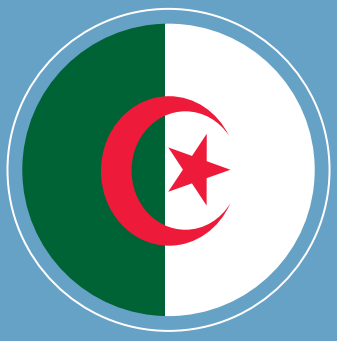
- The development of RBMPs for the country's basins is advancing well, involving stakeholders from all WEFE sectors in the process.

- Albania's IWRM Strategy and the Sectoral Programme for Water have been developed with feedback from all sectors and acknowledge the need to reconcile various sectoral uses for water. However, they do not necessarily fully capture synergies with the priorities and needs of each sector, and a need exists to bridge this gap through enhanced understanding of the complex and dynamic relationship between water, energy, food/land use and ecosystems.

- At the institutional level, cross-sectoral thematic groups in the frame of the country's IPMG have ensured a significant level of coordination across sectors.

- Overlapping responsibilities among institutions, and/or across national and local levels of administration, remain a challenge.

4 ALGERIA



Summary

4.1 Introduction

Algeria is the largest country in Africa. It features a range of climatic conditions due to its vast size. The northern coastal areas enjoy a Mediterranean climate with mild, wet winters and hot, dry summers. Inland regions have a more arid-to-desert climate, characterised by extreme temperature variations and low rainfall. The Saharan region in the south is one of the hottest and driest places on Earth.

Algeria's population is over 43 million people, and is largely concentrated in the northern coastal regions, with a youthful demographic profile – 45% are under 25 years old.

Water scarcity is a significant concern in Algeria, especially in the arid and semi-arid regions. The country relies on finite groundwater resources, which are under pressure due to over-extraction and inefficient use.

Agriculture in Algeria faces challenges such as water scarcity, soil degradation, and a growing demand for food. The country is highly dependent on food imports (20% of all imports in 2017[26]), making it vulnerable to price fluctuations and supply disruptions.

Algeria´s main natural resources are oil and gas, and the country is a major exporter of these commodities. The country ranks tenth in the world for its proven natural gas reserves.

Like most countries in the Mediterranean basin, Algeria is a climate change hotspot, and subject to increases in dryness and decreases in water availability. National analysis indicates that the rise in temperatures is greater than that observed on a global average, lying between 1.5°C and 2°C during the twenty-first century. In addition, the country has experienced a decrease in rainfall in the order of 10–20%, and greater uncertainty in the distribution of precipitation. More frequent droughts, intensification of floods, increased number of heat waves and increased forest fires in the summer have been observed.

4.2 Water resources management

4.2.1 Current status and trends

Algeria is a very water-stressed country with water withdrawals amounting to 138% of available freshwater resources, the third-largest share in the Mediterranean region. Water demand has been rising dramatically due to population growth and economic development. Agriculture is the largest water user (86% of total water withdrawals), while domestic use accounts for 8% and industrial use for 6%[27].

Algeria is divided into five major river basins comprising a total of 17 catchments, concentrated mainly in the north. The renewable surface water resources are estimated to total 11 billion cubic metres (BCM). Almost 7 BCM of surface water are captured by several medium and large dams[28]. Run-off occurs as rapid and powerful floods that replenish the dams during the short rainy season, which typically runs from December to February. Algeria does not share any of its surface water with neighbouring countries.

Algeria's groundwater resources are overexploited. Annual natural recharge is around 1.9 BCM/year, but total withdrawals are estimated at 2.4 BCM/year. In the mountainous region in the north, the aquifers are shallow and exploited using wells and springs. Groundwater in the south is mainly fossil water, with very low renewability. In terms of deep groundwater, Algeria has two major overlapping aquifers, the Complex Terminal and the Continental Interlayer, which form the transboundary North-Western Sahara

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26 World Bank Group: Food imports (% of merchandise imports) website, https://data.worldbank.org/indicator/TM.VAL.FOOD.ZS.UN.

27 N. Drouiche, R. Khacheba and R. Soni (2020): Water policy in Algeria. In S. Zekri (ed.): *Water Policies in MENA Countries, Global Issues in Water Policy*, Cham.

28 GIZ, BGR and OSS (2016): *Projet CREM: Etude d'évaluation du secteur de l'eau en Algérie*.

Aquifer System (NWSAS). The Complex Terminal (100–400 m deep) and the Continental Interlayer (1,000–1,500 m deep) contain significant reserves of 30,000–40,000 BCM. The deep aquifers are exploited mainly using deep boreholes, whereas the shallow ones are exploited using the traditional foggara system. Algeria shares five aquifers with its neighbours: Errachidia with Morocco, Tin-Sérririne with Niger, Air Christalline with Mali and Niger, Taoudéni with Mali and Mauritania, and the NWSAS with Tunisia and Libya[29].

Algeria has begun desalinating seawater to supply drinking water to cities and towns located up to 60 km from the coast. The country has 13 large desalination plants in operation capable of producing up to 2.3 million cubic metres (MCM) of desalinated water per day[30].

Water scarcity has led Algeria to increasingly reuse wastewater for agricultural purposes. Overall, Algeria has a treatment capacity of 1.16 BCM of wastewater per year.

The Ministry of Water Resources will construct around 70 additional dams across all river basins, reaching a total of 139 reservoirs by 2030. This will raise water availability by 5 BCM, in addition to extra desalination and wastewater treatment plants increasing the non-conventional water supply to nearly 3 BCM.

Most of the Algerian population lives in the north along the Mediterranean coast, on only 12% of the country's total area. Therefore, a water deficit is found in northern areas, as the water demands are higher than the available water supply. The deficit in the north is mainly due to a lack of effective groundwater management and lack of coordination between water authorities linked to poor knowledge of the resource, and an increase in the number of illegal wells.

A significant amount of untreated wastewater still spills into the natural environment, adding water quality concerns on top of the pressing scarcity issues. Salination of coastal aquifers is also an issue of increasing concern.

The Algerian Government identifies four main factors for the water challenges it is facing:

- Overuse of underground water;
- Waste in water networks (mainly due to lack of maintenance of existing networks and illegal supply of water);
- Pollution of resources (endangering a degradation of water quality for both agricultural or domestic use); and
- Climate change, which contributes to significant changes in rainfall and an exacerbation of extreme weather events.

A total of 86% of Algeria's population is connected to a sewage network, with the percentage reaching 90% in urban areas and 82% in rural areas according to the WHO/UNICEF Joint Monitoring Programme (JMP). The average production of wastewater per capita per day is estimated at around 140 L/day. A total of 63 cities are served by 61 large wastewater treatment plants. The treatment provided is mainly secondary (56%) and primary treatment (44%).

4.2.2 Policy framework

The national strategies and plans in Algeria related to water resources management include the following.

29 British Geological Survey (2018): Hydrogeology of Algeria website, https://earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Algeria.

30 M. Safar-Zitoun (2019): *Plan National Secheresse Algerie: Lignes Directrices en Vue de son Operationnalisation*, Algiers.

The National Water Plan and regional water resources development master plans.

The National Water Plan, currently being updated, is a strategic planning instrument for 2030, with the objective of programming investments to meet water demand and ensure quality service.

For each hydrographic region, Algeria has a master plan for the development of water resources which defines the strategic choices for mobilisation, allocation and use of water resources, including unconventional waters, with a view to ensuring:

- Meeting water needs of all users
- Protecting the quantity and quality of groundwater and surface water; and
- Prevention and management of risks linked to extreme events, such as drought and floods.

The Water Strategy 2030

An intersectoral committee responsible for coordinating the actions of the different sectors concerned was established by decision of the Prime Minister's Office. The work of this committee resulted in the adoption of a strategy for 2030, accompanied by a precise and detailed action plan over the same period. This strategy includes the following axes:

- The construction of new large seawater desalination stations to supply drinking water to all the wilayas of the coastal strip, and the towns located in the interior of the country to a depth of 150 km;
- Reuse of treated wastewater on a large scale in agriculture and industry;
- Rehabilitation and extension of mobilisation, treatment, transfer and sanitation works;
- Improving the governance of the public water service; and
- Saving water.

The National Sanitation Development Plan (SNDA)

The SNDA aims to provide access to sanitation to the entire Algerian population by 2030, through a combination of collective and non-collective sanitation, as well as treatment of all effluents collected by the networks.

The main strategic orientations of the SNDA are:

- Providing access to sanitation to the entire Algerian population;
- Adapting the collection and treatment of effluent to the receiving environments;
- Controlling industrial discharges and their impacts;
- Valorisation of treated water and by-products of purification and development; and
- Improving knowledge of sanitation assets and receiving environments.

The National Flood Risk Prevention and Management Strategy (SNPGRI 2030)

SNPGRI 2030 is focused on improving knowledge of flood risk, reducing vulnerability, adapting development programmes and the land-use planning approach to flood hazards, and strengthening consultation and intersectoral coordination.

The Seawater Desalination Programme

This is a multi-phase, multi-billion-dollar desalination programme managed by the state-owned Algerian Energy Company, aiming to source 60% of the country's drinking water from desalination by 2030.

4.2.3 Institutional framework

The Ministry of Water Resources is the most important player in the Algerian water sector. It has the responsibility of elaboration and implementation of policies and strategies in the context of water resources and environment protection. There is also an IWRM Department.

The National Agency for Hydraulic Resources is responsible for monitoring water resources in quantitative and qualitative terms, preserving, protecting, and safeguarding these resources against all forms of pollution.

The National Agency for Dams and Transfers is responsible for mobilising and transferring water resources to places of use.

The IWRM Agency and its regional variations made up of River Basin Agencies develop IWRM strategies under the supervision of the MRE.

The National Sanitation Office is responsible for the management and development of urban sanitation infrastructure.

The National Water Desalination Agency is responsible for implementing the national water desalination policy, as a measure to guarantee water security.

The Wilaya Water Resources Directorates ensures local representation of the MRE.

For urban water management, since 2006, the urban water supply is managed by a public company called SEAAL in cooperation with a private partner, SUEZ environment. The company provides drinking water services to approximately 3 million people.

In Oran, the water utility Société de l'Eau et de l'Assanissement d'Oran was established in 2008. It is a 100% state-owned company, operated by a private company, Agbar, through which the company provides drinking water to over 1.6 million people.

Other cities in Algeria rely on the state-owned company L'Algerienne des Eaux, which continues to provide water and sanitation services without partnerships with the private sector. L'Algerienne Des Eaux manages the entire process of supplying drinking and industrial water, including the implementation of annual and multi-year investment programmes.

4.3 Agriculture and land use

4.3.1 Current status and trends

In 2016, the total area of agricultural land in Algeria corresponded to over 8.4 million ha. The agricultural area under permanent meadows and pastures in Algeria added up to nearly 33 million ha in 2019. As of the same year, arable lands and permanent crops in the country occupied an area of around 7.5 million and one million ha, respectively. In recent years, 1.8 million ha of agricultural land in Algeria are under wheat cultivation[31].

In 2019, the agriculture sector accounted for approximately 12% of GDP.

Around 1.1 million people are employed in Algeria's agriculture sector, in which men made up most agricultural workers, corresponding to around 990,000 people.

Agriculture in Algeria is based on both large, irrigated perimeters managed by the National Office of Irrigation and Drainage as well as privately owned small and medium perimeters and irrigation areas.

In the north, large perimeters are irrigated from dams and boreholes. In the south, perimeters are irrigated from deep boreholes in the large aquifers

31 US Department of Agriculture: Country Summary: Algeria website, https://ipad.fas.usda.gov/countrysummary/Default.aspx?id=AG&crop=Wheat.

of the Continental Interlayer. At the same time, small-scale irrigation schemes have developed remarkably thanks to state aid and subsidies granted to farmers, as well as the liberalisation of drilling and well digging. This development has, unfortunately, been accompanied by large and poorly controlled abstractions of groundwater, and even overexploitation of some large aquifers.

Gravity irrigation is still the most widely used method on small- and medium-scale farms. However, more efficient irrigation methods have been gaining traction, especially drip irrigation, which is commonly observed in the arid highlands and Saharan regions.

4.3.2 Policy framework

In 2008, the agricultural development strategy was re-oriented to portray new policy priorities: enhanced agricultural production, revitalisation of natural resources, appropriate consumption of water resources and food safety initiatives. Algeria's Government intends to orient agriculture toward models in the grain sector and establish modern complexes to facilitate the use of public agricultural land. In 2015, a new government action plan, prioritising the development of domestic agriculture and the promotion of agricultural products, has the following aims:

- Invest in food safety, and improve the quality of, diversify and promote local products, with annual funding of 300 billion dinars (€3 billion) allotted to agriculture;
- Develop irrigation to reach the target of 2 million ha of newly irrigated land;
- Promote the mechanisation of production to compensate for the shortfall in farm labour;
- Meet substantial needs in the following priority areas: cereals, raw milk, red meat and poultry, pulses, potatoes, olives, tomatoes for processing, fruit, and dates; and
- Develop infrastructure.

The Algerian Agriculture Roadmap 2020–2024, presented by the Algerian Minister of Agriculture in September 2020, aims to expand the arable land to 9 million ha by 2020 and to expand irrigation networks to cover 2 million ha, or 25% of arable land, by 2021.

4.3.3 Institutional framework

The Ministry of Agriculture has the legislative responsibility for domestic food production and the health and safety aspects of imported agriculture and food products into Algeria.

The National Office of Irrigation and Drainage allocates volumes of water to the irrigation schemes according to the needs expressed by farmers. The user submits their water demand to the agency, by specifying the number of hectares, the crop type and the volume of water desired.

The phytosanitary authority represented by the Plant Protection and Technical Control Directorate of the Ministry of Agriculture oversees the pesticide regulation enforcement. All phytosanitary products for agricultural use must be subject to a prior approval issued by the directorate.

The Algerian Ministry of Commerce is responsible for food inspections, quality control and combating fraud, as well as labeling regulations and laboratory inspections.

The Ministry of Land-use Planning and Environment and the Ministry of Fisheries and Marine Resources are also major cooperative stakeholders and play advisory roles in many common issues.

4.4 Energy

4.4.1 Current status and trends

The country is the leading primary energy producer in Africa due to its abundance of natural

resources such as oil and natural gas, which are the main energy sources used in the country. Algeria is a major energy exporter, exporting 58% of its domestic production.

Algeria's energy mix is evolving, with efforts underway to enhance energy efficiency, expand renewable energy capacity and reduce reliance on fossil fuels. The Government has set ambitious targets for renewable energy deployment and is implementing policies to promote sustainable energy development in the country.

According to the IEA[32], in 2020 natural gas covered 65.9% of Algeria's total energy supply, and oil 33.5%. Coal and renewables had tiny shares of 0.4% and 0.1% respectively.

Its electricity system is almost exclusively (98.9%) powered by natural gas. Solar covers 0.7% of generation, and oil 0.4%.

Algeria's CO_2 emissions are the third largest in Africa, behind South Africa and Egypt. Per capita CO_2 emissions were 3.2 tCO_2/c in 2021, having increased by 62% since 2000.

In 2019, the majority of the primary energy production in Algeria was constituted by natural gas, corresponding to over 54% of the total, with crude oil making up nearly 34% of the country's energy production.

Stagnating hydrocarbon production and a growing urgency to address climate change provide additional incentives for Algeria to diversify its electricity generation mix. To respond to these challenges, the Government has set a target of deriving 27% of electricity generation from renewable sources by 2030.

Renewable energy development will focus on developing extensive solar resources in the high plateaus and Sahel regions, and substituting natural gas consumption with blue and green hydrogen. Algeria's renewable energy targets are ambitious relative to their time frame. With approximately 450 MW of installed solar capacity today, Algeria would need to deploy an additional 22,000 MW to meet the renewable capacity target for 2030.

4.4.2 Policy framework

Algeria has a National Energy Policy that outlines the Government's vision and objectives for the energy sector. This policy emphasises the importance of diversifying the energy mix, increasing energy efficiency, promoting RES and ensuring the sustainable development of Algeria's energy resources.

Algeria is in the process of developing an energy transition strategy aimed at reducing the country's dependence on fossil fuels and promoting the use of RES. This strategy will include targets for increasing the share of renewables in the energy mix and implementing measures to improve energy efficiency across various sectors.

The National Renewable Energy Programme aims to accelerate the deployment of renewable energy projects in Algeria. This programme includes the development of solar and wind energy projects, as well as initiatives to promote energy efficiency and conservation.

Algeria has also adopted a National Energy Conservation and Efficiency Programme, aiming to improve energy efficiency by 10% annually in transportation, housing and industry.

4.4.3 Institutional framework

The Ministry of Energy and Mining is the key institution responsible for the management of the energy sector in Algeria.

The National Renewable Energy Company was created in 2021 as a stand-alone renewable

32 IEA: Energy system of Algeria website, https://www.iea.org/countries/algeria.

energy company. It will serve as a one-stop shop for all prospective investors, contractors, service providers and other renewable energy ecosystem players. It will also issue renewable energy tenders, award contracts and negotiate power purchase agreements.

The Electricity and Gas Regulatory Commission is an independent institution supervised by a steering committee, and is responsible for licencing, demand forecast/investment planning, remuneration of operators and tariffs, access to networks/markets, quality regulations/technical and environmental control, and consumer protection.

The National Agency for Energy Management is responsible for leading and facilitating the process of implementing programmes and actions of energy management.

The Centre for Development of Renewable Energies was established as a research centre specialising in renewable energies, resulting from the restructuring of the Algerian High Commission for Research. The centre is responsible for developing and implementing programmes of research and development in the field of science and technology, and energy systems exploiting solar energy, wind, geothermal and biomass.

4.5 Environmental protection

4.5.1 Current status and trends

Algerian biodiversity (natural and agricultural) is immensely rich, with approximately 16,000 known species overall. Yet Algerian biodiversity is highly endangered. The country has a total of 121 species on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) list, of which 75 are endangered[33].

The main threats to biodiversity include the destruction or overexploitation of habitats, the expansion of cultivated areas, urbanisation and infrastructure development, pollution, tourism and hunting. Pressures on biodiversity are compounded by the effects of climate change, notably through desertification.

There are 43 natural monuments, species management areas, and protected landscapes and seascapes. There are 25 areas managed for sustainable use and unclassified areas. There are 23 protected areas, representing 5.1% of the total land in Algeria.

The declining water quality is acquiring worrying proportions, particularly in the north. Uncontrolled agricultural practices cause water quality degradation through return flows. In urban areas, biological and physicochemical pollution is significant because of the illegal and uncontrolled effluents in the waterways and waterbodies. According to the National Agency of Water Resources, significant sections of rivers in the Tafna, Macta, Cheliff, Soummam and Seybous basins are polluted.

Water quality in the country's aquifers is generally good. However, some coastal aquifers in Mitidja and Bas Sebaou suffer from seawater intrusion due to their high permeability and overexploitation. In the southern Sahara, salinity levels are variable and can reach up to 9 g/l in the Complex Terminal aquifer. Salinity also increases in aquifers surrounding saline lakes.

Forests occupy only around 1% of Algeria's land area. The main driver of tree cover loss in the country has been the expansion of agriculture. Other leading causes of forest loss were commodity-driven deforestation and wildfires.

33 CBD: Algeria – Country Profile website, https://www.cbd.int/countries/profile?country=dz.

4.5.2 Policy framework

The Strategy and National Action Plan for the Sustainable Use of Biological Diversity (SPAN) were defined in 1997. They were strengthened in 2002 through the development and implementation of the National Action Plan for Environment and Sustainable Development, which incorporates global and national objectives on the promotion of the conservation of the biological diversity of ecosystems, habitats and biomes. The SPAN favours an approach advocating habitat and ecosystem protection through the multiplication of protected areas.

Other strategies, plans and programmes include:

- The National Strategy and National Biodiversity Action Plan (2016–2030)
- The National Ecosystem Management Strategy for Wetlands (2015–2030)
- The National Strategy for Integrated Coastal Zone Management and the National Coastal Management Programme (2004)
- Programme to combat forest fires

4.5.3 Institutional framework

The Ministry of Land-use Planning and Environment is the main stakeholder in the protection of the environment in Algeria, with which many stakeholders are cooperating.

4.6 Rapid assessment of the WEFE Nexus in Algeria

4.6.1 Key interlinkages across the WEFE elements

The key challenges for Algeria are the geographical imbalance of water resources and the increase in overall demand driven by population growth.

Water transfers and pumping from deep aquifers are energy intensive, as are the options for additional non-conventional resources (desalination and wastewater reuse).

Overexploitation of groundwater resources, including a large number of illegal wells for residential and agricultural use, is a key challenge.

The disposal of untreated wastewater to water bodies in Algeria remains high and leads to the deterioration of their quality, threatening soil health, agricultural productivity and the environment.

Algeria remains committed to the development of its large fossil fuel reserves, and little attention has been given so far to capture its huge renewable energy potential.

4.6.2 Integration in policy-making and management practices

Overall, there is insufficient coordination and cooperation among the ministries and governmental institutions. Overlapping of mandates within sectors is a key issue.

The political, economic and managerial focus seems to be on ensuring sufficient quantities of water, while the issues of water quality and overall sustainable management of available resources are given less priority.

Public awareness and institutional coordination around environmental problems, their impacts and the sectoral drivers are low.

Algeria still cannot attract or encourage sufficient private investment to address its challenges, especially in an integrated cross-sectoral way.

Agricultural cooperatives could play an important role in cross-sectoral management of resources on the ground, but these remain limited.

5 BOSNIA AND HERZEGOVINA

Summary

5.1 Introduction

Bosnia and Herzegovina features a diverse climate that varies by region. The lowlands and valleys experience a continental climate with hot summers and cold winters, while the mountainous areas have a more alpine climate with colder temperatures and heavy snowfall in winter. This climatic diversity influences the country's ecosystems and agricultural practices.

Bosnia and Herzegovina has a population of approximately 3.2 million people. The country's population is ethnically diverse, with Bosniaks, Croats and Serbs being the three largest ethnic groups. Ethnic and political divisions have been significant aspects of the country's history and contemporary challenges.

The country is blessed with numerous rivers, including the Sava, Drina and Neretva, which are essential for agriculture, industry and energy generation. However, water pollution, over-extraction and inefficient use pose threats to water quality and availability.

Agriculture plays a significant role in the country's economy, providing employment and contributing to food security. However, the sector faces challenges related to land fragmentation, outdated farming practices and limited access to modern technology.

Bosnia and Herzegovina relies heavily on coal for its energy production, making it one of the most coal-dependent countries in Europe. This dependence on fossil fuels raises concerns about air quality, GHG emissions and energy security.

Administratively, Bosnia and Herzegovina consists of two entities: the Federation of Bosnia and Herzegovina (51% of the country's territory) and Republika Srpska (49%). The Federation of Bosnia and Herzegovina further divides into 10 cantons which divide further into municipalities. Republika Srpska divides into municipalities. The Brčko District is the shared property (condominium) of the two entities, and is a unit of local self-governance with its own institutions, laws and regulations.

Bosnia and Herzegovina is still recovering from the effects of the Bosnian War (1992–1995), but since then, there has been progress in economic and social development.

5.2 Water resources management

5.2.1 Current status and trends

There are two main river basin systems and seven major rivers in Bosnia and Herzegovina: the Sava and its tributaries (the rivers Vrbas, Una- Sana, Ukrina, Bosna and Drina), and the Adriatic Sea Basin (the rivers Neretva and Trebišnjica). The Sava is the largest river of the country, and forms its northern natural border with Croatia. It drains 76% of the country's territory into the Danube. Sava River sub-basins are at highest risk of mainly fluvial, pluvial and torrential flooding. Both the Neretva and the Trebisnijca are heavily modified by HPP dams. These Adriatic Sea sub-basins face risk of flooding mainly from groundwater due to their karstic geology.

With an average rainfall of about 1,250 mm, the territory of Bosnia and Herzegovina is one of the wettest areas of Europe, especially southern Europe. Precipitation volume of about 64x109 m^3, it is equivalent to an average flow of about 2,030 m^3/s.

The most destructive flood in the Western Balkans, in the area of the Sava River basin, occurred in May 2014. In Bosnia and Herzegovina, floods affected the central, northern and eastern areas of the country. About 1 million people were impacted, 90,000 people were evacuated, and the floods caused 25 casualties. The total economic impact of the disaster (destruction or severe damage to property, infrastructure and goods, as well the effects of destruction on livelihoods, incomes and production, among other factors) is estimated at

€2.04 billion, which represents an equivalent of nearly 15% of Bosnia and Herzegovina's GDP[34].

Climate models project that extreme precipitation will intensify under warmer climate conditions. Scenarios RCP8.5 and A2 anticipate an increase in annual precipitation for the time horizon 2011–2040 in relation to the reference period 1971–2000 (+5% for most of Bosnia and Herzegovina's territory). Precipitation is projected to increase in winter, spring and autumn, while summer precipitation is projected to decrease.

Pressures and hotspots

Entity level: Republika Srpska

The pressures identified in the first river basin planning cycle and in the process of analysing significant water management issues in the water districts in Republika Srpska are the pollution of surface waters with organic substances originating from discharged untreated or partially treated municipal wastewater from households, industrial wastewater, as well as wastewater from other pollutants into surface waters; pollution of surface waters with nutrients; pollution of surface waters with hazardous substances; the impact of climate change; and groundwater quantity and quality issues.

Entity level: Federation of Bosnia and Herzegovina

According to the River Basin Management Plan in the water area of the Adriatic Sea in the Federation of Bosnia and Herzegovina 2022–2027, and the River Basin Management Plan in the water area of Sava in the Federation of Bosnia and Herzegovina 2022–2027, the most significant pressures on the qualitative state of surface and groundwater are the population in settlements that are not connected to wastewater drainage systems; industrial pollutants; local unorganised and unsanitised municipal landfills; and use of land for agricultural production, fishing and livestock breeding. In terms of quantity/availability, key pressures are water abstraction for water supply purposes, total losses in water supply networks; transfer of water from one basin to another for hydropower purposes (also causing discontinuities for sediment and fauna).

WSS infrastructure

In 2020, the number of connections to the water supply network was 737,128, which is an increase of 6% compared to 2018. There was also an increase in the length of the main pipelines, the length of the distribution network, as well as facilities for the preparation of drinking water. The total length of the closed sewerage network in 2020 is 6.7% higher compared to 2018.

According to the latest available data from 2018, the proportion of residents who use sanitary services that are safely managed in Bosnia and Herzegovina was 40%. This proportion was 25% in 2010[35].

Trends in demand and availability

The total annual water abstraction for public water supply amounts to around 1% of the annual renewable water resources. Water supply is mainly based on the use of groundwaters and springs (80.4%), while 17.4% of water comes from rivers and 2.2% from lakes and artificial accumulations. In the period 2018–2020, the average annual abstraction of ground and surfaces waters for the needs of public water supply in Bosnia and Herzegovina was 310–320 million m^3, while the quantity of water delivered to households, the agriculture sector, the industrial sector, and for other activities and water supply systems, was 150 million m^3. Enormous water losses were partly

34 International Sava River Basic Commission and International Commission for the Protection of the Danube River (2015): *The 2014 Floods in the Sava River Basin*, Vienna and Zagreb.

35 Bosnia and Herzegovina and Agency for Statistics of Bosnia and Herzegovina (2022): *Bosnia and Herzegovina Statistics for Sustainable Development Goals*, Sarajevo.

a result of the failure to implement measuring of supplied water, or inadequate facilities for water transport, storage and distribution with high technical losses or, in most cases, the combination of all the above reasons. Water losses slightly decreased in the period 2018–2020, but are still more than 50% of the abstracted water.

5.2.2 Policy framework

Bosnia and Herzegovina at the national level has only limited power with regard to the water sector and environmental protection, and there is no dedicated water strategy or law. The two entities, the Federation of Bosnia and Herzegovina and Republika Srpska, and Brčko District, have political, administrative and legal jurisdictions on water management and environmental protection in their own territories, and have developed comprehensive policy, legal and institutional frameworks.

Bosnia and Herzegovina's national-level institutions are responsible for the coordination of activities among different levels of authorities within the country and for international cooperation. Implementation of international obligations is the responsibility of the Bosnia and Herzegovina-level institutions, with full involvement of respective institutions of the Federation of Bosnia and Herzegovina and Republika Srpska entities and Brčko District.

A key policy document adopted at the Bosnia and Herzegovina national level is the Action Plan for Flood Protection and River Basin Management in Bosnia and Herzegovina 2014–2017, aligning with the EU Flood Directive.

Following obligations of the Convention on Cooperation for the Protection and Sustainable Use of the Danube River, and the Framework Agreement on the Sava River Basin, RBMPs for the transboundary Danube River basin and the Sava River basin were adopted at the supranational level.

Entity level: Republika Srpska

- The Integrated Water Management Strategy of Republika Srpska 2016–2024 was adopted in 2016. The goal is the achievement of a fully harmonised water regime in the territory of Republika Srpska, in each of its two river basins (districts).

- The Government of Republika Srpska adopted the River Basin (district) Management Plan of the Sava River in Republika Srpska 2018–2021 and the River Basin (district) Management Plan of the Trebišnjica River in Republika Srpska 2018–2021.

Entity level: Federation of Bosnia and Herzegovina

- In 2022, the Government of the Federation of Bosnia and Herzegovina adopted the Water Management Strategy of the Federation of Bosnia and Herzegovina 2022–2032, part of the Environmental Protection Strategy of the Federation of Bosnia and Herzegovina 2022–2032. The strategic goal of the Water Management Strategy is "protection of water quality and ensuring security of water resources and their sustainability". The priorities include preventing deterioration; improving the status of water bodies; creating conditions for sustainable use of water; ensuring drinking water security and water availability for water supply; reducing risks related to extreme water events by establishing a sustainable flood risk management system; climate change adaptation; achieving functional legal and institutional framework for the purpose of aligning with EU water legislation; and ensuring the financial sustainability of the water sector.

- The River Basin Management Plan in the water area of the Adriatic Sea in the Federation of Bosnia and Herzegovina 2022–2027 was adopted in 2022.

- The River Basin Management Plan in the water area of Sava in the Federation of Bosnia and Herzegovina 2022–2027 was adopted in 2022.

All RBMPs were developed under transparent consultation process, including strategic environmental assessments. Issues related to other sectors were considered through detailed analysis of pressures to water resources as well as within the integration issues related to protection of quality and protection of quantity of water. In the Environmental Protection Strategy of the Federation of Bosnia and Herzegovina 2022–2032, of which the Water Management Strategy is an integral part, the available inputs of influence and requirements of other Nexus sectors was determined, taking into account the goals, measures and activities that will achieve the goals. In the chapter alignment of the strategy with other strategic documents, a detailed description of intersectoral alignment is given.

5.2.3 Institutional framework

At the national level, the Ministry of Foreign Trade and Economic Relations (MFTER) is responsible for meeting international water obligations in the entire country. It has the responsibility for operations and tasks within the jurisdiction of Bosnia and Herzegovina relating to the definition of policy, fundamental principles, coordination of activities and harmonising the plans of the entities' governmental bodies and institutions at the international level in agriculture, energy, environmental protection, and the development and the exploitation of natural resources. The Water Resources Department within the MFTER contributes, through regional and international cooperation, as well as cooperation with entity competent institutions, to better management and use of water resources in Bosnia and Herzegovina. All its key activities are carried out in consultation with the competent entity ministries.

Entity level: Republika Srpska

- Ministry of Agriculture, Forestry and Water Management, responsible for administrative, technical and other tasks set by law and related to the Republika Srpska's competences in water management.

- Public institution Vode Srpske, responsible for the implementation of water management tasks put under its competence by the Republika Srpska Law on Waters and legislation adopted according to that law.

- Republika Srpska Inspection Administration, responsible for carrying out inspection of water resource use.

- Republic Hydrometeorological Institute in Republika Srpska.

Secondary stakeholders:

- Ministry of Spatial Planning, Civil Engineering and Environment, responsible for administrative, technical and other tasks set by law and related to Republika Srpska competences in the protection, preservation and improvement of environment.

- Ministry of Health and Social Protection, with jurisdiction within the public health safety of water used or intended for human consumption or production or processing of food and water for sanitary-hygienic and recreational needs.

- Ministry of Industry, Energy and Mining, authorised to participate in activities in the field of use of natural resources, geological exploration, and exploitation of natural and technogenic mineral resources, groundwater (potable, industrial, mineral, thermal, thermo-mineral) and geothermal resources, and concession operations. Activities in the field of geological exploration and exploitation of groundwater are conducted by the Division for Mining and Geology.

- Ministry of Transport and Communication, responsible for water transport and navigation safety in Republika Srpska.

- Fund for Environmental Protection and Energy Efficiency of Republika Srpska, responsible, among other things, for the collection and distribution of funds for environmental protection in Republika Srpska.

- City/municipal legislative bodies, responsible for ensuring public water supply, as well as collection and treatment of wastewater in the city/municipality.

Entity level: Federation of Bosnia and Herzegovina

- Ministry of Agriculture, Water Management and Forestry of the Federation of Bosnia and Herzegovina. The Federal ministry performs administrative supervision over enforcement of the law and over the work and tasks of the water agencies, which are under its competence. The ministry's Water Management Division carries out tasks such as the preparation of strategy and water management development policies; coordination of water resources monitoring activities; coordination of activities for preparation and adoption of integrated water management development documents (RBMPs, programmes of measures, flood protection plans, water pollution prevention plan, plans for water emergencies, droughts and erosion and other documents according to applicable laws); monitoring of the implementation of laws and secondary legislation, etc.

- Federal Administration for Inspection Affairs, responsible for carrying out inspection of water resource use.

- Sava River Watershed Agency and Agency for Watershed of the Adriatic Sea, responsible for the implementation of water management tasks put under their competences with the Law on Waters of the Federation of Bosnia and Herzegovina and legislation adopted according to that law.

- Federal Hydrometeorological Institute in the Federation of Bosnia and Herzegovina.

Secondary stakeholders:

- Ministry of Environment and Tourism of the Federation of Bosnia and Herzegovina, responsible for administrative, technical and other tasks set by law and related to the Federation of Bosnia and Herzegovina's competences in the protection, preservation and improvement of environment.

- Ministry of Health of the Federation of Bosnia and Herzegovina, responsible for the administrative, technical and other tasks set by law and related to the Federation of Bosnia and Herzegovina's competences regarding sanitary quality of water for human consumption.

- 10 cantonal ministries. The organisation of works and tasks which are under canton competences is regulated by canton legislation. Coordination of the activities prescribed by the law between cantons and agencies is ensured by regular meetings organised by the FMAWMF.

- Environmental Protection Fund of the Federation of Bosnia and Herzegovina, responsible, among other things, responsible for collection and distribution of funds/fees for environmental protection in the Federation of Bosnia and Herzegovina.

- City/municipal legislative bodies, responsible for ensuring public water supply, as well as collection and treatment of wastewater in the city/municipality.

Brčko District

- Department of Agriculture, Forestry and Water Management, responsible for water management within the Government of the Brčko District of Bosnia and Herzegovina.

Overall, the administrative organisation of institutions in the water sector in Bosnia and Herzegovina is very complex. Responsibilities are divided into several ministries and implementing agencies or institutions, and municipalities are also responsible for very important issues of

communal activities in the field of WSS. This further complicates the very complex situation in water management. Institutions cooperate on issues within their jurisdiction, but there is no coordinating body that would enable more efficient cooperation.

Ad hoc coordination meetings bring together representatives of the ministries of the entities, watershed agencies and hydrometeorological institutes, as well as other stakeholders, to consider all open issues in the water sector under the jurisdiction of relevant institutions/ organisations.

5.3 Agriculture

5.3.1 Current status and trends

Agriculture is an important branch of the economy of Bosnia and Herzegovina, employing 19.1% of the total workforce. Unfavourable (fragmented) farm structures, low marketability of the country's agrifood products, rural outmigration, and weather extremes and unpredictability are the main factors limiting development of rural areas and the agriculture sector.

The most important place in plant production is the production of cereals, especially corn cereals, which is the main crop used in animal nutrition and wheat as the most important bread grain, then the production of fodder plants, then potatoes, vegetables (cucumber, tomato, paprika, cabbage), fruit (plums, apple, pear), berries (raspberries and strawberries), grapes, and industrial crops such as rapeseed, soybeans and tobacco.

According to the Agency for Statistics of Bosnia and Herzegovina, and the Statistical Offices of Republika Srpska and the Federation of Bosnia and Herzegovina, in 2016, Bosnia and Herzegovina had 2.2 million ha of agricultural land, of which 1.6 million ha were arable land and 600,000 ha were pastures.

Overall, agriculture in Bosnia and Herzegovina is characterised by insufficient production, low productivity, insufficiently developed capacities for the production of agricultural products and low competitiveness of domestic production on the foreign market. For many years, there has been a deficit in trade in agricultural products.

The devastation during the 1992 war and the reforms that led to privatisation left many irrigation systems underutilised and dilapidated. According to the estimate, only 4,700 ha are irrigated, which is less than 27,260 ha before the war. The country has an irrigation potential of 285,000 ha, of which it is estimated that only 15,000 ha will be irrigated[36]. Crop yields and potential options for growing high-value crops are limited without irrigation, primarily due to prolonged dry spells during the summer.

In Republika Srpska there are 7,262 ha covered by irrigation systems, of which only 1,700 ha are functional. The Republika Srpska Government adopted the Strategic Development Plan for Agriculture and Rural Development in Republika Srpska 2016–2020, which provided for monetary support for irrigation system investment with the aim of increasing the irrigated area by 10,000 ha by 2020[37].

Specific information on irrigated areas in the Federation of Bosnia and Herzegovina is not available, as the systems which were in existence before the war have been partially or completely destroyed. A detailed survey of the current situation of the irrigation systems is planned, and eventually an increase to 30,000 ha of agricultural land area covered by irrigation systems is

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36 World Bank Group (2020): *Implementation Completion and Results Report Credit No. 5098-BA on A Credit in the Amount of SDR 28.5 Million (US$ 40 Million Equivalent) to the Bosnia and Herzegovina for the Irrigation Development Project Report, September 28, 2020*, Washington, DC.

37 Republika Srpska (2015): *Strategy for Integrated Water Resources Management in Republika Srpska, 2015–2024*, Banja Luka.

foreseen by 2021, which would constitute 4% of arable agricultural land in the Federation of Bosnia and Herzegovina[38].

It is estimated that the impact of climate change, especially through the rise of average temperatures and decrease of average precipitation, will have an increasingly negative impact on agricultural production in the future, therefore making irrigation an absolute necessity. Securing water for irrigation purposes will have to be resolved through building a number of specific accumulations, as well as redistributing water within the existing accumulation facilities. Excess water may pose a problem, just as the lack thereof. In addition to investing in irrigation, it is also important to simultaneously invest in drainage by building drainage systems, run-off channels, dykes and pumping stations.

5.3.2 Policy framework

National level

- The Law on Agriculture, Food and Rural Development defines the framework for institutional structures, competencies, responsibilities, reporting, legislative drafting, coordination mechanisms, consultation processes, rights, obligations and enforcement measures at all levels of the Bosnia and Herzegovina Government involved in development of the agriculture, food and rural sector.

- Strategic Plan for the Rural Development of Bosnia and Herzegovina 2018–2021 Framework Document (2018).

Entity level: Republika Srpska

- The Strategy for the Development of Agriculture and Rural Areas of Republika Srpska 2021–2027 is harmonised with the newly adopted Law on Strategic Planning and Development Management of Republika Srpska. The five strategic priorities relate to increasing the volume and productivity of agricultural production, increasing competitiveness and developing value chains in the agrifood sector, protecting nature and sustainable use of natural resources, revitalising rural areas, and improving the institutional and legislative environment for agricultural development. Cross-priorities are the fight against climate change, gender equality and improving the position of women in rural areas, reducing poverty, and caring for the elderly.

Entity level: Federation of Bosnia and Herzegovina

- The Strategy for Agriculture and Rural Development 2021–2027 defines the development priorities across all administrative levels of the Federation of Bosnia and Herzegovina, the means for their achievement, the related financial and institutional framework, the rules for implementation of designated measures, monitoring/evaluation issues and related reporting indicators.

5.3.3 Institutional framework

National level

- The MFTER (Sector for Agriculture, Food, Forestry and Rural Development), responsible for coordination of the agriculture sector at national level. Part of this ministry are also its administrative units: the Office of Veterinary Medicine of Bosnia and Herzegovina; the Administration of Bosnia and Herzegovina for Plant Health Protection; and the Office for Harmonisation and Coordination of Payments in Agriculture, Nutrition and Rural Development of Bosnia and Herzegovina.

Entity level: Republika Srpska

- Ministry of Agriculture, Forestry and Water Management of Republika Srpska. The Division for Agriculture and Rural Development carries

38 Strategic Plan for Rural Development of BiH.

out activities in land policies; planning and protection of agricultural land; agroecology; protection and improvement of plant health from harmful organisms; prevention of introduction and spread of quarantine of economically damaging organisms; issuing authorisations and approvals in plant health; registration of plant protection and plant nutrition products; issuing permits for the importation, production and sale of pesticides; control of production of plant, seed and seedlings, variety lists, and plant nutrition products, as well as other duties specified by law.

- Agricultural Institute of Republika Srpska, Banja Luka.

Entity level: Federation of Bosnia and Herzegovina

- Ministry of Agriculture, Water Management and Forestry of the Federation of Bosnia and Herzegovina.
- Federal Institute of Agriculture, Sarajevo.
- Federal Institute for Agro-Pedology, Sarajevo.
- Federal Agro-Mediterranean Institute, Mostar.

Brčko District

- Government of Brčko District (Department of Agriculture Forestry and Water Management).

5.4 Energy

5.4.1 Current status and trends

The total installed electricity generation capacity in Bosnia and Herzegovina is 4578.64 MW, of which thermal power plants are 2065 MW, HPPs 2076.6 MW, wind power plants 134.6 MW and others 203.52 MW (small HPPs, solar, biomass).

Electricity production is constantly growing, from 10.4 TWh in 2020 to 16.4 TWh in 2022. Coal dominates the fuel mix in electricity production, with a share of 67.4% in 2022, followed by hydropower (28.9%) and wind power (2.4%)[39].

Bosnia and Herzegovina is a net exporter of electricity. In 2021, 5,032 GWh was imported, and 9,814 GWh was exported.

In its draft NECP for 2030, Bosnia and Herzegovina envisages a reduction of 41.2% of total GHG emissions compared to 1990 levels, and a share of 43.6% of renewable energy in gross final energy consumption.

5.4.2 Policy framework

National level

Bosnia and Herzegovina is a member of international treaties and agreements that also shape energy policy, namely the Energy Community and the Energy Charter Treaty.

The key national strategies and documents in the energy sector are:

- National Emission Reduction Plan for Bosnia and Herzegovina, adopted 30 December 2015;
- National Renewable Energy Action Plan, adopted 30 March 2016;
- Energy Efficiency Action Plan of Bosnia and Herzegovina to 2035, adopted 29 August 2018;
- Framework Energy Strategy of Bosnia and Herzegovina to 2035, adopted August 2018; and
- Draft NECP (June 2023).

39 IEA: Energy system of Bosnia and Herzegovina website, https://www.iea.org/countries/bosnia-and-herzegovina.

In November 2020, Bosnia and Herzegovina signed the Sofia Declaration, and committed to align its own goals with the EU's energy transition and climate neutrality target for 2050.

Entity level: Republika Srpska

- Energy Development Strategy of Republika Srpska to 2030, dated 2012, lays down the Republika Srpska energy development policies focusing on the use of domestic resources, renewable sources, implementation of energy efficiency measures, use of modern energy technologies, while at the same time preserving the environment and reducing the adverse impacts of the energy sector. It also seeks the sustainable development of the energy sector through the reduction of GHG emissions.

Entity level: Federation of Bosnia and Herzegovina

- Energy Strategy of the Federation of Bosnia and Herzegovina 2022–2035, with a projection to 2050, is under development.
- Following widespread concern over their environmental impact, in 2022 the entity's Parliament voted to ban further construction of small HPPs.

5.4.3 Institutional framework

National level

- MFTER, responsible for coordination of energy policy and international relations at the level of Bosnia and Herzegovina, defining policy, basic principles, coordinating activities and harmonising plans of the entity authorities and bodies at the international level, ensuring implementation of laws and international obligations of Bosnia and Herzegovina, concerning the energy sector, policy-making in accordance with the Law on Transmission, Regulator and System Operator of Bosnia and Herzegovina, and monitoring the work of state institutions in the electricity sector (SERC the Independent System Operator [ISO], BH, Elektroprenos) on the basis of their reports submitted to the MFTER. The MFTER cooperates with the entities and institutions to implement the Law on Transmission, Regulator and System Operator.
- The State Electricity Regulatory Commission regulates the electricity transmission system in Bosnia and Herzegovina, and has jurisdiction and responsibility over the transmission of electricity, operations of the transmission system and international trade in electricity, and the production, distribution and supply of electricity customers in Brčko District.

Entity level: Republika Srpska

- Ministry of Industry, Energy and Mining of Republika Srpska, responsible for the implementation of state policy and energy policy of Republika Srpska, and coordination of the entity's activities. Activities under the responsibility of the Ministry are performed in the Division of Electric Power, Division of Energy-Generating Products, Division of Industry, Division for the Development of Small and Medium-Sized Enterprises and Entrepreneurship, Division of Mining and Geology, and Division for Legal Affairs and European Integration.
- Regulatory Commission for Energy of Republika Srpska, responsible for the regulation of production, distribution and supply of electricity in Republika Srpska.

Entity level: Federation of Bosnia and Herzegovina

- Ministry of Energy, Mining and Industry of the Federation of Bosnia and Herzegovina, implements the policy and enforces the laws as determined by the legislative body; executes the administrative supervision of implementation of the laws and other regulations; proposes and gives recommendations for legislation;

answers questions of the legislative authorities; and performs tasks of administrative and professional nature.

- Regulatory Commission for Electricity of Federation of Bosnia and Herzegovina, responsible for the regulation of production, distribution and supply of electricity in the Federation of Bosnia and Herzegovina.

After the 1992–1995 war, the once-unified power system in Bosnia and Herzegovina was divided into three vertically-integrated companies split along geographic/ethnic lines. The three state-owned electric power generation and distribution companies are Elektroprivreda BiH (EPBiH), Elektroprivreda Republike Srpske (ERS), and Elektroprivreda Hrvatske Zajednice Herceg Bosna (EPHZHB). As the companies were created along ethnic/geographic lines and not for any technical reasons, there are significant generation disparities between them.

5.5 Environmental protection

5.5.1 Current status and trends

Thanks to the ecological heterogeneity of the area, geomorphological and hydrological diversity, specific geological history, and climatic diversity, Bosnia and Herzegovina abounds in exceptional biological richness and diversity of habitats and is among the most biodiverse countries in Europe. About 30% of the endemic flora of the Balkans, i.e. about 1,800 endemic species and subspecies, live on the territory of Bosnia and Herzegovina, and the total number of plant taxa exceeds 5,100[40]. According to assessments of the *First Report of Bosnia and Herzegovina for the Convention on Biological Diversity* (2009), the fauna diversity of Bosnia and Herzegovina consists of 119 fish species, 20 amphibian species, 38 reptile species, 326 bird species, 85 mammal species, and extremely diverse groups of invertebrates, especially among invertebrates of karst springs, mountain streams and canyons.

Red lists have recently been produced for each of the two entities. In Republika Srpska, 818 species of vascular plants, 304 bird species, 46 fish species, 57 mammal species, 20 amphibian species, 25 reptile species and 273 insect species are on the red list. As for the Federation of Bosnia and Herzegovina, 658 plant species, 27 mammal species, 40 bird species, 6 reptile species, 4 amphibian species, 36 fish species and a large number of invertebrate species are red listed. It should be noted that these lists have not been harmonised, and no single list yet exists at state level.

In Bosnia and Herzegovina, protected areas cover 176,899.07 ha or 3.45% of the territory. In Republika Srpska, the area under protection is 73,023.33 ha, which is 2.96% of the territory. A total of 33 areas are protected: two strict nature reserves, three national parks, 16 natural monuments, three protected habitats, six nature parks and three resource management areas. In the Federation of Bosnia and Herzegovina, 12 protected areas take 3.98% of total land (one national park, four nature monuments, two nature parks and five protected landscapes).

Significant progress in the development of an efficient system for collecting data on biological diversity was achieved through the establishment in 2018 of the Information System for Nature Protection of the Federation of Bosnia and Herzegovina, which needs to be upgraded in the coming period. The Environmental Protection Fund of the Federation of Bosnia and Herzegovina is responsible for the development of the information system until the establishment of an expert institution. Systematic data collection on the state of biodiversity in the Federation of Bosnia and Herzegovina has not yet been established, and the existing data are scattered. Data on ecosystem, species (plants, animals, fungi)

40 CBD: Bosnia and Herzegovina – Country Profile website, https://www.cbd.int/countries/profile?country=ba.

and genetic diversity in the Federation of Bosnia and Herzegovina are not systematised, and often not even available.

Exact separated data on diversity at the species and ecosystem level for Bosnia and Herzegovina are almost nonexistent. Of a total of 43 areas under entity protection, half do not have a management plan or enough experts and financial resources.

5.5.2 Policy framework

Country level

- Environmental Approximation Strategy (2017). The main objective of the Bosnia and Herzegovina Environmental Approximation Strategy is to ensure strategic planning of the approximation process, implementation of which would provide conditions for improving of environmental protection with the aim of sustainable development.

- Environmental Protection Strategy for Bosnia and Herzegovina (2022–2032). In order to implement policy and regulations in accordance with the acquis of the EU in the field of environment, taking into account the identical obligations of all levels of government in Bosnia and Herzegovina and the request of the EU, at the beginning of 2019, activities were started on create a comprehensive Environmental Protection Strategy, consisting of strategies for four levels of government (the national level of Bosnia and Herzegovina, the Federation of Bosnia and Herzegovina, Republika Srpska and Brčko District), and contain an overview of the state of the environment, comprehensive strategic protection goals, and priorities and measures to achieve the established goals in the next ten years.

- Bosnia and Herzegovina Environmental Strategy and Action Plan 2030+ (ESAP 2030+). The Bosnia and Herzegovina ESAP 2030+ will be a policy document that establishes the environmental policy goals and key activities up to 2032. ESAP 2030+ is under development. The policy document will provide an overview of the current environmental situation and challenges, as well as a 10-year plan on how to address these challenges. ESAP 2030+ will cover the following seven EU environmental policy areas: water, waste, biodiversity and nature conservation, air quality, climate and energy, chemical safety and noise, resource management, and environmental management (as horizontal policy).

According to the Environmental Protection Strategy, the state of biodiversity and nature largely depends on the actions of other sectors such as forestry, agriculture, water management, energy, industry, traffic and tourism. Nature protection is often recognised in sectoral strategic documents, but is not sufficiently and evenly included in sectoral programmes, as well as in the regulations that regulate their work.

5.5.3 Institutional framework

Country level

In the MFTER, the Department for Environmental Protection within the Sector for Water Resources, Tourism and Consumer Protection carries out legal, analytical and expert operational, informational and documentary activities in the fields of proposing policies, basic principles, and coordination and harmonisation of plans of the entities and Brčko District, and coordinates at the international level in the field of environmental protection for Bosnia and Herzegovina. It bases its activities on the Law on Ministries and other bodies of the administration of Bosnia and Herzegovina, as well as on numerous ratified and adopted international environmental documents.

Entity level: Republika Srpska

- Ministry of Spatial Planning, Construction and Ecology, responsible for public administration activities and improvement of operations in spatial planning, construction and environment through preparation and working within the

committees for developing drafts and proposals of laws and other regulations under the ministry's authority.

- Ministry of Education and Culture. The Republic Institute for Protection of Cultural-Historical and Natural Heritage conducts nature monitoring, collecting and processing of information about natural conditions, making reports and updating the Information System for Nature Conservation (ISNC).

- Environmental Protection Fund of Republika Srpska.

Entity level: Federation of Bosnia and Herzegovina

- Federal Ministry of Environment and Tourism.

- Environmental Protection Fund, Federation of Bosnia and Herzegovina.

An inter-entity body for the environment was established in 2006. In its meetings all current issues are discussed, including implementation of international agreements; coordination of entity action plans; and cooperation on the creation of the Environmental Protection Strategy for Bosnia and Herzegovina 2030+.

5.6 Rapid assessment of the WEFE Nexus in Bosnia and Herzegovina

5.6.1 Key interlinkages across the WEFE elements

Water losses in the distribution networks, as well as non-revenue water issues, remain high. Addressing these issues can reduce the sector's energy consumption and increase the utilities' financial sustainability, including for necessary investments.

Pollution of surface waters with organic substances originating from discharges of untreated or partially treated municipal wastewater from households and industries affects water quality and ecosystems.

The country's irrigation systems remain underutilised and dilapidated as a result of the war. Their rehabilitation will increase the sector's energy consumption. Measures to increase water and energy efficiency, as well as to install renewable energy on irrigation infrastructure and farms, are required in that regard.

Transfers of water from one basin to another for hydropower purposes causes discontinuities for sediment transportation and fauna.

The further development of the country's hydropower potential, especially in small untapped rivers, can threaten riparian ecosystems and migratory species. Reducing related incentives and enhancing the permitting and EIA frameworks can mitigate impacts.

Enhanced coordination of HPP operators with early warning systems can reduce damages from small to medium flooding events, by allowing for appropriate buffers in reservoirs.

5.6.2 Integration in policy-making and management practices

The administrative organisation of institutions in the water sector in Bosnia and Herzegovina is very complex, with responsibilities divided into several ministries and implementing agencies or institutions, as well as municipalities. This further complicates efficient coordination across sectors.

The needs and priorities of other sectors are increasingly considered in water management plans through detailed analysis of pressures to water resources, as well as within the integration of issues related to protection of quality and protection of quantity of water.

The Strategic Plan for the Rural Development of Bosnia and Herzegovina (2018) and the Strategy for the Development of Agriculture and

Rural Areas of Republika Srpska (2021–2027) sufficiently consider the needs of other sectors.

The Environmental Protection Strategy of the Federation of Bosnia and Herzegovina (2022–2032), of which the Water Management Strategy is an integral part, has also been developed on the inputs of other Nexus sectors, taking into account the goals, measures and activities that will achieve the goals.

Overall, environmental protection in Bosnia and Herzegovina, both at the national level and at the entity level, has recently been considering relations with other sectors with due care when defining policies, strategies and plans. Despite the improved situation, there is still room for better coordination.

6 EGYPT

Summary

6.1 Introduction

Egypt predominantly experiences a desert climate, with hot summers and mild winters. Coastal areas along the Mediterranean Sea enjoy a more moderate climate.

Egypt is the most populous country in the Mediterranean, with a population exceeding 100 million people. Egypt's population has been growing rapidly in recent decades, at a rate of 2.1% annually from 1989 to 2018. Rapid population growth and urbanisation have implications for infrastructure development and resource management.

The Nile River is the lifeblood of Egypt, providing the majority of the country's freshwater supply. However, Egypt's water resources are under stress due to population growth, pollution and competition with upstream Nile basin countries.

The expected impacts of climate change are arguably the greatest challenge that Egypt faces. Climate models predict reduced precipitation, especially in West Egypt, and increased temperatures, which will further increase evapotranspiration (estimated at +4% per air temperature rise of 1°C).

6.2 Water resources management

6.2.1 Current status and trends

Egypt is in a semi-arid and arid region, where most of its renewable freshwater is from the River Nile. Almost 85% of the Nile reaches Egypt from the Ethiopian Highlands and 15% from the Equatorial Plateau. The available conventional freshwater supply is 59.3 BCM/year, comprising Egypt's Nile water quota of 55.5 BCM/year, non-renewable deep groundwater of 2.45 BCM/year, and coastal winter rainfall and flash floods of about 1.3 BCM/year.

The flow of the Nile River is completely controlled by the Aswan High Dam and seven barrages between Aswan and the Mediterranean Sea.

Deep groundwater's total quantity is 2.4 BCM/y. In terms of groundwater hydrology, Egypt can be divided into four provinces: Western Desert, Eastern Desert, Sinai Peninsula, and Northern Coastal Zone. The Nubian Sandstone Aquifer in the Western Desert is the largest in North Africa. However, the quantity that can be readily made economically viable is limited.

Rainfall is very scarce except in a narrow strip along the northern coastal areas. Flash floods occur in the Red Sea area and southern Sinai. Flash floods are utilised by dams and ground reservoirs.

Non-conventional resources include the reuse of agricultural drainage water (13.5 BCM/year), wastewater and industrial wastewater, as well as the shallow aquifer in the Nile Valley and Delta, in addition to the desalination of seawater and brackish water with 0.3 BCM/year. Egypt has been expanding its desalination projects in recent years, in light of its concerns about water scarcity. A total of 63 desalination stations exists at present, with a total production capacity of 800,000 m^3/day.

The total current water requirements for different sectors is 81.3 BCM/year. The gap from the available conventional freshwater supply is about 21.5 BCM/year, which is compensated by the reuse of drainage water, wastewater and shallow groundwater. Agriculture is the largest water user and consumer in Egypt, with an overall volume of 68.5 BCM/y (85% of total water requirements). The aggregate quantity of water released to the drinking water sector is 9.9 BCM/y and the industrial water requirements are 2.4 BCM/y, excluding water used for cooling power stations. Although desalination of seawater or brackish water represents a small fraction at the national level, it is considered a major source of drinking water in some tourist areas alongside the coasts of the Red Sea and the Sinai.

Climate change will be the key driver for water scarcity in Egypt, exacerbated by a growing population. Climate change will affect Egypt principally through higher uncertainty on the upstream water supply through the River Nile; and clear negative pressures on the coastal zone in terms of sea level rise, storms, erosion and saltwater intrusion, aggravated by continued land subsidence. In addition, more water will be required to produce the same amount of agricultural commodities because of higher evaporation and lower yields.

Egypt has been following a successful policy for drinking water supply, which includes the expansion of service delivery, the introduction of modern technology in operations, maintenance and management, and increasing the private sector's participation in activities that are unessential to its mission. The total number of water treatment plants is 2,175 with a capacity of 25.3 MCM/year. The total length of the drinking water network is 150,000 km, with a coverage percentage of 96%. The Government has been supplying safe drinking water to the entire population in 222 cities and the majority of 4,617 villages. However, only two thirds of water produced is consumed.

Sanitation services in Egypt are less developed compared to water supply services. Sanitation coverage is more than 95% in urban areas, and less than 15% in rural areas. Only 0.7 BCM/year of treated wastewater is being used in irrigation, of which 0.26 BCM (secondary treated) and 0.44 BCM (primary treated) is used to cultivate forests and crops. Another 2.95 BCM/year is pumped to drains and canals in Cairo and the Delta.

6.2.2 Policy framework

The Water Resources Development and Management Strategy for 2050 was prepared in 2011 and updated in 2017. The strategy sets a long-term time horizon, and emphasises two strategic concerns: the urgent need for climate change adaptation, and the importance of higher level of management over the water resources.

The National Water Resources Plan for Egypt 2017–2037 aims to support Egypt's socio-economic development by the sustainable use of its water resources. In support to its overall purpose, the plan pursues four pillars: improving the water quality, enhancing the availability of freshwater resources, enhancing management of water use, and improve the enabling environment for IWRM, planning and implementation. It envisages a number of important projects and initiatives:

- National Project for Canal Rehabilitation, to maximise the efficiency of water use and the yield;
- Modern Irrigation Project (sprinkler/drip irrigation) aiming to convert to modern irrigation systems in an area of 3.7 million fed by 2025;
- Four mega-projects for water treatment and reuse;
- Shore protection projects (Integrated Coastal Zone Management (project); and
- Projects for desalination and sustainable use of ground water.

One of the most important pillars of the NWRP is the enabling environment for IWRM (for planning and implementation), where an updated programme is being developed for the measures of the 27 governorates' water resources plans that reflect complete consistency between the national goals and five-year plans, and the priorities set at the governorate level.

6.2.3 Institutional framework

- The Ministry of Water Resources and Irrigation (MWRI) is the key institution in the management of water resources in Egypt. The MWRI oversees the development and management of water resources and operates and maintains dams, weirs, irrigation canals and drainage canals. It also monitors water quality. The MWRI has

restructured its role to include establishing integrated water districts at the local level.

- The Ministry of Agriculture and Land Reclamation (MALR) is involved in improving agricultural activities and land reclamation, including water management at the farm level.
- The Holding Company for Water and Wastewater provides WSS services.
- The Ministry of Health and Population and the Ministry of State for Environmental Affairs, together with the Egyptian Environmental Affairs Agency (EEAA) and the Ministry of Local Development, also have cooperative and consultative roles in the sector.
- A permanent inter-ministerial committee is headed by the MWRI, and includes the Ministers of Electricity and Renewable Energy; Housing, Utilities and Urban Communities; and Agriculture and Land Reclamation, as well as the Governors of Cairo, Giza, Qalyubia and Alexandria.

6.3 Agriculture

6.3.1 Current status and trends

A total area of 9.29 million acres is cultivated in the country, of which 6.09 million acres are in the Nile Valley and Delta region, the "old lands", and 3.2 million acres in the reclaimed "new lands". Though the arable land is one of the most fertile in the world and offers year-round cultivation of many crops, as well as including fruits and vegetables, it nonetheless falls short of meeting the food requirements of the country's growing population. Currently, Egypt imports about 50% of its food. The current levels of self-sufficiency for wheat and average cereals stand at 42% and 59%, respectively. Wheat is the most widely cultivated crop in Egypt in terms of growing area, comprising 50% of the cultivated area during the winter season.

Agriculture is by far the largest freshwater demanding sector, consuming 85% of all water withdrawals, and is the sector most affected by the increasing challenge of water scarcity.

Longstanding challenges for the agriculture sector in Egypt are land fragmentation, lack of appropriate good agricultural practices at the field level, dated extension systems, low investment, deteriorating water quality, poor water and fertiliser management, poor involvement of the community, and unreliable and inequitable distribution of water along canals.

The completion of the Aswan High Dam on the Nile in 1971 allowed a transition to perennial irrigation and longer-term water storage, allowed further reclamation of land to the east and west of the Nile Valley, and permitted the production of significant hydropower. Water released from the Aswan High Dam flows into the primary and branch canals and then into *mesqas* (canals serving areas of 100–350 *feddan* [a *feddan* is an area slightly larger than an acre]) and finally into *marwas* (canals serving areas of 3–5 *feddan*). The irrigation water is distributed via the irrigation network of 35,000 km based on the planned cropping pattern, and several projects have been implemented. Agricultural drainage water and effluents from municipalities and industries are collected and transported by an extensive drainage network. This system comprises field drains (open drains or subsurface drains), collector drains, and main drains which convey the water into irrigation canals and the River Nile, where it mixes with freshwater for further downstream use.

6.3.2 Policy framework

Two agricultural policy reform programmes were implemented between 1987 and 2002. The first was the Agricultural Production and Credit Project (1987–1995), and the second was the Agricultural Policy Reform Programme (1996–2002). The Agricultural Production and Credit Project included the reduction of subsidies in some agricultural inputs, as well as the removal of controls on area

allotments and price and marketing restrictions for some major crops. The Agricultural Policy Reform Programme which followed was broader in context, and included the privatisation of public firms. In parallel, the launching of the Economic Reform and Structural Adjustment Programme in 1991, with the International Monetary Fund and the World Bank, had an indirect impact on the agriculture sector. By shifting government policy from a state-controlled to a market economy, the Structural Adjustment Programme accelerated the liberalisation of markets and encouraged the private sector to play a greater role in agricultural trading.

The strategy of the MALR for sustainable agricultural development until the year 2030 adopted the national project for developing and upgrading field irrigation systems for lands in the Valley and the Delta. The strategy aims at increasing agricultural production; improving its quality to achieve food security; maximising utilisation of land units and water units; enhancing water use efficiency by expanding the application of advanced irrigation systems in the lands of the Valley and the Delta; increasing income of farmers; creating new work opportunities; bringing about sufficiency, equality, reliability, responsiveness and transparency in respect of the distribution of water and accessibility of water to fields in the right time and quantity; and forming water users' associations, and their participation in the improvement efforts.

6.3.3 Institutional framework

- The MALR is the main government body responsible for formulating agricultural policies, regulations and programmes. It oversees various aspects of agriculture, including crop production, irrigation, land reclamation, and agricultural research and extension services.
- Agricultural Research Centre (ARC): The ARC is tasked with conducting research to improve agricultural productivity, develop new crop varieties and address challenges facing the sector. It operates research stations and laboratories across Egypt.
- Egyptian Agricultural Organisation (EAO): The EAO is involved in agricultural development projects, marketing agricultural products, and providing technical support to farmers. It also manages agricultural cooperatives and provides financial assistance to farmers.
- EEAA: While not solely focused on agriculture, the EEAA plays a role in environmental conservation and sustainable agricultural practices.
- Cooperative Agricultural Credit Societies: These provide financial services, including credit and loans, to farmers to support agricultural activities.
- MWRI: Given the importance of water management in agriculture, this ministry plays a crucial role in providing irrigation infrastructure and managing water resources for agricultural purposes.
- Land Reclamation Authority: Tasked with reclaiming and developing arable land to expand agricultural production areas.
- National Research Centre (NRC): Though not exclusively focused on agriculture, the NRC conducts scientific research relevant to agriculture and provides expertise in various fields related to agricultural development.

6.4 Energy

6.4.1 Current status and trends

Egypt has significant fossil fuel resources, approximately 4.189 billion barrels of oil reserves, and an estimated 77,200 BCM of natural gas reserves. In 2017 it was the fifth-largest oil producer in Africa, with an average output of 0.66 million barrels per day, and the second-largest producer of natural gas in Africa, with 49 BCM[41].

Total energy supply is dominated by fossil fuels, and in particular natural gas (52% in 2022) and oil (41%).

Despite having significant fossil fuel reserves, Egypt imports more energy than it exports with imports covering 9.3% of total energy supply.

Electricity generation in Egypt has been increasing rapidly from 78 TWh in 2000 to 209 TWh in 2022. Egypt is self-sufficient in electricity with some minimal exports to neighbouring countries (0.7% of generation in 2022).

The fuel mix in electricity generation is dominated by natural gas (79% in 2022), followed by oil (8.6%) and hydropower (7%)[42].

Egypt's updated NDC to the UNFCCC, submitted in 2022, sets ambitious goals for increasing renewable energy to transition away from fossil fuels. A key target is achieving 42% of electricity generation capacity from renewable sources by 2030, prioritising a balanced mix of solar and wind energy.

6.4.2 Policy framework

Egypt's Vision 2030 is a key strategic document which aims to achieve a diversified, competitive and balanced economy within the framework of sustainable development.

Energy strategic objectives under Vision 2030 include ensuring energy security, increasing the contribution of energy sector to the GDP, maximising utilisation of domestic energy resources, enhancing rational and sustainable management of the sector, reducing the intensity of energy consumption, and limiting the environmental impact of the sector's emission.

The Ministry of Electricity and Renewable Energy's Integrated Sustainable Energy Strategy 2035 establishes the necessary conditions to enable the increased development of renewables through the engagement of all sectors and confirms Egypt's ambition to become an energy hub between Europe, Asia and Africa by expanding grid interconnections across the Arab region and beyond. Under this strategy, Egypt intends to increase the supply of electricity generated from renewable sources to 20% by 2022 and 42% by 2035.

6.4.3 Institutional framework

- The Ministry of Electricity and Renewable Energy oversees the overall energy sector, including setting policy and strategy.
- The New and Renewable Energy Authority, established in 1986, promotes renewable energy development and facilitates investment in the sector.
- The Egyptian Electricity Holding Company is a state-owned company responsible for generation, transmission and distribution of electricity. However, reforms are underway to introduce more competition into the market.
- The General Authority for Investment works to improve the investment climate in Egypt, including for the energy sector.

41 BP (2018): *BP Statistical Review of World Energy 67th Edition*, London.

42 IEA: Energy system of Egypt website, https://www.iea.org/countries/egypt.

- The Egyptian Electric Utility and Consumer Protection Regulatory Agency (EgyptERA) is the regulatory authority responsible for regulating the electricity sector, including setting tariffs, issuing licences, and ensuring compliance with regulations and standards.

- The National Agency for Energy Conservation, established in 2004, works to improve energy efficiency across all sectors of the economy.

6.5 Environmental protection

6.5.1 Current status and trends

Egyptian biodiversity comprises 143 types of globally important species, 800 species of non-flowering plants, 2,302 flowering plants, 111 species of mammals, 480 species of birds, 109 species of reptiles, 9 species of amphibians and more than 1,000 species of fish. Overall, 51 species of mammals are already endangered, along with 26 bird species and 26 reptile species. In coastal ecosystems, which represent one of the most threatened natural habitats, endangered mammals amount to at least 17 species, sharks to 20, birds to 300, fish to 150, algae to 80, coral species to 20, molluscs to 80 and crustaceans to 60, with many seaweed species also currently at great risk[43].

The main threats to Egypt's biodiversity include hunting, habitat destruction for developmental purposes, and pollution, primarily refuse from industry and human settlements.

Water pollution in the Nile Delta is very clear, especially in the Rosetta branch, due to the disposal of agricultural drainage mixed with municipal and industrial wastewater. The Rosetta branch of the Nile receives drainage water from five agricultural drains transporting their water from intensive drainage networks. The deterioration of branch water quality is one of the most serious environmental threats to public health and the environment in Egypt, as the branch water is the main source for irrigation, municipal and industrial purposes on the western side of the Nile Delta.

Egypt has 50 protected areas, covering 13% of its land and 5% of its coastal waters[44]. The EEAA is responsible for developing and managing protected areas.

6.5.2 Policy framework

- Egypt Vision 2030: This overarching national strategy includes a focus on environmental sustainability. It outlines goals for areas like pollution reduction, resource conservation and climate change adaptation.

- Egyptian Biodiversity Strategy and Action Plan (EBSAP): Developed in line with the United Nations Convention on Biological Diversity (CBD), the EBSAP identifies the following six strategic goals (and related actions): conserve and manage terrestrial and aquatic biodiversity to ensure sustainable use and equitable benefits to the people; sustainable use of natural resources; access to genetic resources and Benefit-sharing – Nagoya Protocol, Indigenous knowledge and traditions; improve our understanding of biological diversity and ecosystem functioning in a changing environment; prepare for climate change and combat desertification; and build partnerships and integrate biodiversity into all national development frameworks.

- National Waste Management Strategy: This strategy tackles the challenge of waste disposal, aiming to reduce waste generation, promote recycling, and improve waste collection systems.

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43 CBD: Egypt – Country Profile website, https://www.cbd.int/countries/profile?country=eg.

44 Protected Planet (2025): Egypt website, https://www.protectedplanet.net/en/country/EGY.

- National Strategy for Climate Change (NSCC): Launched in 2022, this comprehensive strategy sets a roadmap for managing climate change impacts and transitioning to a low-emission economy.

6.5.3 Institutional framework

- The Ministry of Environment is the main governmental body responsible for formulating environmental policies and regulations in Egypt. It plays a strategic role in environmental policy-making and coordinates with other ministries on environmental issues. The policies of the ministry are executed by the EEAA.

- The EEAA operates under the Ministry of Environment, and is responsible for implementing environmental policies and programmes at the local level. It works to raise awareness about environmental issues, enforce environmental regulations, manage protected areas and promote sustainable development practices.

- EEAA's National Institute of Oceanography and Fisheries is a research institution under the EEAA that focuses on marine and coastal environmental research, monitoring and conservation. It conducts scientific studies to assess the health of marine ecosystems, develop sustainable fisheries management practices and protect marine biodiversity.

- EEAA's Nature Conservation Sector is responsible for conserving Egypt's biodiversity and protected areas. It manages national parks, nature reserves and wildlife sanctuaries, conducts biodiversity surveys, and implements conservation programmes to protect endangered species and habitats.

- EEAA's Environmental Inspection Sector is responsible for conducting environmental inspections and enforcing environmental laws and regulations. It monitors compliance with environmental standards, investigates environmental violations and takes enforcement actions against polluters.

- The General Authority for Sustainable Development and Environmental Compliance is responsible for regulating and monitoring industrial activities to ensure compliance with environmental standards and regulations. It conducts environmental inspections, issues permits for industrial facilities, and enforces environmental laws to prevent pollution and mitigate environmental impacts.

6.6 Rapid assessment of the WEFE Nexus in Egypt

6.6.1 Key interlinkages across the WEFE elements

The vast majority of Egypt's water resources come from outside the country, making evident the need of coordination across borders.

Water intrusion in the Nile Delta is a key issue affecting agriculture and ecosystems.

An increase in the reuse of drainage water is expected to address water shortage concerns, which will subsequently increase the water's salinity, thereby reducing crops' productivity.

Transforming surface irrigation into a modern irrigation system and expanding agriculture to new desert lands will increase the energy demand, as will the expansion of desalination.

Energy is one of the main determinants of agricultural sustainability, and the sector has been struggling due to increased energy prices.

The decades-long focus to maximise yields and food production has led to over-fertilisation in many areas, threatening the quality of drainage water.

6.6.2 Integration in policy-making and management practices

Overall, there is lack of clarity in the definition of the roles of the key institutions and the supporting entities.

The institutional setup in the Egyptian water and wastewater sector is complicated with many ministries and agencies involved in the sector and its management, leading to overlapping of responsibilities, especially between planning and operations.

In terms of water quality, the MWRI sets the standards for municipal effluent discharge, while the Ministry of Health and Population is responsible for monitoring, sampling and testing drinking water and effluent quality.

Another key issue is that compliance to laws and regulations for protracting water resources is not enforced adequately.

The Government has taken steps to strengthen the decentralisation, privatisation and participatory approach within the water boards and water users' associations.

7 JORDAN

Summary

7.1 Introduction

Jordan's climate is predominantly arid, characterised by hot summers and mild winters. Seasonal variations in temperature are more pronounced in the interior, while the western areas near the Jordan River and the Dead Sea enjoy milder conditions. Water resources and fertile soil are scarce, mostly located in the Jordan Valley.

As of 2020, Jordan has a diverse population of over 10 million people, including a significant number of refugees from Palestine and Syria.

As most countries in the region, Jordan is vulnerable to the impacts of climate change, including rising temperatures, reduced rainfall and increased frequency of extreme weather events.

Jordan faces severe water scarcity, with a limited supply of freshwater from both surface and groundwater sources. Over-extraction, pollution, and inefficient water use exacerbate the problem.

Agriculture is a critical sector in Jordan's economy, providing employment and contributing to food security. However, the sector faces challenges such as water scarcity, soil degradation and limited arable land.

Jordan is among the most energy-dependent countries in the world, with 96% of the country's energy needs coming from imported oil and natural gas.

Jordan's economy and society have faced significant shocks in recent years due to the regional conflicts in Syria and Iraq, the country's main trading partners, which disrupted Jordan's trade routes and capital inflows. The Syrian refugee crisis put considerable pressure on the country's economic, physical and social infrastructure.

7.2 Water resources management

7.2.1 Current status and trends

Jordan is one of the ten most water-scarce countries in the world, with only 61 m^3 available per capita in 2021. Climate change is projected to cause a further 15% decline in freshwater resources by 2040[45]. Climate change and overuse of water resources have reduced groundwater and surface water resources, while the population has grown at a very high rate.

Water in Jordan is supplied from three main resources: groundwater (about 59%), surface water (about 27%) and the rest from treated wastewater (around 18%)[46].

The major surface water sources in Jordan are the Jordan river, the Yarmouk River and the Zarqa River, with a total of 288 MCM/year. The available water supply from each has become highly unreliable, as much of the Jordan River flow is diverted by Israel and much of the Yarmouk River flow by Syria, leaving only a small share to Jordan. An annex to the Israel-Jordan Peace Treaty of 1994 specifies the allocation of the Jordan River and lower Yarmouk River water between the two countries. The King Talal Dam, Jordan's largest surface water reservoir, faces low water levels and pollution.

Countrywide, 12 groundwater basins have been identified. In terms of sustainability, their state can be described as critical since some of them are exploited to their maximum capacity, while others are overexploited, threatening their future use. The long-term safe yield of renewable groundwater has been estimated at 275 MCM/year. Groundwater (renewable and non-renewable) accounts for about 60% of the annual water budget, or about 618.8 MCM/year[47].

45 Jordan Ministry of Water and Irrigation (2023): *National Water Strategy 2023-2040*, Amman.

46 Jordan Ministry of Water and Irrigation (2017): *Jordan Water Sector Facts and Figures 2017*, Amman.

47 Jordan Ministry of Water and Irrigation (2017): *Jordan Water Sector Facts and Figures 2017*, Amman

Treated wastewater supplies around 18% of the national water supply, with 146.7 MCM/year to be used in agriculture, which is forecast to increase to 411 MCM/year in 2035. Most of the treated wastewater is released from treatment plants near the major population centres (and major wastewater sources) in the middle of the country, into watercourses on the ridge of the Jordan Valley, where it flows into the valley for use in irrigation. The amount of wastewater has increased over the years due to the significant population increase. This has resulted in the existing wastewater treatment plants being used beyond their originally designed capacity.

The combination of new supply resulting from desalination and the sustainable management of renewable freshwater will not only halt the deterioration, but also restore groundwater resources while still meeting demand projections.

The country has reached a high level of providing WSS services, where 99.3% of the population has access to improved water supply and 99.5% to improved sanitation.

Jordan faces a geographical imbalance between water demand and supply, where water is moved for long distances to reach most of the population for domestic use.

7.2.2 Policy framework

The first National Water Strategy of the Ministry of Water and Irrigation (MWI) was produced in 1998, followed by another strategy covering the years 2008–2022, which was then replaced by a 2016–2025 strategy to account for the changed conditions brought on by the Syrian refugee crisis and adoption of the SDGs in 2016.

The basic objective of this National Water Strategy is the sustainable management of water and sanitation for all Jordanians. To achieve the goal, the strategy essentially covers the national water sector goals and approach through five key areas: IWRM; water, sewage and sanitation services; water for irrigation, energy and other uses; institutional reform; and sector information management and monitoring. The strategy also, in its most recent version, rapidly addresses cross-cutting issues of climate change adaptation; transboundary/shared water resources; humanitarian water, sanitation and hygiene (WASH) sector coordination; public/private partnerships; and the economic dimensions of water.

Supply increases have been planned through seawater desalination, an increase in treated wastewater, dam construction and new fossil groundwater exploitation. The planned Red Sea-Dead Sea Conveyance, whereby water will be desalinated at the Red Sea and brine discharged at the Dead Sea, will add 85 MCM (25 for irrigation) in phase 1 and another 150 MCM in phase 2.

Other large-scale projects include a conveyance system that will transport 100 MCM/year of high-quality fossil (non-renewable) water from the Disi aquifer for an expected 50–100 years. It is expected that, at least between 2014–2022, Disi flows will facilitate a reduction in renewable groundwater over-extraction during the winter, provide the flexibility needed to meet peak demand requirements during the summer, and dilute the salinity of treated wastewater serving the Jordan Valley.

7.2.3 Institutional framework

The MWI is the official body responsible for the overall monitoring of the water sector, water supply and wastewater system and related projects, planning and management, the formulation of national water strategies and policies, research and development, information systems, and procurement of financial resources. Its role also includes the provision of centralised water-related data, standardisation and consolidation of data. MWI has been supported by several donor organisation projects that have assisted in the development of water policy and water master planning, as well as restructuring the water sector.

The MWI embraces the two most important entities dealing with water in Jordan: the Water Authority of Jordan (WAJ) which oversees water and sewage systems, and the Jordan Valley Authority (JVA) which is responsible for the socio-economic development of the Jordan Rift Valley, including water development and distribution of irrigation.

WAJ was established as an autonomous corporate body, with financial and administrative independence from, but linked to, the MWI. WAJ carries full responsibility for the public water supply, wastewater services and related projects, as well as for the overall water resources planning and monitoring, construction, operations and maintenance. A total of 18 directorates of WAJ, under the directive of eight assistant secretary-generals (for water affairs, sewerage affairs, technical affairs, regional affairs [the southern, central and northern regions), financial affairs and administrative affairs), as well as five units directly subordinated to the WAJ Secretary-General, fulfil the said functions. The WAJ Programme Management Unit (PMU) regulates water supply and wastewater utilities under private management.

The JVA was established in 1977 with a mandate for the integrated development of the Jordan Valley encompassing all aspects of life. In 1988, JVA became part of the MWI. The JVA manages and protects water and land resources and their supporting infrastructure in the Jordan Valley in an environmentally and economically sound manner, in the Jordanian national interest, through creating partnerships with the private sector where appropriate. Empowered by its special law, JVA represents the Jordanian Government in the valley, with a broad spectrum of authority and administrative and financial autonomy to perform its activities in an efficient manner.

The WAJ and public utilities are responsible for water and wastewater service provision. The Utilities Performance Monitoring Unit, established by the Water Authority Law, acts as a regulatory oversight body monitoring the performance of the water utility companies.

The two major actors in Jordanian drinking water quality monitoring are the WAJ and the Ministry of Health. The former is responsible for managing water, from extraction to distribution, while the latter is the monitoring agency responsible for public health. Both agencies carry out routine tests of drinking water quality at their laboratories.

7.3 Agriculture

7.3.1 Current status and trends

Jordan is divided into three major climatic regions: the Jordan Valley (Ghor), the highlands that form the eastern edge of the Jordan Valley, and the desert named the Syrian Arab Desert Plateau which extends to the south and east, as well as the Fertile Crescent in northwest Jordan.

The area under agriculture is estimated to comprise approximately 12% of Jordan's total land area. About 90% of Jordanian land is classified as arid desert. However, destruction of arable land is increasing substantially due to overgrazing and climate change.

Jordan faces significant challenges with food sufficiency due to its high dependency on food imports, which account for nearly 97% of its grain needs. This dependency makes Jordan vulnerable to global price fluctuations and external supply chain disruptions. Water scarcity exacerbates these issues, limiting local agricultural productivity.

Over the last decades, Jordan has grown as a modern country with expanding urban centres, and domestic, agricultural and industrial demand for water has increased. To meet these needs, standard technologies used worldwide have been put in place. Large dams have been built to capture and control surface water. Large pumping and piping systems have been established to move

water from the dams and groundwater sources to where it is needed in the big cities, for industrial use and for agricultural irrigation.

One of the new irrigation water resources has been domestic wastewater. Between a fifth and a quarter of water used in agriculture is provided by treated wastewater (144.2 MCM out of 551.8 MCM).

The MWI has been building 12 dams to pump water from different parts of the country towards the high-water-demand areas, mainly Amman with a total of 62 MCM/year. This is in addition to two main projects to increase Jordan's freshwater supply:

- The Disi Water Conveyance Project transports water to Amman and other Jordanian cities in the north, including Zarqa, Ajloun, Irbid, Mafraq and Jerash, from Disi, a fossil aquifer located on the border with Saudi Arabia in the southeast. The project began in 2009 and became operational in 2013. Since 2013, the project has supplied about 100 MCM/year to Amman. The Disi aquifer is shared with Saudi Arabia, which also extracts water from the resource. The two countries signed an agreement in 2015, which underlines the need to use the aquifer for domestic purposes and not for agriculture.

- The Red Sea-Dead Sea Conveyance Project (National Water Carrier): In 2013, Jordan signed an agreement with Israel and Palestine for the joint implementation of the Red Sea-Dead Sea Conveyance Project, the aim of which was to increase water supply to the three countries through seawater desalination, and to replenish the Dead Sea with the brine from the desalination process. After the peace treaty in 1994, the implementation of a canal linking the Red Sea and the Dead Sea became a focal point of Israeli-Jordanian cooperation.

7.3.2 Policy framework

In 2015, the Government launched Jordan's overarching 2025 National Vision and Strategy (NVS). This is the reference for all development pathways in the country, and sets a holistic economic and social framework based on equal opportunities for all. It contains over 400 policies, including ones on environment and climate. The National Vision and Strategy, National Green Growth Plan, National Climate Change Policy and Sector Strategic Guidance Framework have now been extended to 2030.

For the agriculture sector, the key strategic document is the National Strategy for Agricultural Development 2016–2025, which aims to achieve several key results over a 10-year period:

- High agricultural productivity;
- Efficient irrigation water use;
- Technology adoption;
- Public-private partnerships;
- Competitive agricultural marketing;
- Quality and accreditation systems;
- Export-oriented production;
- Food security;
- Integration with other sectors;
- Risk management; and
- Equitable distribution of revenues.

7.3.3 Institutional framework

The Ministry of Agriculture is the central authority responsible for agricultural policies, regulations and development. It oversees various aspects of agriculture, including crop production, livestock, fisheries and rural development.

The MWI is responsible for planning and maintaining irrigation infrastructure and ensuring adequate water quantities.

The National Agricultural Research Centre (NARC) is considered the scientific arm of the Ministry of Agriculture, and is the only specialised governmental agricultural research institution at the national level, to constitute a national umbrella for applied agricultural research and governmental agricultural consultations. Since its early beginnings, NARC aimed at utilising the outcomes of agricultural research that are developed locally or devised from other sources for the purposes of increasing agricultural production – both plant and animal – while improving its efficiency and quality and conserving the agricultural natural resources and optimising their use, serving the purposes of agricultural development and ecological balance.

The JVA manages water resources and irrigation systems in the Jordan Valley. It plays a critical role in ensuring efficient water use for agriculture.

The Jordan Enterprise Development Corporation (JEDCO) promotes agricultural exports and facilitates market access for Jordanian products. It supports agribusinesses in reaching international markets.

7.4 Energy

7.4.1 Current status and trends

Jordan has limited energy resources and depends heavily on imported oil and natural gas for its energy use. Its net energy imports account for 96% of total energy supply. This is the key challenge for the resilience of Jordan's energy sector, as it exposes the country to external price fluctuations and related economic consequences: energy imports account for about one fifth of Jordan's GDP.

Oil is the main energy source in Jordan, accounting for 51% of total energy supply, followed by natural gas (37.6%) and wind and solar (7.7%).

In electricity generation, natural gas is the main fuel, accounting for 73% of generation, followed by solar (15.4%) and wind (7.5%)[48].

Jordan's Vision 2025 aims at achieving an 11% share of renewables in total energy by 2025.

7.4.2 Policy framework

The Jordan Energy Strategy 2020–2030 outlines the country's vision and strategic goals for the energy sector. Key objectives include diversification of energy sources to reduce dependence on imports and enhance energy security; energy efficiency; and scaling up renewables (wind, solar, hydro) to achieve sustainable development. The strategy emphasises the participatory approach, technical committees and collaboration with stakeholders.

The Executive Action Plan of Jordan Energy Strategy 2020–2030 provides a detailed roadmap for implementing the broader energy strategy, focusing on specific actions, timelines and key performance indicators. Key programmes include:

- Energy efficiency improvement, targeting a 9% reduction in energy consumption by 2030 compared to 2018; and
- Increasing the contribution of renewable energy projects to cover the country's increased electricity demand.

7.4.3 Institutional framework

The Ministry of Energy and Mineral Resources is responsible for formulating energy policies, regulations and development strategies. It oversees various aspects of the energy sector,

48 IEA: Energy system of Jordan website, https://www.iea.org/countries/jordan.

including energy diversification, efficiency and sustainability. The responsibilities of the ministry include the comprehensive planning process of the sector, and setting the general plans and ensuring their implementation in a way that achieves the general objectives of the energy sector, the most important of which are providing energy, in its various forms, for the development process, organising its affairs, exchanging electric power with neighbouring countries, and attracting international capital for investment in this field, especially the generation of electric power, the production of oil derivatives, transportation of oil and gas, and utilising local energy sources.

The Energy and Minerals Regulatory Commission (EMRC) is a governmental body with financial and administrative independence. It regulates the energy and minerals sectors, ensuring compliance with laws and standards.

The National Electric Power Company (NEPCO) is the owner and operator of the electric transmission grid in Jordan. It ensures reliable electricity supply and manages interconnections with neighbouring countries.

The Electricity Distribution Company (EDCO) is responsible for installing and operating electricity distribution systems in southern and eastern Jordan. It covers a large concession area, distributing electricity to several governorates.

7.5 Environmental protection

7.5.1 Current status and trends

Although Jordan is a small country of around 90,000 km^2, it has a great variety of wildlife. This is attributed to several factors including its geographical location at the junction of three continents, Asia, Africa and Europe, as well as its diverse landscape, weather conditions, and geological structure. Jordan is divided into four different biogeographical zones: the Mediterranean, Irano-Turanian, Saharo-Arabian, and Sudanian or tropical penetration. Within these diverse zones, there are 13 different vegetation types each representing different elements of flora and fauna. Much of the country's diversity is due to the formation of the Great Rift Valley. The titanic forces that created the Rift Valley produced the high Western Mountains. The altitude ranges from around 400m below sea level by the shores of the Dead Sea, up to 1,854m at the edge of the Southern Heights. Apart from the Rift Valley, Jordan is mainly desert composed of either basalt or *hammada*, a striking, ecologically rich ecosystem that is unique to Jordan and Syria. Furthermore, Jordan has some highly specialised habitats, the most noteworthy being the Dead Sea, which are of global importance.

Despite its rich biodiversity elements, Jordan's nature is facing many threats as reflected by the national and global status of many species and their habitats. Efforts are needed at the national level to help in reviving the populations of threatened species.

Regarding the biodiversity of Jordan, the following number of species have been recorded[49]:

- 2,543 plant species;
- 436 bird species;
- 82 mammal species, belonging to 26 families; and
- 99 reptile species, belonging to 18 families.

Over the last 120 years, many native Jordanian species have been lost and become nationally extinct, and plant diversity is facing a dramatic decline. In total, Jordan hosts 47 globally threatened species, as classified by the International Union for the Conservation of Nature red list. Of its 78 species of mammals, 12 species are globally threatened, including the Arabian

49 Royal Society for the Conservation of Nature: National Biodiversity Database website, https://www.rscn.org.jo/national-biodiversity-database?lang=en.

oryx, Nubian ibex, and three gazelle species: dorcas gazelle, goitered gazelle, and one recently thought to be nationally extinct, the mountain gazelle. The Arabian oryx has become nationally extinct due to excessive hunting, and the Nubian ibex was about to follow suit, but its population was brought back through captive breeding programmes. There are also 15 globally threatened bird species present in Jordan, the most notable of which are the houbara bustard (Chlamydotis undulate) and the saker falcon (falco cherrug). In the Gulf of Aqaba, many of the coral species are globally endangered and protected by several international conventions and treaties, such as the red and black corals[50].

Threats to biodiversity in Jordan are largely induced by anthropogenic activities. These include intensive agricultural practices, use of agrochemicals, overgrazing, excessive hunting, unplanned development, urbanisation and pollution. They have led to the destruction of natural habitats and ecosystems, afflicting large mammal populations the most, as well as plant diversity due to species being isolated, and thus losing their genetic diversity and facing a higher risk of extinction.

7.5.2 Policy framework

The National Action Plan of Green Growth 2020–2022 presents Jordan's efforts for its gradual transition towards green economy. It includes results-oriented implementation plans for each of the key national green growth sectors (energy, water, waste, agriculture, transport and tourism), a cross-cutting action plan, and a framework for measuring and evaluating green growth progress. The National Action Plans for Green Growth covers the six sectors with a total of 86 actions.

The National Climate Change Policy provides guidance to build a climate-resilient society in Jordan. It aims to align with global efforts toward carbon neutrality by 2050. Beyond mitigation objectives it also addresses adaptation for enhancing resilience to climate impacts, and integrates climate action with development goals.

7.5.3 Institutional framework

The mission of the Ministry of Environment is to protect the environment and its various components, conserve environmental and ecological systems, and their diversity, and move towards a green economy. To that end, the ministry drafts the necessary legislative frameworks, develops strategies and policies, and sets standards governing environmental protection, conservation and sustainability, in addition to strengthening environmental control and law enforcement. The ministry also works to promote environmental culture and adjust individual and societal behavior toward greater awareness of environmental issues, in a way that leads to the preservation and protection of the environment.

The National Center for Environmental Justice (NCEJ) works on environmental justice, awareness and empowerment. It collaborates with various stakeholders to promote environmental sustainability.

The Jordan Environment Fund (JEF) was established in 2009 under the provisions of the Environment Protection Law of the Ministry of Environment. It supports environmental projects and sustainable development initiatives.

7.6 Rapid assessment of the WEFE Nexus in Jordan

7.6.1 Key interlinkages across the WEFE elements

Jordan is characterised by critical security of supply challenges in all WEFE sectors. It is one of the ten most water-scarce countries in the world,

50 CBD: Jordan – Country Profile website, https://www.cbd.int/countries/profile?country=jo.

it is among the most energy-dependent countries in the world, having to import more than 90% of its energy needs, and is extremely dependent on food imports, reaching 100% in the case of cereals.

Jordan's key water rivers and aquifers are generally situated at a considerable distance from the cities and agricultural areas. This means that water needs to be transported between the source and the consumer, sometimes covering a great difference in altitude, requiring significant energy consumption.

Jordan plans to significantly increase use of treated wastewater and desalination, which provides opportunities for synergies with domestic renewable energy development.

At the same time, almost half the water supply is lost in the network, while groundwater resources are under threat from overexploitation, making measures to increase water efficiency critical.

7.6.2 Integration in policy-making and management practices

The National Action Plan of Green Growth 2020–2022 is a positive example of strategic policy-making across sectors.

In terms of institutional settings, a key cross-sectoral coordination role lies with the Ministry of Planning and International Cooperation, which hosts an Inter-Governmental Committee in tandem with its Foreign Funding Unit. The committee's core functions include:

- Evaluating foreign funding applications to ensure alignment with national development priorities;
- Streamlining approval processes to meet predefined timelines; and
- Strengthening monitoring and evaluation – ensuring that funded projects yield beneficial outcomes for their intended targets.

The Government has been strengthening the decentralisation, privatisation and participatory approach. But there is still a need to establish effective community cooperatives and associations in rural areas to support all environmental-related interventions and engage in the management of scarce water resources, not only as communities receiving subsidies and assistance.

A clear separation of functions, roles and responsibilities remains to be seen, especially in the agriculture sector, where lack of coordination and communication has been observed between departments within ministries, between the Ministries of Water and Irrigation and of Agriculture, and between ministries and farmers.

8 LEBANON

Summary

8.1 Introduction

Lebanon has a Mediterranean climate, defined by its location on the eastern coast of the Mediterranean Sea. Topographic variations result in localised modifications of the basic climatic patterns, which are the coastal, the mountainous and the inland. The coastal areas enjoy milder temperatures compared to the inland regions, which can see more extreme weather variations.

The population of Lebanon (around 5.5 million) includes significant ethnic and religious diversity, with large communities of Lebanese Christians and Muslims, and smaller groups of Druze and others. Population trends in Lebanon have been marked by fluctuations influenced by various factors, including political instability, economic conditions and conflicts in neighbouring regions.

Politically, Lebanon has faced challenges due to its complex sectarian power-sharing system, which has often led to gridlock and instability. The country has also been impacted by regional conflicts, notably the Syrian Civil War, which has strained resources and exacerbated internal tensions.

The country's water resources are under pressure from population growth, pollution and climate change, leading to issues of water scarcity and quality. Food security is threatened by limited agricultural land, dependence on food imports and economic instability. Energy shortages result from insufficient infrastructure and reliance on costly fuel imports.

Expected climate impacts in Lebanon include increased temperatures, changes in precipitation patterns, and more frequent extreme weather events such as droughts and heavy rainfall. These changes will likely exacerbate existing challenges, affecting agriculture, water resources and infrastructure.

8.2 Water resources management

8.2.1 Current status and trends

Lebanon has 40 rivers: 17 perennial and 23 seasonal ones. Based on available measurements, the estimated yield from rivers is 4,260 MCM/year, divided into 2,210 MCM/year of surface water either remaining or leaving the country, and 2,050 MCM/year being the estimated springs flows discharging into rivers.

Regarding groundwater resources, the total number of public wells is estimated to be 1,615. A much larger number of private wells is in service, many of which are illegal. The exact total volume extracted from public and private wells is impossible to define due to poor data availability, but is estimated at approximately 990 MCM/year[51].

While treated wastewater reuse is a key non-conventional water resource, currently only one wastewater treatment plant (WWTP) is equipped with a reuse system, while most treated wastewater is still discharged to the sea. Lebanon generates about 248 MCM of wastewater per year. There are currently 78 WWTP distributed over the country, several of which are not operational. Most of the WWTP are small scale and were funded through international non-governmental organisations. About 68% of the generated wastewater is collected, and only 19% undergoing treatment (primary 13% and secondary 6%), while 32% is discharged in septic tanks or cesspools without treatment, and 53% is untreated and discharged to rivers, lakes or the sea. Around 24.2% of the Lebanese population was estimated to be served by primary and secondary wastewater treatment in 2018[52].

A complete and inclusive long-term annual average water balance is still missing for Lebanon and requires further knowledge and studies,

51 Lebanon Ministry of Energy and Water (2020): *Updated National Water Sector Strategy 2020–2035*, Beirut.

52 Lebanon Ministry of Environment, UNDP and Global Environment Facility (2021): *Lebanon: Fourth Biennial Update Report on Climate Change*, 2021.

especially regarding real evapotranspiration estimation and groundwater resources leaving Lebanon to adjacent countries or to the sea through submarine springs. In addition, new information collected on snow cover contribution during last decade should be integrated into the annual water balance.

Due to the unbalanced distribution of the available resources across the country and the poor maintenance of the infrastructure, IWRM is challenging, and physical losses are considerable. Unless effort is put into increasing and optimising resources, and properly managing consumption, the population will witness severe water shortages, with some areas affected considerably from a deficit at the distribution system level. Action is needed also to ensure a better water quality status, and to face pollution of surface and groundwater due to solid waste, wastewater discharge and agricultural and industrial chemicals. Salinity levels are also increasing in coastal areas due to seawater intrusion into aquifers.

8.2.2 Policy framework

The Water Code issued in 2018 and amended in 2020 serves as the primary comprehensive law governing the water sector. A key aspect of this legislation is its provisions for reforms, targeting the overall institutional framework that governs the sector. It explicitly recognises the significance of adopting an integrated approach to water management. It offers comprehensive guidelines on the process involved in establishing an IWRM master plan for Lebanon. The law emphasises the necessity of creating this plan based on watershed or river basin schemes, and outlines the specific prerequisites for their development.

An updated National Water and Wastewater Sector Strategy was issued in May 2020. It reassesses priorities with a horizon to 2035, in light of the country's actual context. It takes into account the adopted Water Code, as well as recent studies and projects. The Strategy comprises several components to achieve sustainable and integrated management: legal and institutional reforms, financial and commercial reforms, reporting and monitoring, capacity-building, operation and maintenance of facilities and services, and service coverage. Moreover, it highlights the importance of an Integrated Hydrological Information System for water resources data, and the establishment of a data centre. It considers such a system necessary to provide real, scientific data for proper planning of infrastructure, and for building holistic management also based on climate change considerations. The National Water and Wastewater Sector Strategy also presents cost estimates associated with its implementation.

8.2.3 Institutional framework

The Ministry of Energy and Water (MoEW) is the main institution responsible for the management of water in all its natural states and geomorphological conditions, and the public facilities designated or needed for its management. MoEW responsibilities include the development of national water sector strategies and sustainable water policies to conserve the water resources of the Lebanese state, protect them from pollution and waste by issuing laws, rules and regulations and their application and enforcement, including through monitoring, control and measuring of water resources, design and implementation of large water infrastructures, and proper treatment of wastewater, with the final objective to meet the water needs of various sectors and all legal human activities.

The four Regional Water Establishments (RWEs) are the utilities in charge of WSS and for the distribution of potable water for domestic, agriculture and industrial uses. They also plan, build, operate and maintain potable and irrigation water transmission (primary and secondary systems), storage, and distribution networks and wastewater treatment plants. RWEs also monitor the quality of distributed potable and irrigation water and the quality of wastewater on outfalls and wastewater discharges; suggest tariffs for potable and irrigation water and

discharging wastewater; combat floods, droughts, emergency pollution and threats to public health; and conserve, remediate and rehabilitate aquatic ecosystems, including wetlands.

The Litani River Authority (LRA) is responsible to manage the Litani River basin, the largest river in the country, and to execute the Litani River Master Plan for irrigation, drainage and domestic water. The LRA is also responsible for planning and operating all potable, irrigation and hydro-electrical schemes associated with the Litani River basin.

The Ministry of Agriculture regulates the distribution of secondary and tertiary systems for irrigation water and ways to use it, and monitors the implementation of these regulations inside the agricultural parcels/farms. It evaluates infrastructure and investment requirements, and designs, builds, operates and maintains the irrigation water transmission and distribution networks.

The Ministry of Public Health's role in relation to the water sector includes the monitoring of drinking water to control the incidence of waterborne diseases. It recommends actions to prevent pollution of water sources, reviews and approves sewerage and drainage schemes, and controls pollution at water intake points. The ministry also issues permits related to water bottling and the establishment of water bottling facilities.

The Ministry of Public Works and Transportation is responsible for rainwater and drainage infrastructure and flood prevention.

The Ministry of Environment reviews the strategic environmental assessment of any plan or programme for the sector to ensure that related environmental issues are considered, and the EIAs for specific components of plans and projects. It contributes to the preparation of the masterplan for water and wastewater; promotes water conservation campaigns and protection of water resources as mentioned above, establishing technical specifications for design of wastewater treatment plants and safeguarding against illegal sewage disposal in coordination with relevant stakeholders; enforces regulations and standards for water resources protection, including for water quality suitable for aquatic life and for swimming and for wastewater discharged into sewers and surface water; controls and monitors environmental impacts of industries; and designs natural freshwater sites to be protected.

8.3 Agriculture

8.3.1 Current status and trends

In 2018, the agriculture sector in Lebanon was responsible for 38% of the country's industrial output, and 2.9% of its GDP[53].

Arable land comprises 35% of Lebanon's entire surface area (360,000 ha). However, only 232,200 ha of cropland currently exist. Due to Lebanon's geographical and climatological diversity, this sector produces a variety of different products, both animal and plant based. Concerning plant production, 31% is derived from fruit trees, 23% from olives; 20% from cereals; 17% from vegetables, and the remaining 9% from tobacco, grape and other plants[54].

Olive trees span an area exceeding 47,500 ha, and cereals are widely cultivated throughout the country, occupying a total of 45,000 ha and including wheat (30,000 ha), barley (10,000 ha) and other miscellaneous products (5,000 ha). Wheat production is largely dependent on precipitation rates in Lebanon, meaning that it is a very volatile aspect of the agriculture sector much dependent on climate conditions.

53 Investment Development Authority of Lebanon (2020): *Agri-Food Sector in Lebanon 2020 Factbook*, Beirut.

54 World Bank Group (2018): Droughts and Agriculture in Lebanon: Causes, Consequences, and Risk Management, Washington, DC.

Animal production is an important contributor to the agriculture sector, accounting for 40% of the sector's output. The top products are milk, chicken and beef. In rural areas, specifically those characterised by high poverty rates, livestock production represents one of the main activities of the population, employing most of the workforce, with 60% of farmers depending on dairy products as their primary means of subsistence.

Lebanon exported agricultural products worth $434 million in 2019, accounting for 11.7% of the total exports of the country. The largest group of exports were jams and fruit jellies (38%). However, the volume of food products imported far exceeded Lebanon's agricultural exports ($1.6 billion in 2019), due to the fact that local production does not cover the needs in essential products (wheat, vegetable oils, etc.), many local products cannot compete with the quality of foreign commodities, and there are large refugee populations which require food. In fact, domestic agrifood production satisfies only 20% of the local demand. Most of the inputs used in the sector (fertilisers, pesticides, animal feed, drugs and vaccines, etc.) are also imported, but due to the financial crisis many companies have decided to halt all nutrient imports[55].

Agriculture accounts for 61% of water withdrawals in the country, coming from groundwater (49%), surface waters/rivers (39%) and reservoirs (12%). A recent inventory across the country refers to a presently irrigated land area of around 100,000 ha, and 78.8% of arable land equipped for irrigation. A total of 65% of the irrigated areas are permanently irrigated, whereas the remaining 35% are partially irrigated[56].

8.3.2 Policy framework

The National Strategy for the Agriculture Sector 2020 (NAS 2020) for the years 2020–2025 has as its overall objective to "transform the Lebanese agrifood system in a more resilient, inclusive, competitive, and sustainable agrifood system". The main objectives of the NAS 2020 are described in its five pillars, dedicated respectively to:

- Restoring the livelihoods and productive capacities of farmers and producers;
- Increasing agricultural production and productivity;
- Enhancing efficiency and competitiveness of agrifood value chains;
- Improving climate change adaptation and sustainable management of agrifood systems and natural resources; and
- Strengthening the enabling institutional environment.

The National Strategy for Conservation and Management of Plant Genetic Resources for Food and Agriculture In Lebanon 2015–2030 aims to ensure the rational management of such resources, including seed delivery.

8.3.3 Institutional framework

The Ministry of Agriculture is the main institution responsible for proposing legislation governing the agriculture sector, formulating the national strategic vision and developing related policies and programmes. Moreover, it also plays a key role in the management of natural resources, such as agricultural land, irrigation water (at the farm level), and forests, fisheries and rangelands, and in the preparation and implementation of rural development programmes. It is also responsible for protecting agriculture lands and soils, and for pesticide management by controlling the mechanisms of granting import permits and registrations, production, and the disposal and handling of empty fertiliser containers.

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55 Investment Development Authority of Lebanon (2020): Agri-Food Sector in Lebanon 2020 Factbook, Beirut.

56 Lebanon Ministry of Energy and Water (2020): *Updated National Water Sector Strategy 2020–2035*, Beirut.

The Lebanese Agriculture Research Institute conducts applied and basic scientific research for the development and advancement of the agriculture sector, as well as some development activities, such as production of quality seeds, diagnosis of animal diseases, production of vaccines, food quality control, soil analysis, feed composition, plant protection and others. Moreover, it also provides extension services to farmers on soil fertility and water use management, control of plant pests and diseases, crop rotation, and other topics, and collects and provides agrometeorological data through their 80 interconnected meteorological stations distributed over the country.

The Green Plan is a longstanding rural development and agricultural investment body that implements activities including land terracing, development and conservation; rehabilitation of agricultural land; water harvesting; agricultural roads construction; reforestation and seedling distribution; execution of irrigation infrastructure projects (storage facilities of capacity lower than 100,000 m^3, irrigation system at the farm level), etc.

The MoEW has responsibilities related to the sector, including meeting its water requirements and licensing wells and all water extraction and irrigation water supply projects (artificial lakes, storage tanks, etc. with capacity higher than 100,000 m^3). The MoEW is responsible for primary and secondary irrigation systems, and the RWEs provide water for the agriculture sector in their relevant areas and can recommend tariffs. The LRA is responsible for planning and implementing irrigation schemes around the Litani River.

The Ministry of Environment sets the standards for pesticide use and wastewater disposal, reviews and approves EIA studies related to agricultural projects, and is in charge of the protection of the environment, biodiversity and natural resources.

The Ministry of Public Health reinforces food safety, which includes monitoring water quality used for irrigation and agriculture.

8.4 Energy

8.4.1 Current status and trends

Lebanon has no fossil fuel reserves, and in 2022 relied on imports for 97% of its total energy needs.

Total energy supply is dominated by oil, with a share of 86% in 2022[57].

Lebanon has been facing an electricity crisis and a severe gap between supply and demand for decades. Electricity generation relies almost entirely on imported fuel, while electricity imports are also needed to cover part of the demand. Fuel expenses for power generation and thermal use account for 3.5% of the country's GDP[58].

In 2019 about 43% of the electricity came from oil power stations, 19% came from combined cycle gas power plants, 18.7% was imported, 11% came from barges, 1.82% came from HPPs, 5.29% came from biogas from landfill municipal solid waste and 0.73% came from solar PV. Private generators (diesel-fired) are estimated to have covered 80% of the Electricité du Liban (EDL) supply deficiency, with about 85% of households relying on them to partially satisfy their energy needs. These households paid two electricity bills, with an overall estimated cost of $1 billion per year for private generators.

RES are abundant and can play an essential role in the development of the energy sector. Since 2020, the demand for decentralised solar PV systems has increased significantly, with the reduction in electricity supply by EDL and the private sector,

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57 IEA: Energy system of Lebanon website, https://www.iea.org/countries/lebanon.

58 Lebanon Ministry of Environment, UNHCR, UNICEF and UNDP (2021): *SOER Report. Lebanon State of the Environment and Future Outlook: Turning the Crises into Opportunities 2020*, Beirut.

due to their decreasing costs, increasing efficiencies and storage lifetime. As for wind energy, three power purchase agreements have been signed with private developers for the installation of three wind farms with a total capacity of 226 MW. A total of 11 licenses for the production of electricity (165 MW) from solar energy have also been signed[59].

A potential contributor to Lebanon's energy security is oil and gas resources exploration, in case commercially extractable quantities are discovered and exploration activities are successful.

In its NDC, Lebanon commits to unconditionally generating 18% of its electricity demand and 11% of its heat demand (in the building sector) from RES in 2030, and conditionally commits (depending on financial support) to generating 30% of its electricity demand and 16.5% of its heat demand (in the building sector) from RES in 2030.

8.4.2 Policy framework

The National Renewable Energy Action Plan (NREAP 2016-2020) was prepared to lead the way for the development of renewable energies to reach the 12% target by 2020. The document also integrated existing action plans from the National Bioenergy Strategy for Lebanon set in 2012 by the MoEW with the United Nations Development Programme (UNDP). The Government is preparing a second National Renewable Energy Plan (NREAP 2024-2030), defining a path toward achieving 40% electricity consumption from RES by 2030.

In March 2022, a new policy statement was issued by the MoEW, under the title Setting Lebanon's Electricity Sector on a Sustainable Growth Path. The policy prioritises quick and efficient solutions to secure additional supply hours for residents in Lebanon. The current circumstances and crises affecting Lebanon's various sectors have "stalled most of the MoEW's plans and projects".

8.4.3 Institutional framework

The MoEW is responsible for the management and development of the energy sector in Lebanon, including the formulation of the general policy, master plans, legal texts and rules related to the electrical energy production, transmission and distribution, supervision of execution, approval of renewable energy development proposals and projects, granting of permitting and licencing relevant to energy, and undertaking the necessary contacts with other countries, aiming at establishing electrical interconnections and exchanging electrical energy.

The oil and gas sector is mainly supervised by the Lebanese Petroleum Administration, an autonomous public institution under the MoEW mandated to plan, regulate, manage and monitor the petroleum sector in Lebanon's offshore across the activities' value chain.

The electric power sector is managed primarily by EDL, an autonomous power utility under MoEW's administrative tutelage, the responsibilities of which include power generation, transmission and distribution; follow-up on the execution of MoEW's plans; and monitoring the implementation of the net-metering process related to RES projects.

The LRA is responsible for HPP operation.

The Lebanese Center for Energy Conservation supports MoEW in energy efficiency, RES and green buildings issues, and to set relevant national strategies and action plans, update/develop the legal and administrative framework for greening the energy sector, and develop energy efficiency standards and labels and national energy database indicators.

The Ministry of Environment is responsible for approving EIA and strategic environmental assessment studies for development projects

59 Lebanon Ministry of Environment, UNHCR, UNICEF and UNDP (2021): SOER Report. Lebanon State of the Environment and Future Outlook: Turning the Crises into Opportunities 2020, Beirut.

and master plans, including those related to the energy sector. The ministry is the national climate change focal point and has been leading on the development and coordination of climate change research and policy to inform a low carbon, climate-resilient Lebanon by 2030 and beyond.

8.5 Environmental protection

8.5.1 Current status and trends

Lebanon has one of the highest densities of floral diversity in the Mediterranean basin, one of the most biologically diverse regions in the world. It counts about 2,600 terrestrial plant species, 8.5% of which are broadly endemic to Lebanon, Syrian Arab Republic and Palestine, and 3.5% strictly endemic to Lebanon. The vegetation of Lebanon has an exceptionally high species/area ratio (0.25 species/km^2). A notable keystone and flagship plant species in the country is the Lebanese cedar (Cedrus libani) that has been exploited since the rise of civilisation in the Fertile Crescent[60].

Yet, at present, much of Lebanon's biodiversity is heavily threatened by human activities. Although national red lists for species in Lebanon do not exist, reports indicate that up to 5% of Lebanese fauna is threatened. Further, seven mammal species are extinct (including the Syrian brown bear, Mesopotamian deer and Arabian gazelle); 31% of mammal species are reported as rare, 20% as vulnerable and 7.5% as close to extinction. Among bird populations, 1 species is reported as critically endangered, 1 as endangered, 9 as vulnerable and 16 as near-threatened. A total of 96 terrestrial floral species, most of which are endemic to Lebanon, are listed as rare or threatened. Finally, the marine ecosystem counts 68 threatened species, and 5% of the country's freshwater fauna is threatened.

Threats to ecosystems and biodiversity mostly stem from human activities, mainly particularly habitat loss due to urbanisation; destruction of coastal zones and extension of agricultural areas; unsustainable harvest of natural resources, notably through overhunting, overharvesting, overfishing and escalating uncontrolled exploitation of groundwater; pollution due to the spread of modern chemical-intensive agriculture and the discharge of effluents into rivers; pollution from urban and industrial activities; and invasive alien species, particularly the introduction of marine species from the Red Sea to the Mediterranean Sea through the Suez Canal. Climate change constitutes a major threat to biodiversity, and is expected to increase the likelihood of major changes to terrestrial ecosystems (e.g. regression of forest to shrubland or grassland, increase in rodents and their predators, shifts in routes of migratory birds), along with water shortages, increasing temperatures, and more frequent and intense storms.

8.5.2 Policy framework

Lebanon has ratified several international treaties, conventions and protocols related to the environment. Strategies and action plans for the protection of ecosystems and biodiversity are led and implemented by the Ministries of Agriculture or of the Environment, depending on the issues tackled.

For example, the NAS 2020 aims at promoting sustainable use of natural resources (soil, pastures, forests and fisheries), and climate change adaptation activities, such as afforestation and reforestation.

The National Afforestation and Reforestation Programme 2014-2028 is a Ministry of Agriculture initiative for reforesting 70,000 ha of public land and expanding forest cover from the current 13%

60 CBD: Lebanon – Country Profile website, https://www.cbd.int/countries/profile?country=lb.

to 20% of Lebanese territory by 2030. In addition, the Lebanon National Forest Plan 2015–2025 aims to restore degraded lands and increase Lebanese forest cover while meeting the ecological, social and economic needs of sustainable forest management at a regional scale. The National Strategy for Forest Fire Management (2009) aims to "reduce the risk of intense and frequent forest fires while allowing for fire regimes that are socially, economically and ecologically sustainable".

Moreover, the National Strategy for the Conservation and Management of Plant Genetic Resources for Food and Agriculture 2015–2030 aims to promote and ensure the rational management of such resources.

Other long-term national development plans are the National Biodiversity Strategy and Action Plan 2016–2030 prepared by the Ministry of Environment, and relevant action plans related to the conservation of coralligenous assemblages (2020), and species introductions and invasive species (2018), a national stranding network for sea turtles and cetaceans, a protocol for monitoring the interaction between marine litter and sea turtles in Lebanon, and a Monitoring Programme for Marine Biodiversity (2018).

8.5.3 Institutional framework

The Ministry of Environment's mandate includes policy, oversight and guidance related to environmental protection, nature and biodiversity conservation in Lebanon; protected areas and natural reserves, their designation criteria, and proposing laws and regulations for protected area management; the implementation of strategic environmental assessment and EIA decrees to ensure environmental safeguarding; coastal zone management; climate change; the sustainable and integrated management of chemicals (persistent organic pollutants [POPs], industrial chemicals and pesticides); drafting solid waste regulations, standards and guidelines; drafting national strategies and plans; developing and implementing a national reforestation plan and a plan for the management of communal lands, with other ministries; and preparing the legal texts to regulate the hunting sector.

The Ministry of Agriculture is the lead government agency entitled with the protection and management of forest resources, and is responsible for developing relevant laws, regulations and projects and implementing these provisions. These include detection of forest fires; application of laws and regulations related to conservation and collection of forest products; setting the terms for exploitation of forests; and oversight of the fishing sector by setting regulations, including equipment to be used, issuing annual fishing licences, monitoring (catch/effort data), etc. Forest centres and forest guards are representatives of the Ministry of Agriculture on the ground. Forest guards are responsible for law enforcement, overseeing, controlling, and monitoring of works and investments in forests.

The Ministry of Interior and Municipalities is responsible for firefighting through the General Directorate of the Lebanese Civil Defense, while municipal councils and unions of municipalities are in charge of the protection of environment, landscapes, monuments, maintaining trees and forested areas, and preventing pollution.

8.6 Rapid assessment of the WEFE Nexus in Lebanon

A more detailed WEFE Nexus assessment for Lebanon is under development by GWP-Med in the framework of the Nexus Child Project 2.2 of the MedProgramme.

8.6.1 Key interlinkages across the WEFE elements

The key interlinkages across sectors in Lebanon are mostly observed in the agriculture sector.

The country is increasingly facing a water shortage, creating challenges in the need to expand agricultural production to reduce import

dependency, and in related energy requirements. Agricultural practices remain mostly traditional and unsustainable, with limited considerations to impacts on natural resources, especially soil and water.

The discharge of untreated domestic wastewater is the principal source of freshwater pollution at the national level, with impacts also on coastal areas.

Salinity levels are also increasing in coastal areas due to seawater intrusion into aquifers, threatening available resources.

Integrated approaches and measures are required to increase water efficiency, reduce distribution losses, and adopt efficient irrigation and agricultural practices, while utilising renewable energy to cover related energy needs, as well as desalination and wastewater treatment.

8.6.2 Integration in policy-making and management practices

Lebanon's updated National Water and Wastewater Sector Strategy addresses to a significant degree the needs and considerations not only of the WSS sector, but also of agriculture. It takes into account the results of recent studies and projects, and highlights the importance of an Integrated Hydrological Information System for water resources data.

Overall, Lebanon suffers from lack of coordination between key institutions resulting in a dilution of responsibilities in the different segments of the services management, and poor overall performance. Responsibilities often overlap, which can lead to a duplication of efforts or lack of enforcement of rules and regulations. Gaps still exist in the legal framework, while existing laws are not always fully implemented, including the establishment of necessary entities that allow coordination and increase sectoral transparency, such as the Electricity Regulatory Authority, NWC, Food Safety Lebanese Commission, and the Multi-stakeholder Committee for Management of the Agriculture Sector proposed under the NAS 2020.

The activation and sustain of inter-ministerial committees proposed in national laws and plans could increase coordination in the planning and management of the sectors.

The new approach towards IWRM on a watershed basis could permit a better management of specific conflicts and competition between users sharing the same resources (including ecosystems), and that vary between various regions based on abundance of resources, their conditions, and existing and adopted agricultural practices.

9 LIBYA

Summary

9.1 Introduction

Libya is one of the driest countries in the world: only 5% of the country receives more than 100 mm of rainfall per year. It is also one of the most water-scarce countries in the world, with a 817% share of freshwater withdrawal as a percentage of available freshwater resources, relying on groundwater or desalination systems to satisfy the water needs of its population.

Libya's climate ranges from a temperate Mediterranean climate in isolated areas on the Mediterranean coast, to a tropical desert climate in the vast majority of the country's interior.

Libya has a population of around 6.9 million people, concentrated mainly along the Mediterranean coast, 85% in urban areas. The country has faced demographic challenges, including migration and displacement due to conflict.

The economy is almost entirely dependent on hydrocarbon production and exports, which bring up to 90% of revenues to the country.

More than a decade of political crisis and violent conflict has had a significant impact on Libya's development trajectory.

9.2 Water resources management

9.2.1 Current status and trends

Annual water demand in Libya is around 1 BCM, compared to annual groundwater recharge estimated at only 250 MCM. The Libyan Government attempted to address water scarcity through the Great Man-Made River project, which taps into non-renewable fossil aquifers in the Sahara desert. These aquifers are now responsible for nearly 95% of the country's water use.

Libya has no water streams. It has temporarily limited surface run-offs following extreme rainstorms in the winter. This contributes about 2% of the total existing water use. To control these intermittent resources in the *wadis*, 18 dams were constructed to collect around 170 MCM. Natural springs in Jabal al-Akhdar, Jabal Nafusa and several places in central Libya are another surface source.

Six basins have been identified for groundwater exploitation, with groundwater resources classified into renewable and non-renewable. Renewable basins are found in the north (Jifara plain, Jabal al-Akhdar and part of Hamada al-Hamra), while the other sedimentary basins (Murzuk, Kufra and Sarir) containing non-renewable groundwater are found in the south.

Libya shares groundwater with several of its neighbours. The North Sahara Basin extends over an area of more than 1 million km^2, of which 700,000 km^2 are in Algeria, 60,000 km^2 in Tunisia and 250,000 km^2 in Libya. The fossil water of the deep aquifer, known as the Septentrional Saharan Aquifer System, has two main deep aquifer layers: the continental interlayer and the shallower terminal complex. The consultation system to manage the share of water resources is conducted under the management structure of the Sahara and Sahel Observatory in Tunis.

Desalination has been used in Libya since the early 1960s as an important non-conventional water resource. Currently, there are 21 desalination plants operated by different authorities and owned by the Government. The plants produce 70 MCM of desalinated water per year.

Treated wastewater is another important non-conventional water resource. Libya has built more than 75 WWTPs, with design capacities exceeding 450,000 m^3/d. The reused wastewater accounts for only 1% of water use.

The major water consumer is agriculture, accounting for about 85% of water demand. Water demand in agriculture is expected to increase resulting from temperature rises.

A further challenge is salination from Mediterranean Sea water intrusion, which is expected to increase the salinity of fossil groundwater and soil.

Libya's Bureau of Statistics and Census estimated the urban and rural populations supplied by sanitary networks to be 45%, while 54% are served by on-site septic tanks. Since 1971, more than 70 WWTPs have been constructed to serve more than 400 urban and semi-urban areas. At present, only 19 plants are operating adequately, producing 200,000 m^3/d. WWTPs are designed to produce effluents suitable for agricultural irrigation, using modified activated sludge treatment technology in large cities, whereas on-site oxidation ponds are employed in rural or remote locations.

9.2.2 Policy framework

A Water Resources Management Strategy for Libya is under preparation, with the support of the African Development Bank. It aims to minimise Libya's water budget deficit, raise the level of institutional performance, meet the challenges of climate change, manage and reduce the impacts of development on the environment, maintain and enhance biodiversity and the ecosystem, manage and reduce water losses, solve long-term water allocation problems, and contribute to sustainable economic growth.

A series of laws and regulations govern water allocations, irrigation, drainage, industrial effluent discharges, and municipal WSS.

9.2.3 Institutional framework

The Ministry of Water Resources was established to manage water resources organisations and their infrastructures. Historically, water governance fell under the General Water Authority (GWA), which was responsible for integrating water resources management, and still carries out this function under the umbrella of the Ministry of Water Resources. It oversees the planning, development and management of water resources, including surface water and groundwater, and is involved in water allocation, infrastructure development and water conservation efforts.

The Ministry of Agriculture, Livestock and Marine Wealth is responsible for agricultural development, including irrigation management and water use in agriculture. It plays a crucial role in formulating policies and strategies related to agricultural water management.

The General Desalination Company and General Company for Water and Wastewater are the responsible authorities for desalination plants and WSS respectively.

9.3 Agriculture

9.3.1 Current status and trends

Libya has a very small agriculture sector and very low agricultural production. As a result, Libya imports more than 90% of the food it consumes.

The total arable area in Libya is 1.72 million ha, of which 0.47 million ha is equipped for irrigation[61]. Most arable land is in the Jabal al-Akhdar region near Benghazi, and the Jifara plain near Tripoli which has an underground aquifer, enabling effective irrigation. Desert dominates the south, with occasional oasis cultivation at Kufra, Sabha and Murzuk.

Barley, wheat and vegetable/leguminous products (tomatoes, onions, beans, etc.) remain the main cultivated crops. Further crops include fruit trees (dates, citrus, olives, figs and grapes), and other crops such as alfalfa and clover, generally used as fodder, as well as melons and aromatic plants.

61 FAO: AQUASTAT: Libya website, https://www.fao.org/aquastat/en/geospatial-information/global-maps-irrigated-areas/irrigation-by-country/country/LBY.

There are currently 18 dams in the north of the country, where seasonal surface run-off is common to control *wadi* floods, supply irrigation water and recharge underground aquifers, with a total capacity of 389.89 MCM and average annual storage capacity of 61.35 MCM.

9.3.2 Policy framework

Regarding the agriculture sector, Libya's Plan for Transformative Change by 2020 has the following objectives:

- Establish a food security strategy that would balance between local production, internal and external investments in agrobusinesses, and the acquisition of farmland in other countries;
- Reform the agricultural extension system and support local farmer organisations to increase information access, develop and disseminate improved varieties, improve techniques, and enhance access to production inputs;
- Improve access to credit by strengthening the Agricultural Bank of Libya and local farmers' and agricultural credit organisations;
- Develop an effective and integrated watershed management system and rehabilitate existing irrigation systems to ensure adequate supply of water for agriculture and prevention of soil erosion; and
- Fast-track existing plans for desalination plants for domestic and agricultural use to hedge against overreliance on water supplies from the Man-Made River.

9.3.3 Institutional framework

The Ministry of Agriculture, Animal and Marine Resources is the only key institution responsible for this sector. The ministry exercises the responsibility of implementing policies and plans and setting the necessary programmes to implement the legislation in force in the fields of agriculture, animal and marine wealth in accordance with the scientific method that ensures the achievement of society's goals, and following up their implementation to achieve the required results.

The Ministry of Economy supports the Ministry of Agriculture, Animal and Marine Resources to activate the role of the private sector and encourage the establishment of small and medium enterprises in agricultural, animal and marine activities through various financing institutions.

9.4 Energy

9.4.1 Current status and trends

Libya is a significant producer and exporter of fossil fuels. It produces 2.6 MTJ of oil and 0.3 MTJ of natural gas. A total of 76% of its production is exported. In terms of domestic supply, 62% of Libya's primary energy comes from oil and 34% from natural gas.

Libya's power system is almost exclusively based on fossil fuels. Natural gas accounts for 74% of electricity generation, and oil for the remaining 26%. Total electricity generation has increased from 15.5 TWh in 2000 to 31 TWh in 2021[62].

Libya aims to achieve 10% renewable energy contribution to the electric energy mix by 2025, with installed capacities of 1000 MW from wind, 400 MW from concentrated solar power and 800 MW from solar PV.

9.4.2 Policy framework

Libya's Renewable Energy Strategic Plan (2013–2025) aims to describe and disseminate the strategy of the Renewable Energy Authority of Libya, established in 2007, to achieve the

62 IEA: Energy system of Libya website, https://www.iea.org/countries/libya.

vision having a positive impact on the social and economic development of Libya through the optimal use of renewable energies. The objective shall be achieved by working toward integrating the locally available RES (mainly solar and wind) with the national energy system, and increasing the share of renewable energy in the national energy mix. It envisages an increased contribution of renewables to the national energy generation mix, from 3% in 2015 to 10% in 2025. It also envisages the development of a National Energy Efficiency Action Plan.

Libya also engages in international cooperation and partnerships to strengthen its energy sector and promote sustainable energy development. This includes collaboration with regional organisations, bilateral agreements with other countries, and participation in international initiatives and forums on energy policy and regulation.

9.4.3 Institutional framework

The Ministry of Oil and Gas is the main governmental body responsible for formulating and implementing energy policies related to oil and gas exploration, production, refining and export. It oversees the management of Libya's vast hydrocarbon resources and plays a central role in the country's energy sector.

The National Oil Corporation (NOC) is Libya's state-owned oil company responsible for managing the country's oil and gas sector. NOC oversees exploration, production, refining and marketing of oil and gas products, as well as the development of energy infrastructure, including pipelines, terminals and refineries.

The Renewable Energy Authority of Libya is responsible for promoting the development of RES in Libya, including solar, wind and biomass. It oversees renewable energy projects, provides technical support and facilitates investment in renewable energy infrastructure.

The General Electricity Company of Libya is the state-owned utility responsible for electricity generation, transmission and distribution in Libya. It operates power plants, transmission networks and distribution grids to ensure the reliable supply of electricity to consumers across the country.

The Electricity Regulatory Authority is the regulatory body responsible for overseeing the electricity sector in Libya. It regulates electricity generation, transmission, distribution and pricing, as well as licencing and compliance with regulatory standards and codes.

9.5 Environmental protection

9.5.1 Current status and trends

Libya consists of three main local botanical habitats, coastal, mountainous and desert, crossed by valleys from south to north and from west to east. More than 1,800 plant species flourish in these habitats. The number of animal species in Libya according to preliminary estimates is 4,590. The most important of these taxa in terms of number is the insects (81%), followed by birds (7%)[63]. However, animal diversity in Libya still needs further taxonomic studies to be well documented.

Currently Libya has four protected land areas covering 0.1% of its terrestrial area, and one in the sea covering 0.6% of its marine area. None of these are managed effectively.

9.5.2 Policy framework

Libya has no comprehensive national plan to tackle various environmental problems. Law 15 of the year 1371 (2002) on the environment is the main legal instrument in that regard.

The Ihya Libya Vision 2030 acknowledges the importance of environmental protection,

63 UNEP/MAP and SPA/RAC (2023): *Management Plan of the Coastal and Marine Area of Shash – Gulf of Sirte in Libya*, Tunis.

emphasises the need for sustainable development practices, and highlights environmental challenges like desertification and water scarcity.

While Libya signed the UNFCCC in 2015 and ratified the Paris Climate Accord in 2021, it has not submitted the requisite policies, plans or reports, such as an NDC, National Adaptation Plan or National Communication.

9.5.3 Institutional framework

The Ministry of Environment is responsible for executing government policies and its vision regarding environmental aspects, and issuing regulations and acts in that regard.

Libya's Environmental General Authority (EGA) is a scientific, regulatory and advisory body concerned with environmental affairs with respect to conservation of biological resources, environmental pollution, and sustainable development and integrated planning of the community. The EGA has two powerful tools that are somewhat underutilised at present for understandable reasons. They are the preparation of the annual State of the Environment Report and EIA, both mandated by Libyan national law.

The EGA fostered the creation of a Health, Safety and Environment Unit inside NOC. This modest but dynamic unit is the first line for promoting environmental prudence inside NOC and all its subsidiaries. It reports directly to the president of NOC.

9.6 Rapid assessment of the WEFE Nexus in Libya

9.6.1 Key interlinkages across the WEFE elements

Libya has no water streams and is one of the most water-scarce countries in the world, relying on groundwater or desalination systems – and increasingly on treated wastewater – for its water needs.

Libya therefore has a very low agricultural production, and is dependent on imports for almost 90% of its food consumption.

On the other hand, Libya has considerable natural gas and oil reserves and related exports, bring up to 90% of the country's revenues.

Adopting an integrated WEFE Nexus is essential for Libya in order to prepare for an even more water-scarce future and to provide opportunities for sustainable development and economic growth.

Ensuring that sanitation covers the entire population and that treated wastewater is reused in agriculture while maximising use of renewable energy in the process is a key objective.

9.6.2 Integration in policy-making and management practices

More than a decade of political crisis and violent conflict has had a significant impact on Libya's politics and development trajectory.

Libya has no comprehensive national plan to tackle various environmental problems. The Ihya Libya Vision 2030 is an attempt to formulate a vision for the country, including on developmental dimensions across sectors.

The Government must take serious steps for improving the institutional framework, roles and functions of different authorities. A key step could be for the EGA to decide which ministries or agencies it wants to catalyse first, and then establish units as the EGA's main entry point into each ministry.

10 MAURITANIA

Summary

10.1 Introduction

Mauritania's climate is predominantly desert, with arid and semi-arid conditions prevailing across much of the country. Coastal areas enjoy a more moderate climate due to their proximity to the Atlantic Ocean.

Mauritania has a population of approximately 4.5 million people and is has third lowest population density of African countries. Nomadic herding and subsistence agriculture are essential aspects of the country's culture and economy. Mauritania is the only Least Developed Country in the broader Mediterranean region, with a low Human Development Index of only 0.433, ranking 136th among 169 countries.

Mauritania is highly vulnerable to climate change, with rising temperatures and changing precipitation patterns exacerbating existing challenges. Desertification threatens arable land and grazing areas, while droughts disrupt food and water supplies.

Water resources are limited in Mauritania, and the availability of freshwater varies significantly across regions. The Senegal River is a critical water source for agriculture and livelihoods in the southern part of the country.

Agriculture in Mauritania is predominantly subsistence-based, with half the population depending on agriculture for their income, and faces challenges related to aridity, soil degradation and water scarcity. The country imports a significant portion of its food, making it vulnerable to price fluctuations.

Mauritania has made efforts to diversify its energy sources by harnessing renewable energy, particularly solar and wind power.

10.2 Water resources management

10.2.1 Current status and trends

The total renewable surface water resources are estimated to be 11.1 BCM/year. The Senegal River and its tributaries constitute the main part, the rest primarily being dam reservoirs scattered in the southern and central regions. Only 0.1 BCM of the total of 11.1 BCM/year is generated within the country[64]. The country also contains significant groundwater resources in the southwest, south and southeast (large continuous sheets of Tarzi and Taoudenni in sedimentary formations, layers of the river valley, high flow-time), with groundwater being less favourable in the rest of the country (discontinuous layers).

In Mauritania, water resources are mainly surface water. The Senegal River, which rises outside Mauritania, contributes 7 BCM/year to the renewable water resources of Mauritania. Apart from the Senegal, six rivers, draining watersheds of 2,000 to 8,000 km^2 are identified.

The groundwater potential is estimated at up to 50 BCM and is considered as non-renewable. Actual contribution is small, with only 0.3 BCM per year. This rate could be considered as the rate of total replenishment.

Agriculture is by far the largest user, responsible for 88% of all water withdrawals, followed by domestic use at 9% and industry at 3%.

Overall, Mauritania's freshwater resources are very unevenly distributed, with concentrations along the southern border, leaving the country's growing population under water stress and in competition over limited water resources. Mauritania has experienced strong seasonal and annual variation in precipitation, as well as recurring droughts, all of which present major constraints to agricultural production.

64 Centre for Environment and Development for the Arab Region and Europe and Arab Water Council (2015): *3rd State of the Water Report for the Arab Region*, Cairo.

Mauritania is also threatened by flooding, with potentially damaging and life-threatening river floods expected to occur at least once in 10 years.

The present hazard level is expected to increase in the future because of climate change.

Projections of future water availability from precipitation vary depending on the region and scenario. Water availability is projected to increase in parts of western, central and northeastern Mauritania under RCP2.6. Under RCP6.0, however, model agreement is low, with precipitation decreases of up to 30% projected for the south of Mauritania.

Mauritania ranks lowest in the Mediterranean region in terms of water access, with 42.1% of the population not having access to safe drinking water, a share almost equal in both urban and rural areas. There is however an urban-rural gap in terms of access to sanitation (14% in rural areas compared to 58% in urban areas).

According to the World Health Organization (WHO), the lack of water sanitation causes nearly 90% of the 2,150 deaths from diarrheal diseases in Mauritania each year. International organisations and non-governmental organisations (NGOs) have been active in Mauritania, providing WSS in schools and/or vulnerable communities.

In 2020, the World Bank secured funding for the Water and Sanitation Sectoral Project and the Mauritania Health System Support project. The Water and Sanitation Sectoral Project received an International Development Association (IDA) grant of $44 million to improve latrines, install hand-washing facilities and rehabilitate water systems. In the Hodh el Chargui region in eastern Mauritania, an additional $23 million IDA grant will increase the quality of reproductive, maternal, neonatal and child health, and nutrition services. Together, these projects will benefit more than 473,000 people.

10.2.2 Policy framework

The management of water resources has been placed at the top of the national priorities of the National Strategy for Accelerated Growth and Shared Prosperity (SCAPP) 2016–2030.

The National Strategy for the Water Sector for 2023 focuses among others on improving knowledge of water resources and on improving the governance of the water sector.

IWRM practices were tested, between 2009–2010, in two pilot zones of the country, the regions of Brakna and Trarza, with a view to their duplication throughout the country.

The water and sanitation sector in Mauritania is guided by the National Strategy for Sustainable Access to Water and Sanitation by 2030, in line with the SCAPP.

10.2.3 Institutional framework

The Ministry of Water and Sanitation of Mauritania plays the main role in water management and related public works. The institutions involved in the implementation of IWRM within the ministry are the Directorate of Planning and Cooperation and the National Water Resources Centre (CNRE). There is a Central Directorate for Water Quality Control in the ministry, but the coverage is not sufficient.

The CNRE monitors water resources in the well fields of the country's large cities.

The ministries responsible for water resources and for the environment are in the process of setting up a joint committee for the study and monitoring of wetlands or oases.

10.3 Agriculture

10.3.1 Current status and trends

The agriculture sector contributed 23% to Mauritania's GDP in 2015. More than half of Mauritania's 4.4 million people earn a living from agriculture and livestock. Animal production represents over three quarters of value added in agriculture, provides revenues to roughly one million individuals, plays a key role in food security, and is a means of capital accumulation and insurance, especially among the poorest. While Mauritania's herders have coped with rainfall variability through traditional transhumance for centuries, the livelihoods and food security of most of the poor, who rely on livestock-rearing and agriculture, are threatened by encroaching desertification, rising temperatures, increasing water scarcity and flash flooding.

About 20 million ha (20% of the country's surface) are suitable for various agro-sylvo-pastoral activities. The space dedicated to agropastoral activities barely covers 10% of the territory, including only 513,000 ha of cultivable land, of which 135,000 ha of irrigable land along the Senegal River and its tributaries. Cereal production, which is very irregular from one year to the next, covers only 30% of domestic demand, making the country dependent on imports and food aid. The population's dependency on imports is much lower for animal products, in particular red meat.

The activities are divided into four major agro-ecological zones: an arid or Saharan zone characterised by an oasis-type production; a Sahelian zone with irregular rains where rainfed crops are grown extensively alongside transhumant herding; the Senegal River valley with irrigated agriculture; and a maritime zone along the Atlantic coast, which is important for dairy and poultry farming and peri-urban vegetable crops in intensive mode.

10.3.2 Policy framework

There is a strategic reference framework outlined in the National Rural Sector Development Strategy (NRSDS) document, including a National Food Security Strategy. The NRSDS lays the groundwork for the development of the strategic agropastoral sector by 2025, including: agriculture sectors oriented towards vegetable and fruit productions according to different production methods, traditional cereal production in the rainfed areas, and rice production along the Senegal River valley; and animal and dairy production, organised around modern industrial processing units and informal small milk production, processing and sales units, red meat production by small, medium and large breeders, and peri-urban poultry farms.

10.3.3 Institutional framework

The Ministry of Agriculture has the general mission of designing, executing, monitoring and evaluating policies of the Government in matters of agriculture development.

The creation of the Ministry of Animal Husbandry shows a political will to improve the management of the country's animal resources to achieve the goal of self-sufficiency in local products and improve Mauritania's food security. In its policy of livestock development, the State aims to make animal production more complete, productive and diversified, hence the particular emphasis on improving the institutional framework.

The National Centre for Agronomic Research and Agricultural Development is one of the key stakeholders under the supervision of the Ministry of Agriculture.

The Ministry of Hydraulics and Sanitation of Mauritania plays the main role in water and public works.

10.4 Energy

10.4.1 Current status and trends

The share of the Mauritanian population having an electricity access has increased from about 20% in 2000 to about 50% in 2020. The electricity access rate in Mauritania is low due to difficulties in expanding the network and the dispersed nature of demand, making interconnection difficult. Power consumption increases by more than 10% annually.

In 2019, Mauritania's energy mix was dominated by oil products (65%) and biofuels and waste (32%).

The total electricity consumption increased from 0.2 TWh in 2000 to 2 TWh in 2021. Oil has been the dominant energy source for electricity generation, but its share declined from 87% in 2000 to 73% in 2021. Recently, RES have been increasing to cover the energy consumption, including solar and wind. The share of electricity production by renewables in the total electricity production has increased from 15% in 2000 to 26% in 2021[65].

10.4.2 Policy framework

The 2012 Master Plan for Power Generation and Transmission in Mauritania aims to address sector difficulties and constraints, encourage the diversification of sources of power generation, particularly clean energy sources (sun, wind, etc.), and attract private capital to the sector.

Mauritania's National Energy Strategy (2020) in line with its NDC under the UNFCCC Paris Agreement, aims to reduce the country's GHG emissions by at least 92% by 2030, and increase the share of renewables in its energy mix to 60% by 2030.

To this end, the country plans to produce and export green hydrogen and liquified natural gas from the offshore Grand Tortue Ahmeyim project, which is expected to commence production in 2023.

10.4.3 Institutional framework

The Ministry of Petroleum, Energy and Mines oversees the energy sector in Mauritania. It plays a crucial role in policy formulation, regulation and strategic planning.

The Energy Regulatory Authority is responsible for regulating energy-related activities, ensuring compliance with standards and promoting fair practices.

The Mauritanian Electricity Company manages the electricity sector in Mauritania. It oversees generation, transmission, distribution and access to electricity.

10.5 Environmental protection

10.5.1 Current status and trends

Mauritania is predominantly a desert country (about 80–85% of the territory is arid land). The country is subdivided into four large ecological zones, each with its own potential and wildlife wealth.

The flora currently found on Mauritanian territory is very diverse and varies from one region to another. There are major differences between groups in the north and those in the south, essentially due to rainfall variations. Indeed, going from north to south, we go from a Saharan region more-or-less influenced by the ocean, towards a more humid Sahelian region.

65 IEA: Energy system of Mauritania website, https://www.iea.org/countries/mauritania.

The main causes of environmental degradation in Mauritania are:

- The effect of desertification on wildlife through the disappearance of the natural habitats necessary for survival;
- The clearing of forests in the Senegal River valley for crops, which has led to the disappearance of the kobs (antelope), monkeys and birds that depended on them;
- The clearing of several *tamourts* (waterholes) in the southeast, which served as refuges for wildlife during dry years, for the installation of flood recession crops; and
- The destruction of most of the gallery forests in Trab el Hajra, which served as refuges in the dry season for wild animals, to produce firewood or wood for construction.

The country also has a problem with water pollution, resulting from the leakage of petroleum and industrial waste along with sewage into the nation's ports and rivers.

The main threats to terrestrial ecosystems have been identified as overgrazing; overexploitation of forest products, including non-timber forest products; habitat fragmentation; poaching; climate change; bush fires; urbanisation; salinisation; erosion; alien invasive species; and mining and oil exploitation.

10.5.2 Policy framework

Mauritania's sustainable development strategy places human beings at the centre of decision-making, with the satisfaction of the needs of the poorest and most marginalised groups as a priority. It intends to establish a common vision of the sustainable development of the country in the long term, through a strategic approach integrating both social, economic and environmental dimensions. It defines the main priority axes on which action must be concentrated so that the country's development can be sustainable.

The Environmental and Social Management Framework (ESMF) prepared in coordination with the African Development Bank provides guidelines for managing environmental and social risks and impacts in development projects. It outlines measures to mitigate negative impacts and enhance positive ones.

In general, the national environmental policy strives to guarantee the conservation of biological diversity and the rational use of natural resources, the fight against desertification, the fight against pollution and similar nuisances, improvement and protection of the living environment, and the harmonisation of development with the safeguarding of the natural environment.

10.5.3 Institutional framework

The Ministry of Environment and Sustainable Development is the key stakeholder for environmental protection and development in Mauritania. It oversees environmental policies, regulations and sustainable development initiatives, and collaborates with various stakeholders to address environmental challenges.

The National Agency for Environmental Protection focuses on environmental protection, conservation and sustainable resource management. It plays a vital role in monitoring and enforcing environmental laws.

10.6 Rapid assessment of the WEFE Nexus in Mauritania

10.6.1 Key interlinkages across the WEFE elements

Mauritania is an outlier among the countries in the broader Mediterranean region, being the only one still facing critical developmental challenges: less than 60% of the population has access to safe drinking water, and only 50% have electricity access.

The key cross-sectoral interlinkages are observed in the agriculture sector, and are also related to the risk of desertification.

Agriculture is responsible for 88% of all water withdrawals in Mauritania, and contributes 23% to its GDP. Animal production is the key subsector which represents over three quarters of value added in agriculture. The expansion of domestic herds onto grazing land formerly restricted to wildlife has taken a serious toll on the environment, both in erosion and in encroachment on wildlife species.

The urgently needed expansion of sanitation services should be accompanied with the reuse of treated wastewater, especially in the country's more arid areas.

The planned construction of a dam on the Senegal River is expected to reduce the country's water problems and stimulate agriculture, but it is important that all considerations to minimise impacts on riparian ecosystems and sediment transport are implemented.

10.6.2 Integration in policy-making and management practices

Overall, the institutional and policy frameworks in Mauritania's sectors is quite basic, without any comprehensive strategies and policies.

A lack of adequate authorities with the necessary resources to carry out inspection and enforcement has already been observed. The regulatory approach is not effective and comprehensive and not established in an integrated manner.

International organisations have been assisting Mauritania in capacitating authorities and drafting legal frameworks, and these developments should take into account the considerations of all sectors under a WEFE Nexus approach.

11 MONTENEGRO

Summary

11.1 Introduction

Montenegro is a southeastern European country on the Balkan Peninsula, essentially an Adriatic-Mediterranean and Dinaric country, with an Adriatic coastline of 293,5 km. It enjoys a Mediterranean climate along its coastline, characterised by mild, wet winters and hot, dry summers. As one moves inland and into the mountainous areas, the climate transitions to a more continental and alpine climate, with colder winters and significant snowfall.

Montenegro has a population of approximately 620,000 people and has experienced emigration, with demographic and economic implications. Urbanisation is increasing, particularly along the coastal areas.

Montenegro is an EU candidate country. After 10 years of accession negotiations, all the 33 screened chapters have been opened, of which 3 are provisionally closed.

11.2 Water resources management

11.2.1 Current status and trends

Montenegro has significant surface and underground water resources, which are of generally good quality. The richness and quality of water resources are among the most important comparative advantages of the country.

There are two river basins in Montenegro: the Danube basin (52.5% of the territory) and the Adriatic Sea basin (47.5%).

The major rivers which flow into the Danube basin are the Lim (the longest river, 220 km long), the Tara (146 km), the Ćehotina (125 km) and the Piva (78 km). Rivers that flow into the Adriatic Sea basin are the Morača (99 km), the Zeta (65 km) and the Bojana (40 km). Important water resources also include natural lakes, the most significant of which are the Biogradsko, Plav, Black, Šasko and Skadar Lakes. The largest artificial reservoir is Lake Piva, which has a total accumulation capacity of 880×10^6 m^3.

Given that 95% of Montenegrin watercourses are formed within the country, water is considered one of its most valuable natural resources. In terms of water resources relative to land area, Montenegro ranks among the most water-rich countries in the world. However, despite receiving high levels of precipitation, a large portion of the territory suffers from water shortages because significant amounts of water are lost through underground infiltration in the karst subsoil. Hydrological analyses reveal substantial seasonal and spatial variations in water availability. Intra-annual water distribution is among the most uneven in Europe, with prolonged low-flow periods. During dry seasons, even large rivers such as the Morača experience significantly reduced flows along long stretches of their beds, leading to serious ecological and social consequences. Despite overall wealth of water, approximately 35% of Montenegro's territory suffers from water shortages, which can only be mitigated with expensive hydrotechnical interventions such as regional water supply projects.

Montenegro faces water quality issues in surface waters due to both concentrated sources of pollution, such as urban and industrial wastewater, and diffuse sources, including agriculture, forestry and road run-off. The quality of groundwater in natural conditions is classified as class I for the majority of the year (with the exception of coastal aquifers influenced by the sea).

Also, HPPs, especially small HPPs, have potentially significant impacts on downstream water flows, including changes in river morphology and habitats, barriers to the migration and dispersal of protected species, disturbances in sediment transport, and the displacement or loss of aquatic species.

At the national level, 85.9% of the population is served by centralised public drinking water supply

services, while 6.5% relies on rural water supply schemes, and 7.9% depends on individual water sources.

The coverage of the population with wastewater collection services at the national level is about 47.5%; however, this varies significantly from region to region. The rate is relatively low in the northern region at about 38% of the population, while it is significantly higher in the coastal region at about 52%. The rest of the population relies on some kind of on-site solution, the most common of which is the use of septic tanks. Out of 36 agglomerations in Montenegro, 14 have wastewater treatment plants.

The amount of water captured and taken over by business entities that manage public water supply and public sewerage in Montenegro in 2020 compared to 2017 recorded a growth of 1.9%. A total of 80.2% of the total amount of water is taken from underground and spring water, only 1.6% is taken from surface water, and 18.2% is taken from other water supply systems.

Estimates for the Danube basin in Montenegro based on the latest report on the water sector show that the percentage of non-revenue water is 68.1%. The main reasons for this large gap are deficiencies in the water transportation network (technical losses), as well as unregistered and illegal connections to the network, and incorrect metering water consumption (administrative losses).

11.2.2 Policy framework

The Water Management Strategy for 2017–2035 (2017): Among other goals, the strategy aims to reduce losses in public water supply systems to less than 30%; estimates the technical hydro potential to be 4.1–5 TWh; and does not directly address the impacts of climate change on water resources. Future water management documents are expected to study the effects of climate change on the regime and balance of water resources in more detail.

The water management plans in the water areas of the Danube and Adriatic basins: RBMPs are developed with support of the project "Strengthening of Capacities for Implementation of the Water Framework Directive in Montenegro" (2021). RBMPs have been prepared to ensure efficient water management of the river basins in the country, taking into account current practice, availability of data and resources. RBMPs were prepared in accordance with the requirements of the EU Water Framework Directive and national legislation in the field of water management and nature protection. Based on these, a legal framework is established to protect and improve the status of all waters and protected areas, including water-dependent ecosystems, and prevents deterioration of their status and ensures long-term optimal (sustainable) use of water resources.

The Management Plan for Municipal Wastewater of Montenegro 2020–2035 is a key strategic document prepared as part of consulting services for the project "Revision of Master Plans for Municipal Wastewater Management Measures and Drafting of the Plan for the Implementation of the EU Urban Wastewater Directive".

11.2.3 Institutional framework

The Ministry of Agriculture, Forestry and Water Management (MAFWM) is responsible for proposing and implementing water policies. The Water Directorate within the MAFWM is the most important body in the field of water management. The Water Directorate performs ministry duties related to current and development policy in water management; proposes system solutions for the provision and use of water; protection of water from pollution; regulation of water and watercourses; and protection from flooding. The Water Directorate is responsible for the normative activity regulating the management of water; proposals of professional bases when drafting laws and other regulations governing these areas; proposals for the adoption of laws and other strategic documents; plans and programmes in

the field of water; and harmonising regulations within the framework of its jurisdictions with the EU acquis.

Other stakeholders related to IWRM include the following:

- The Ministry of Ecology, Sustainable Development and Northern Region Development, among other roles, carries out activities related to sustainable development and environmental protection; activities related to the system of integrated environmental protection and sustainable use of natural resources; integrated pollution prevention and control; wastewater management; coordination of regional water supply systems; development of environmental protection standards; environmental monitoring, etc.
- The Ministry of Health is responsible for controlling and monitoring the safety of drinking water through the Institute for Public Health, which performs physical and chemical analyses of water and microbiological testing of drinking water.
- The Ministry of Economic Development is responsible for the use of water for hydro-energy purposes.
- The Ministry of Interior (Directorate for Emergency Situations) is responsible for risk management and emergency response, including floods.
- The Institute for Hydrometeorology and Seismology is responsible for the collection and analysis of hydrometeorological data, and for the preparation of forecasts and the information in case of a potential disaster.
- The Environmental Protection Agency is in charge of monitoring the state of the environment and conserving nature, collecting and updating data on the quality of all segments of the environment including water, and reporting to national and European institutions.
- The Institute for Geological Research of Montenegro performs hydrogeological research for the purposes of water supply, ground water protection, and the construction of HPPs, and in this regard creates related maps, studies and reports. It also prepares documentation for the purposes of granting water concessions.

11.3 Agriculture

11.3.1 Current status and trends

Agricultural production plays an important role in the economy of Montenegro, with a significant share in GDP, including forestry and fishing. This share has been slightly declining over time as production has moved toward construction and services, with tourism leading the shift. Nevertheless, the agriculture sector continues to be a key source of income for approximately a quarter of the country's population, especially in rural areas[66].

According to the Preliminary Data of the Agricultural Census, in 2024 Montenegro had 26,711 agricultural holdings, 248,234 ha of utilised agricultural land including *katuns* (seasonal highland settlements) and communal land, 126,614 ha of utilised agricultural land excluding *katuns* and communal land, 8,542 ha of arable land, 9,435 ha of permanent crops, 107,606 ha of meadows and pastures, and 1,032 ha classified as other land.

Forests cover over 60% of the territory of Montenegro, and their overall health, vitality, quality, functions and products represent a notable ecological symbol of the country.

66 World Bank Group (2022): *Project Performance Assessment Report. Montenegro: Montenegro Institutional Development and Agriculture Strengthening Project (MIDAS)*, Washington, DC.

The dominant agricultural crops in Montenegro are corn, wheat, barley, alfalfa and clover.

In Montenegro, according to 2023 MONSTAT data, a total of 2,490 ha of agricultural land is irrigated.

11.3.2 Policy framework

Agricultural policy in Montenegro is conducted according to the Strategy for development of agriculture and rural areas 2023–2028. The main strategic objectives prescribed through this strategy are increasing the resilience and competitiveness of safe food production and processing; developing efficient management of natural resources and achieving the goals of the European Green Deal; raising the quality of life and enabling sustainable business development in rural areas; developing a network of knowledge transfer and application of new technologies to increase food safety, increase competitiveness and protect the environment; and managing agricultural and rural development policies efficiently and transparently.

11.3.3 Institutional framework

The MAFWM is responsible for the policies in the country's agriculture sector.

The Forest Administration is responsible for issues of forest management and protection.

11.4 Energy

11.4.1 Current status and trends

Electricity generation facilities in Montenegro consist of two large HPPs in Piva and Perućica, with total installed capacity of 649 MW, one coal-fired thermal power plant of 225 MW in Pljevlja, two wind power plants with 118 MW installed capacity, and a number small HPPs with installed capacity of 52.6 MW in operation.

The country is not connected to natural gas systems, but could provide facilities for small quantities of liquefied natural gas to be further transported by railway. In recent years, Montenegro supported investments in wind power plants; however, its high solar potential is not yet utilised.

The total production of electricity in 2024 amounted to 3,446.60 GWh, of which 2,108.76 GWh was produced from RES, while 1,338 GWh of electricity was produced from TE Pljevlja.

The updated NDC sets an ambitious goal of reducing GHG emissions by 55% by 2030 and 60% by 2035, covering all sectors, including land use, land-use change and forestry (LULUCF). Accordingly, Montenegro will implement measures in the energy, industry, agriculture, and transport sectors, with a special focus on forest ecosystems as key carbon sinks.

The updated NDC envisions two implementation periods: 2025–2030, aiming for a 55% emissions reduction, and 2031–2035, targeting a 60% reduction. This approach encompasses the entire economy, including the LULUCF sector, creating a comprehensive framework for achieving sustainable climate goals. Additionally, through this process, Montenegro strengthens its alignment with European climate policy and the European Green Deal, particularly considering its EU candidate status and the obligation to achieve climate neutrality by 2050.

In November 2020, Montenegro signed the Sofia Declaration and committed to align its own goals with the EU's energy transition and climate neutrality target for 2050.

On 15 December 2022, the Energy Community Ministerial Council adopted a package of 2030 energy and climate targets for the Western Balkan countries. Under this decision, by 2030 Montenegro will reduce its GHG emissions by 55% compared to 1990, and achieve a share of 50% renewables in total energy consumption.

11.4.2 Policy framework

The Energy Development Strategy of Montenegro by 2030 is the key strategic document in the field of energy. It is expected to be replaced by Montenegro's NECP, which is in its final stage of development. The NECP sets new national targets by 2030 in accordance with obligations under Energy Community Treaty, and defines policies and measures for their achievement.

11.4.3 Institutional framework

- The Ministry of Energy performs activities related to energy policy; policy implementation; coordination of the implementation of projects in the field of energy efficiency; performing technical and administrative activities in the field of energy efficiency; setting directions and dynamics for energy development; preparation of the energy balance of Montenegro; the concession system and granting of concessions, etc.
- The Energy and Water Regulatory Agency of Montenegro (REGAGEN).
- Elektroprivreda Crne Gore (EPCG AD) currently has the status of a public supplier of electric energy in Montenegro.
- The Montenegrin Electricity Transmission System Operator (CGES AD) was separated from EPCG AD in 2009. CGES AD has two licences, for the operator transmission system and electricity transmission.
- The Montenegrin electricity market operator (COTEE d.o.o.).

11.5 Environmental protection

11.5.1 Current status and trends

Montenegro is home to diverse geological bases, landscapes, soils and climates. It can be divided into two main biogeographical regions, Mediterranean and Alpine, with a variety of ecosystems falling within these two ecoregions.

The wealth of flora and fauna species puts Montenegro among the most biologically diverse countries in Europe, classifying it as a global biodiversity hotspot. Estimates suggest that over 1,200 species of freshwater algae, 300 species of marine algae, 589 species of moss, 7,000–8,000 species of vascular plants, 2,000 fungi, estimates of 16,000–20,000 species of insects, 407 species of marine fish, 56 species of reptile, 352 regularly visiting birds, and a high diversity of mammals (including large predators and ungulates) are found in Montenegro.

The national network of protected areas currently has 81 areas and covers 183,645 ha, which is 13.29% of the land territory of Montenegro. The largest part (100,427 ha or 7.27%) consists of five national parks: Durmitor, Skadar Lake, Lovćen, Biogradska Gora and Prokletije. The remaining part includes the following categories: strict nature reserve, special nature reserve, nature park, nature monument and area of exceptional qualities. In 2021, the revision process was initiated for 37 protected areas established in 1968. This process will define zonation, clarify borders, and potentially remove protection status if results show that an area has lost the values for which it was originally proclaimed. Additionally, a revision was conducted for Biogradska Gora National Park, and three revisions are currently in progress for the national parks Durmitor, Skadar Lake, and Lovćen. Montenegro is also in the process of mapping terrestrial area and territorial sea in order to define Natura 2000 network. Based on the latest data analysis, it is mapped 76% of terrestrial area and 10% of territorial sea.

The main anthropogenic threats to Montenegro's biodiversity are uncontrolled urbanisation and tourism development in natural habitats with associated infrastructure development; changes in land-use practices, particularly in relation to agriculture and forestry; unsustainable and illegal use of natural resources (including illegal hunting,

overharvesting, etc.); water, soil and air pollution from industrial and agricultural pollutants and municipal wastes; and impacts of climate change, especially the effects of hot and dry periods on forest habitats causing wildfires, which need more attention. Issues such as the impact of alien and invasive species and climate change are still poorly understood, but can be expected to have a higher importance among threats to biodiversity in the future.

11.5.2 Policy framework

- The Law on Environment (Official Gazette of Montenegro, 052/16, 073/19) stipulates mandatory drafting of a State of the Environment Report of Montenegro for a period of four years, based on the National List of Environmental Indicators (2013).
- The Law on nature protection (Official Gazette of Montenegro, 054/16).
- The National Biodiversity Strategy 2016–2020.

11.5.3 Institutional framework

- The Ministry of Ecology, Sustainable Development and Northern Region Development is responsible for natural resources, biological diversity and the territory of Montenegro. Environmental protection, care for the air, water and soil, the impacts of climate change, and preservation of exceptional spatial heritage are priorities in the ministry's work.
- The Environmental Protection Agency is the main executive administrative body responsible for the implementation of regulations in the field of environmental protection and climate change. It is responsible for organisation, planning and participation in monitoring the state of the environment, including the creation of a proposal for a national list of environmental protection indicators, as well as for updating data on all segments of the environment and reporting.
- The Environmental Protection Fund.
- The Public Enterprise for National Parks of Montenegro is responsible for the protection and management of national parks, preparation and implementation of protection programmes, controlling the use of natural resources, establishing internal regulations, and promoting the parks.

11.6 Rapid assessment of the WEFE Nexus in Montenegro

11.6.1 Key interlinkages across the WEFE elements

Montenegro is among the most water-rich countries the world. However, a third of the country faces chronic shortages of water.

Montenegro, together with all Western Balkan countries, has committed to carbon neutrality by 2050. Despite its significant hydropower resources, it is important for Montenegro to diversify towards non-hydro renewables, since HPPs – especially small ones – have potentially significant impacts on downstream water flows, which include changes in the morphology of rivers and river habitats; barriers to migration and dispersal of protected species; disturbance in sediment dynamics; displacement and disturbance of species; and loss of habitat.

Further, Montenegro still faces significant losses in the water transportation network, resulting in unnecessary energy consumption among others impacts.

In the path towards full sanitation coverage, it is important to maximise use of renewable energy and reuse of treated wastewater.

Montenegro has the potential to significantly expand its irrigated areas. In that case, sustainable practices that minimise water pollution and on-site installations of renewable energy should be prioritised.

11.6.2 Integration in policy-making and management practices

Montenegro has benefitted from being an EU candidate country in enhancing cross-sectoral coordination. The environment sector coordinates the activities of Montenegro in the accession process, so that the previously established cooperation with other sectors has been intensified.

The first RBMPs have already been developed in accordance with the requirements of the EU Water Framework Directive, meaning that other sectors' considerations were addressed through a detailed analysis of pressures on water resources in terms of quantity and quality, protected areas, water use, and protection of water quality. This especially applies to hydropower, agriculture and protected areas related to water.

The Water Management Strategy, in addition to looking at the needs and impacts on the water sector, analysed the goals of other sectoral strategic and planning documents and their mutual interaction with the goals of water management.

However, some institutions do not have sufficient professional capacities or financial resources for regular activities.

12 MOROCCO

Summary

12.1 Introduction

Morocco features a wide range of climatic conditions due to its geographical diversity. The northern and coastal regions experience a Mediterranean climate, characterised by mild, wet winters and hot, dry summers. The interior includes arid and semi-arid areas, while the Atlas Mountains receive significant snowfall in winter.

Morocco has a population of over 36 million people, with a growing trend of urbanisation.

Morocco is susceptible to climate change impacts, including rising temperatures, changing precipitation patterns and increased occurrences of extreme weather events.

The country is confronted with structural constraints of scarcity and depletion of water resources, placing it among the countries with the lowest water capital per capita in the world (approximately 600 m^3/capita/year).

Morocco has made significant strides in renewable energy development, particularly in solar and wind power.

12.2 Water resources management

12.2.1 Current status and trends

Morocco has ten major river basins and several smaller basins. The ten major basins from north to south are the Loukkos River, the Moulouya River, the Sebou River, the Guir Ziz Rheris River, the BouRegreg-Chaouia River, the Oum Er-Rbia River, the Drâa Oued Noun basin, the Tensift River, the Souss-Massa-Drâa basin, and the Sakia el Hamra-Oued Eddahab basin. Except for the Loukkos River, all these rivers originate in the Atlas Mountains. There are few inter-basin transfers in Morocco, the most important one being the Sebou-Bouregreg Interconnection Project, a strategic initiative under Morocco's National Water Plan, designed to enhance water security and resilience against climate change. Further interconnections include ones from the Oum Er-Rbia basin to the Tensift basin near Marrakesh and to Casablanca, and a transfer from the Bouregreg River also to Casablanca.

Morocco has about 18 BCM of surface water resources per year. Morocco has constructed about 153 dams of various sizes, with a total storage capacity of 20 BCM.

Groundwater accounts for about 20% of water resources. The most important aquifers cover a total area of almost 80,000 km^2, about 10% of the country. Total groundwater withdrawals are estimated at 0.3 BCM/year. However, groundwater has been overexploited, by around 4.2 BCM/year, 10% higher than the average yearly recharge. This high extraction has led to a rapid drop in the water table. The current water level in the Saiss aquifer is 64 m lower than in the 1980s. Similar drops can be seen in the Souss, Témara, Haouz and South Atlas aquifers. This problem occurs in areas where precipitation is less than 400 mm/year and groundwater is used for agricultural irrigation by local farmers. Groundwater supplies 40% of the water used for irrigation.

Morocco has 17 operational desalination plants with a capacity of 186.58 MCM/year. By 2030, Morocco aims to increase the production of water from desalination to at least 1.4 BCM/year.

Agriculture is the largest water user in Morocco (89.3% of total water withdrawals), followed by domestic use (9.1%) and industrial use (1.5%).

The main challenges for Morocco's water sector concern the expected impacts of climate change that will lead to overall reduced water availability and increased frequency and severity of droughts. A further key challenge concerns inefficiencies in the use of water and leakages, both in irrigation and domestic networks.

Deteriorating water quality is also one of the major problems facing Morocco's water sector.

Groundwater resources, especially those close to the Atlantic, experience a high level of pollution. Salinity also exceeds the threshold allowed in the coastal groundwater reservoirs because of overexploitation. Critical levels of pollution have been observed in several sections of watercourses, and several water streams have high concentrations of phosphorus, ammonia and organic matter, and high coliform counts.

The main sources of water pollution are domestic wastewater (323 MCM per year – 43% of total wastewater volume – are discharged into the environment untreated), industrial wastewater (mainly from agro-food, leather, paper mills, textiles installations), and agricultural pollution from the use of fertilisers.

Access to drinking water is universal in urban areas. In rural areas, the rate of access to drinking water has experienced spectacular development in recent years, rising from 14% in 1994 to over 98% in 2022.

Morocco has built 177 wastewater treatment plants, able to treat over 450,000 m^3 per day. A total of 83% of the total population is connected to the sewer network, with 62% connected to wastewater treatment plants.

Water availability dropped from 2,560 m^3/capita/year in 1960 to 730 m^3/capita/year in 2012 and 606 m^3/capita/year in 2024, well below the so-called "water poverty level" of 1,000 m^3/capita/year. Even without further change in water resource availability, a projected population of nearly 39 million by 2030 would yield a ratio of 510 m^3/capita/year by 2030, which is close to the "extreme water scarcity level" of 500 m^3/capita/year[67].

12.2.2 Policy framework

In 2009, Morocco launched the National Water Strategy and National Water Plan, which focus on the role of complementary water management actions to address water problems and achieve coordinated management of supply and demand, while ensuring an equitable distribution between rural and urban areas. The National Water Plan is based on three main axes, namely, water demand management and water recovery; increase of water availability; and preservation of water resources and the natural environment, and adaptation to climate change.

The National Programme for Drinking Water Supply and Irrigation 2020–2027 was prepared in 2020 and consists of five axes: development of the water supply, demand management and water recovery, strengthening the supply of drinking water in rural areas, reuse of treated wastewater, and communication and awareness.

The National Shared Sanitation Plan brings together the National Liquid Sanitation Plan, the National Rural Sanitation Programme and the National Programme for the Reuse of Purified Wastewater. It aims to develop the collection and reuse of treated wastewater. Its objective is to achieve a connection rate of 95% in 2040 (in particular by equipping 1,200 town centres in rural areas) and a depollution rate of 76% in urban areas.

12.2.3 Institutional framework

The Water and Climate Council (CSEC) is responsible for formulating the general orientations of national policy on water and climate. The CSEC also examines and formulates its opinion on the national strategy for improving climate knowledge and controlling its impacts on the development of water resources, the national water plan and the integrated development plans for water resources; water from hydraulic basins, and in particular the distribution of water between the different user sectors and different regions of the country or the same basin; and the provisions for the development, protection and conservation of water resources.

67 World Bank Group (2017): *Managing Urban Water Scarcity in Morocco*, Washington, DC.

The Interministerial Water Commission examines and implements the necessary provisions to ensure coherent and concerted development of the water sector, and monitors the implementation of CSEC recommendations. It is made up of representatives of all ministerial departments concerned with water issues.

The Ministry of Equipment and Water is responsible for implementing the national water policy. It is represented at the central level by the General Directorate of Hydraulics, at the regional level by the Hydraulic Basin Agencies (public establishments with legal personality and financial autonomy, responsible for implementing decentralised management, integrated and concerted water resources by large hydraulic basin) and at the provincial level by water services.

The National Office of Electricity and Water (ONEE) is responsible in the field of drinking water and sanitation for planning the supply of drinking water, the programming of investments in drinking water and sanitation, procurement and monitoring of project implementation, managing services, and quality control.

12.3 Agriculture

12.3.1 Current status and trends

The agriculture sector is at the heart of Morocco's social, economic and territorial development. It accounts for 13% of GDP and is a significant job provider for a large segment of the population (nearly 38% of the working population employed at the national level, and 74% in rural areas).

The total area of cropland of Morocco is about 9.6 million ha. Usually, a portion of available cropland (about 15–20%) remains uncultivated each year in Morocco. Hence, the country has about 8.5 million ha of good agricultural land. Crop production in Morocco heavily relies on irrigation because of low productivity of rainfed cropping. Although the share of irrigated crops in the total harvested area of Morocco is around 20–25%, nearly 65% of the monetary value of crops produced comes from irrigated crops.

Wheat has the largest share (39.4%) in the harvested area of Morocco, followed by coarse grains and oilseeds (29.2% and 12.2% respectively). The shares of vegetables and fruits in the total area were about 10% and 8.3% respectively, being however the most productive and valuable crops produced in Morocco and exported mainly to the EU. The main imported crops are usually wheat and coarse grains.

A major strength factor supporting the agriculture sector in Morocco is its phosphate production for soil amendment. With over 75% of global phosphate reserves, Morocco is positioned to play a leading role in contributing to global food security through growth in this industry. The country recently launched an ambitious industrial development programme which aims to double the current mining capacity and triple chemical capacity by 2020. Different stages of phosphate mining and chemical processing require considerable amounts of water, energy, land and resource inputs.

Only a small portion of irrigated cropland is equipped with advanced irrigation systems including sprinkler or drip irrigation systems. The Government of Morocco plans to support farmers to install advanced irrigation systems on about 555,000 ha of irrigated land. With this plan, the share of irrigated cropland equipped with advanced irrigation technologies will reach 55–60% of the total area of irrigated land.

12.3.2 Policy framework

In April 2008, the Moroccan Government adopted a global strategy for the agriculture sector, entitled the Green Morocco Plan for 2010–2020. It aimed to fully exploit the agricultural potential of the country and aspires, for the next 10–15 years, to double the agricultural GDP, create 15 million additional jobs, fight against poverty, and improve the agricultural income by two to three times

in favour of the rural population of 3 million, and increase the value of exports from 8 to 44 billion Moroccan dirhams for the sectors in which Morocco is competitive. The plan focused on increasing olive, citrus, fruit and vegetable production.

The new strategy, Generation Green 2020–2030, was developed following the Green Morocco Plan in order to provide a new strategic vision for the agriculture sector in terms of growth and sustainability. Like the old strategy, Generation Green is based on two founding pillars. The first consists of improving human development to create an agricultural middle class, energise the youth in rural areas, develop human capital and better structure farmers around efficient agricultural organisations. The second pillar concerns the sustainability of agricultural development in order to promote competitiveness and create wealth to increase economic and social growth. This pillar is broken down into specific actions on agriculture sectors, distribution chains, quality and innovation, as well as preserving natural resources and strengthening the resilience of the sector.

The National Irrigation Water Saving Programme is a component of the transverse measures of the Green Morocco Plan. Its objective is to improve the use efficiency and valorisation of water in irrigated perimeters. It is also included as an axis of demand management and water development in the National Water Strategy. It aims to convert nearly 555,000 ha to localised irrigation by 2020. This conversion would allow water savings of nearly 1.4 billion m^3. In 2022, the reconverted areas amount to more than 700,000 ha, and the programme continues under Generation Green until 2030, with the objective of reaching approximately 1 million ha converted to irrigation.

The National Priority Drinking Water Supply and Irrigation Programme 2020–2027 aims to improve supply and demand management, as well as raise awareness about the rational use of water resources.

12.3.3 Institutional framework

The Ministry of Agriculture, Maritime Fisheries, Rural Development and Water and Forests is responsible for developing and implementing government policy in the agriculture sector. To this end, it oversees the following assignments, considering the attributions of the other government departments:

- Define and implement government agricultural policy;
- Examine and develop an intervention strategy to improve and restructure the organisation of the agriculture sector;
- Take the main arrangements to rationalise the use of water resources for irrigation;
- Develop and implement government policy to promote agricultural production and ensure the upgrading of professional agricultural organisations in production chains;
- Perform studies and research for the development of agriculture at regional and national levels;
- Collect, analyse and distribute the statistics and agricultural information;
- Define and implement the strategy in higher agricultural education, agronomic research, and agricultural technical and vocational training;
- Participate in negotiations related to free trade in agriculture and the management of the agreements in this field;
- Develop and participate in transformation and industry upgrading of plant and animal production studies and projects;
- Examine and follow the evolution of national and international markets and prices of agricultural products, as well as production

costs, and suggest suitable measures of intervention; and

- Develop government policy for plant, animal and food product safety throughout the national territory and at border posts.

The National Office of Agricultural Consulting is administered by a board of directors and managed by a Director-General. It is responsible for implementing the Government's policy on agricultural consulting.

The Agency for Agricultural Development is a public establishment with legal personality and financial autonomy. It is placed under the supervision of the Ministry of Agriculture, Maritime Fisheries, Rural Development and Water and Forests. Its mission is to launch concrete projects, intermediation, monitoring, and implementation and management of partnerships with institutional and social investors. It oversees the launch of various projects and programmes with the aim of developing the value chain of local Moroccan products on the national and international market.

Decentralised entities in each region include the Regional Directorate of Agriculture, Regional Agricultural Development Office and the Regional Directorate of the National Office for Food Safety.

12.4 Energy

12.4.1 Current status and trends

Morocco's energy sector depends heavily on imported hydrocarbons. Currently, the country imports approximately 90% of its energy needs. In 2020, approximately 10% of energy supply came from RES (including biomass), and the remaining 90% from fossil fuels. Morocco's Government estimates future demand for primary energy will triple or quadruple in the next 20 years, presenting a challenge to the country, whose current low local energy production fails to meet demand. Morocco's electricity production in 2020 came mainly from coal (68%), natural gas (9%), wind (11%) and solar (4%).

Growth of the renewable energy sector is a top priority for the Moroccan Government. Morocco's energy efficiency strategy includes an efficiency target of 20% by 2030, including specific energy consumption reduction targets, and implementing development plans for transportation, construction, industry, agriculture and public lighting.

Imported fossil fuels, including refined oil, gas and coal, currently provide 90% of Morocco's energy needs. To meet the growing demand for electricity, and address certain issues arising from the significant expansion of renewable energy, Morocco plans to diversify its generation mix by increasing the use of liquefied natural gas. In May 2021, the Moroccan Office of Hydrocarbons and Mines launched a call for expression of interest for development and operation of an integrated floating storage and regasification unit (FRSU) terminal off the Atlantic coast.

12.4.2 Policy framework

Morocco has implemented a National Energy Strategy Horizon 2030, to lay the foundations for a sustainable energy model. It is based on four objectives: security of supply and availability of energy; generalised access to energy at reasonable prices; control of demand; and preservation of the environment.

The National Strategy for Sustainable Development 2030 (2017) recommends the implementation of a policy to promote renewable energies and energy efficiency. This policy aims, among other things, for sustainable development, through the strengthening of the competitiveness of the country's productive sectors and the preservation of the environment, by limiting GHG emissions.

This strategy is based on five strategic orientations, namely:

- A diversified and optimised mix around reliable and competitive technological choices;
- The mobilisation of national energy resources by increasing the power of renewable energies;
- Energy efficiency made a national priority;
- Strengthening regional integration; and
- Sustainable development.

The National Strategy for Energy Efficiency by 2030 (SNEE) is part of the national energy strategy. It was set up with the aim of ensuring the gradual transition to the green economy, the fight against climate change, the improvement of precarious territorial spaces, the reduction of social and spatial disparities, and the promotion of the culture of sustainable development. It aspires to achieve 52% renewable energy, instead of 34% which was planned in 2015.

12.4.3 Institutional framework

The Ministry of Energy Transition and Sustainable Development (MTEDD) is responsible for the development and implementation of government policy in the fields of energy, as well as the control of the actors dependent on its authority. Its supervision extends to the entire profession: research, exploration and production in the field of hydrocarbons, the electricity sector, the refining of crude oil, gas transport infrastructures, and the distribution of petroleum products and coal.

The MTEDD relies on a number of public agencies and establishments created to develop and implement the Government's energy policy. The most important among these establishments are:

- ONEE, created in 2012 by the merger of the National Office of Electricity and the National Office of Drinking Water. In addition to the distribution of drinking water and sanitation, ONEE's mission is to produce and transport electricity and ensure its distribution in certain regions of the country.
- ONEE Electricity Branch is the majority Moroccan electricity supply operator. Created in 1963, ONEE Electricity Branch operates in the three key energy sectors: production, transport and distribution. ONEE is a public industrial and commercial establishment placed under the administrative and technical supervision of MTEDD.
- Moroccan Agency for Sustainable Energy (MASEN), created in 2010 to implement the Moroccan Solar Plan, and subsequently responsible for the development of renewable production projects in all sectors. In December 2015, it was decided that MASEN would take the lead in coordinating the development of all renewable energy projects (wind, solar and hydroelectric projects, and any other renewable energy source likely to be developed in Morocco).
- Energy Investment Company (SIE), created in 2010 with the objective of participating in the financing and development of renewable energy and energy efficiency projects. The SIE is considered a benchmark investor and the financial arm of the State for the implementation of the national energy strategy. It was set up by the Government in 2010 to promote private investment in renewable energy and energy efficiency. Currently, the SIE contributes to the financing of projects in the field of renewable energies. SIE's investment strategy is to take a minority stake in a feasible renewable energy project.

12.5 Environmental protection

12.5.1 Current status and trends

Moroccan biodiversity includes more than 24,000 animal species and 7,000 vegetal species,

with rates of endemism particularly high among Mediterranean countries (20% for vascular plants, 11% for fauna). Forest and marine ecosystems are especially rich. Globally, Morocco ranks among the countries with the highest levels of fish diversity.

At present, over 600 endangered species have been identified throughout the country, and the degradation rate is irreversible for some of them, especially for those species located around cities and in the Central Rif region. Of the 7,000 taxa comprising Morocco's flora, a national study on biodiversity considers 1,700 as rare and/or threatened, representing a potential loss of 24% of plant diversity. A decline in biodiversity is observable in all ecosystems[68].

Threats to biological diversity in Morocco stem mostly from human activities, economic development and population growth. They include sand mining, water pumping, habitat transformation (notably due to droughts), overexploitation of resources, pollution (for example, salinisation affects around 16% of irrigated lands), erosion (which concerns 25% of irrigation canals in the Drâa valley) and the introduction of invasive species. The degradation of important marine areas is due to increased activity (economic, population, construction) in coastal areas, water pollution and overfishing. In the forest environment, threats include the unsustainable extraction of non-timber products, overgrazing by pastoralists (almost all forests are overgrazed), clearing for agriculture, and urbanisation.

There are 39 protected areas, representing 3.8% of the total land in Morocco.

12.5.2 Policy framework

The 2030 National Sustainable Development Strategy aims to implement the foundations of a green and inclusive economy in Morocco by 2030. It is based on four principles, namely, international compliance; compliance with the principles of Framework Law 99-12 on the National Charter for the Environment and Sustainable Development; stakeholder engagement; and an operational strategy. With a view to achieving this vision, seven challenges have been defined: consolidation of the governance of sustainable development; success of the transition to a green economy; improving the management and development of natural resources and strengthening the conservation of biodiversity; acceleration of the implementation of the national policy to combat climate change; special vigilance in sensitive areas; promotion of human development and the reduction of social and territorial inequalities; and promotion of a culture of sustainable development.

The National Strategy and Action Plan for the Biological Diversity of Morocco has been developed to take into account, on the one hand, the strategies in progress or in anticipation by the national actors, and on the other hand, the national priorities in terms of conservation and enhancement of biodiversity, as well as international concerns expressed in the CBD Strategic Plan 2011–2020 and the Aichi Targets. Its vision is as follows: "By 2030, biological diversity is conserved, restored, valued, and rationally used, ensuring the maintenance of the services provided by ecosystems, for the benefit of all, while contributing to sustainable development and well-being of Moroccan society".

A National Action Programme to Combat Desertification was adopted in the context of implementing Morocco's commitments under the United Nations Convention to Combat Desertification. This is a sectoral programme of national scope which aims to favour measures likely to complement existing sectoral programmes, catalyse their implementation, and promote a real dynamic of development based on integration, territorialisation, partnership and the adoption of the participatory approach. It aims to

68 CBD: Morocco – Country Profile website, https://www.cbd.int/countries/profile?country=ma.

evaluate the current situation, define quantified strategic and operational objectives to reverse the process, seek a differentiated approach for intervention (ecosystem zoning), and establish links between climate change and desertification, with a view to a prospective adaptation strategy.

12.5.3 Institutional framework

The MTEDD, and in particular the Department of Sustainable Development, is the competent administration to ensure coordination to support biodiversity. It intervenes on all environmental issues, and prepares and implements government policy in the areas of the environment, in particular those relating to the protection and enhancement of biodiversity. This administration ensures awareness and communication actions around biodiversity. It plays a role in raising awareness of the extreme importance and benefit of preserving biodiversity.

Coordination missions at the regional level falling under the responsibility of this authority are carried out by the regional environmental services and by the Regional Observatories for the Environment and Sustainable Development.

The Association for Integrated Resource Management is strongly involved in contributing to the conservation of Mediterranean ecosystems and adjacent seas, as well as their threatened species, through the involvement and permanent mobilisation of stakeholders through participatory research, to set up integrated management of natural resources and improvement and promotion of ecosystem services.

The Association Research Group for the Protection of Birds in Morocco works for the conservation of nature by offering a framework for action and sharing between those concerned with the preservation of nature in Morocco. It implements numerous actions for the protection and conservation of biodiversity, and pays particular attention to the conservation and enhancement of heritage species of Moroccan avifauna.

12.6 Rapid assessment of the WEFE Nexus in Morocco

A more detailed WEFE Nexus assessment for Morocco, and in particular the Tanger-Tétouan-Al Hoceima (TTA) region, is under development by GWP-Med in the framework of the Nexus Child Project 2.2 of the MedProgramme.

12.6.1 Key interlinkages across the WEFE elements

The key cross-sectoral challenges for Morocco concern the expected impacts of climate change, that will lead to overall reduced water availability and increased frequency and severity of droughts, affecting crop yields and potentially reducing the country's GDP significantly.

Groundwater resources have been overexploited, especially those close to the Atlantic, and experience a high level of pollution and the threat of salinity. Given that expansion of irrigated agriculture is one of the top priorities of the agriculture sector in Morocco, it is imperative to support farmers to install advanced and efficient irrigation systems, powered by renewable energy.

Deteriorating water quality is a major problem facing Morocco. Expansion of wastewater treatment plants, together with sustainable agriculture practices, can help address the issue. Reuse of treated wastewater can be an additional water resource for irrigation.

Rainfed agriculture is the predominant agricultural system in Morocco. Rainwater harvesting can represent an important tool to improve rainfed agriculture and increase crop yield sustainably.

Morocco is a global leader in phosphate production for soil amendment. Further development of the industry needs to carefully consider water, energy and land inputs.

Currently, Morocco imports approximately 90% of its energy needs. Speeding up the transition to

the abundant domestic wind and solar energy resources will bring benefits across the economy and society.

12.6.2 Integration in policy-making and management practices

The 2030 National Sustainable Development Strategy provides a good basis for an integrated consideration of each sector's priorities and objectives.

In terms of institutional settings, the Ministry of Energy Transition and Sustainable Development ensures coordination in policies and measures on both environmental protection and energy. Related coordination at the regional level is carried out by the regional environmental services and by the Regional Observatories for the Environment and Sustainable Development.

Regarding the water-climate-agriculture interface, the interministerial CSEC provides policy and planning coordination, while the Interministerial Water Commission examines, implements and monitors the necessary provisions.

13 PALESTINE

Summary

The information and analysis presented in this chapter are based on data available up to 2022. Since October 2023, the region has been experiencing an unprecedented and ongoing crisis that has dramatically affected lives, infrastructure and institutions, including those related to water, energy, food and ecosystems. Due to the rapidly evolving situation, reliable and comprehensive post-2022 data are not yet available, and the current context may differ from the conditions reflected here.

13.1 Introduction

The State of Palestine comprises the West Bank, including East Jerusalem, and the Gaza Strip. The West Bank is divided into three areas, each of which is under a different type of control: Area A is made up of Palestinian city centres, excluding Hebron, and is under Palestinian civil and security control. Area B, made up of the built-up areas around Area A, is under Palestinian civil control and joint Israeli and Palestinian security control. Area C, which makes up 61% of the West Bank, is under Israeli civil and security control.

The recognition of United Nations General Assembly of the State of Palestine as a non-member observer in the United Nations system in November 2012 enabled the State of Palestine to join international frameworks, through international organisations and treaties.

The 2017 census showed 4.7 million Palestinians living in the State of Palestine, with 1.88 million in the Gaza Strip and 2.83 million in the West Bank.

The economy in the State of Palestine has experienced considerable structural change since the establishment of the Palestinian National Authority in 1994. Agriculture's contribution to GDP declined from 37% at the end of the 1970s to 3.8% in 2014. In 2016, the highest contributing sectors in percentage terms were services (20.2%), wholesale and retail trade (18.2%), public administration and defence (15.1%) and mining, manufacturing, electricity and water supply (13.3%).

The Gaza Strip's economy has been kept afloat in recent years by large transfers, including donor aid and spending through the budget of the Palestinian Government. Together these contributed up to 80% of Gaza's GDP.

Palestine has historically faced challenges related to resource scarcity, particularly water resources, due to population growth and political tensions. The region relies on shared water resources, primarily the Jordan River and underground aquifers, which have been a source of tension in the Israeli-Palestinian conflict.

Agriculture plays a vital role in the Palestinian economy and food security. However, limited access to arable land and water, coupled with the challenges of movement and trade restrictions, hinder agricultural development.

Palestine faces challenges in meeting its energy needs, with dependence on imported electricity and a limited energy infrastructure.

13.2 Water resources management

13.2.1 Current status and trends

All surface and ground water resources in Palestine are shared with Israel and/or other states. Surface waters are scarce and include the Jordan River and a number of *wadis* (stream beds or ravines where water only flows seasonally and temporarily, often as flash floods after thunderstorms).

The Jordan River is the only watercourse that can be used as a year-round source of surface water for the West Bank. It is currently controlled and used exclusively by Israel. The river originates on the slopes of Mount Hermon in Lebanon and

flows southwards through Lake Tiberias for a total of 223 km until it spills into the Dead Sea at approximately 425 metres below sea level. The historical flow of the Jordan River was around 1,400 MCM/year. However, the river's natural flow has been drastically altered following the construction of a series of dams and diversion projects along the river and its tributaries in Israel, Jordan and Syria. Israel diverts around 400 MCM/ year from Lake Tiberias. Most of this water is transported through the National Water Carrier for use along Israel's densely populated Coastal Plain and in the Negev. Syria has also built a series of dams on the main tributary of the Jordan River. As a result, the flow of the Lower Jordan River has dropped dramatically to 20–200 MCM/year, and the water quality has sharply deteriorated.

Groundwater is the major source of freshwater supply for Palestinians. There are four groundwater aquifer basins in Palestine, which are located either partially or totally in the West Bank and Gaza Strip. Each of these basins can be divided into subaquifer basins.

As Palestinians in the West Bank do not have access to the Jordan River, the main water resource left to them is the Mountain Aquifer. This groundwater resource lies under both Palestine and Israel. It is 130 km long and some 35 km wide, fed mainly by rainwater falling over the mountains of the West Bank. With a total average yield of 679–734 MCM/year, the Mountain Aquifer is divided into three parts: The western, northeastern and eastern aquifer basins. It is a very important resource for both Israelis and Palestinians. It contributes about 25% of Israel's total water budget. Israel extracts about 80% of the Mountain Aquifer's potential yield, and restricts Palestinians to only about 20% of its estimated potential. In 1999, for example, overall Palestinian water extraction from the Mountain Aquifer was 138 MCM, dropping to 113 MCM in 2007 and 87 MCM in 2011, which is less than the 118 MCM/year that was allocated to Palestinians in the 1996 Oslo agreement.

Gaza's only source of freshwater is the Coastal Aquifer, a groundwater basin that runs the length of the Gaza Strip and along part of the Israeli coast. Its average recharge is estimated at up to 450 MCM/year in Israel and 55–60 MCM/year in Gaza. However, current extraction rates in Gaza reach up to 200 MCM/year, nearly four times as much as the aquifer can sustainably recharge each year to meet the growing demand of Gaza's population. The overexploitation of the Coastal Aquifer and the absence of adequate sewage treatment facilities in the Gaza Strip have resulted in the deterioration of water quality in Gaza, as described in the next section. It is estimated that 90–95% of Gaza's water is unfit for human consumption due to pollution.

By international and regional standards, Palestinians have the least access to freshwater resources. The West Bank ranks lowest among Jordan basin states in terms of access to water. For example, the average West Bank Palestinian uses around 70 litres per day (L/d). In some rural areas, this amount drops to 20 L/d, far below the 100 L/d recommended by WHO.

Deterioration of water quality in Palestine, especially in Gaza, is a key environmental challenge that requires urgent action. Groundwater resources are suffering due to infiltration of untreated wastewater from leakages in the infrastructure, overloaded treatment plants and effluent discharged directly into the environment. Adequate treatment of wastewater has been neglected throughout Palestine, both prior to and during the present spike in conflict since 2023, and little has been invested in wastewater treatment since the Oslo Accords of 1995.

According to the WHO/UNICEF JMP, about 90% of Palestinians in the occupied territories had access to an improved water source. Due to unreliable water delivery, virtually every Palestinian house has at least one, most several, water cisterns to store water. In 2012, the losses of water in the network were estimated some 28% in the West Bank, and even up to half of the supplied amount

in Gaza. In the West Bank, construction and maintenance of water and sewage infrastructure are problematic. The high water loss rates are ascribed to illegal connections, worn out pipe systems in the networks, and utility dysfunction. Especially in the Gaza Strip, high losses are caused by illegal connections. Illegal use of water is often the result of water shortages and insufficient supply. In many cases the distribution system is antiquated, and there is an urgent need for its gradual replacement. Old and leaky pipes are widespread, and water losses in the distribution system and through unregistered connections are estimated to reach some 45%.

Concerning wastewater, the existing treatment plants do not have the capacity to treat all the wastewater produced, causing severe water pollution. The development of the sector highly depends on external financing.

13.2.2 Policy framework

This National Water and Wastewater Policy and Strategy is a double sectoral document (ground and surface waters, fresh, brackish and salt waters, and water and wastewater services) valid for all the Palestinian territory and to be implemented in the next 20 years.

The National Water Policy 2013–2032 provides the planning and management framework necessary for the protection, conservation, sustainable management and development of water resources, and for the improvement and sustainable management and provision of water supply and wastewater services and related standards in the Palestinian territories.

To this end it seeks for reinforcement of the Palestinian Authority's approach to sustainable water resources management by ensuring that Government works together in the pursuit of shared water resources management goals; establishment of a framework for the coordinated development, regulation and financial sustainability of water supply and wastewater services to ensure concerted efforts towards improved water systems management, rehabilitation and maintenance; and being a platform for ensuring close collaboration and cooperation among all water-related agencies and stakeholders at the national, governorate, municipal and local levels.

The Wastewater Strategy aims to improve the water and wastewater services provided to Palestinian citizens over the next 20 years. It is will be achieved through increasing the quantity of water delivered to customers; maximising the volume of water made available for irrigation; providing all citizens with good access to a reliable source of water, with an affordable tariff, in particular for the poorest families; reducing inequalities among regions and localities; improving the quality of the water delivered to customers; improving the sanitation to protect the natural water resources from pollution and excessive depletion; and managing the water resources in sustainable and environmental manner.

As for governance, the document aims to separate policy and regulatory functions from those of service delivery; encourage the institutional restructuring of the water sector and involvement of the private sector in the funding, implementation, operation and maintenance of water supply and wastewater systems; and stipulate that the organisations responsible for the water sector produce financially and technically sound plans to achieve the strategic objectives of the sector.

13.2.3 Institutional framework

In 2014, the Palestinian Authority signed a new Water Law that intends to bring about major reforms in the water sector. Under the new law, some of the previously identified fragmentation in the water institutions is expected to be resolved. The Palestinian Water Authority (PWA) has become the body in charge of ministerial functions, and an independent regulator has been

created to supervise service providers. The new law also separates functions at the governance and operational level; it restricts PWA to the policy and planning level, including the functions of an existing Project Management Unit; and establishes a new body, the Water Regulatory Council (WRC), to monitor and regulate water and wastewater service provisions. The WRC will prepare all indicators and standards based on international practice, and control and regulate the water tariff and the water/wastewater prices based on cost recovery and other operational and management criteria. On the operational level, the national water company and service providers will be responsible for water supply and wastewater collection and treatment.

The current governance framework prevents the PWA from implementing and operating an IWRM system in the West Bank. This includes the fact that the PWA must get approval from the Joint Water Committee for any proposed management measure or infrastructure project in the West Bank. In urban areas, for example, water resources are managed, distributed and controlled by local utilities and municipalities such as the Jerusalem Water Undertaking and the WSS Authority. Water distribution in rural areas, on the other hand, is handled by municipal water departments, Joint Service Councils and village councils. With input from Mekorot, Israel's national water company, these numerous and often low-volume providers feed into the Palestinian water system. They provide about 90% of the overall consumption of water throughout the West Bank. This includes domestic, industrial and agricultural uses.

The Ministry of Agriculture, Ministry of Public Works and Housing, Environmental Quality Authority, and the Palestinian Energy Authority are further cooperative stakeholder for managing the water resources system in Palestine.

13.3 Agriculture

13.3.1 Current status and trends

A total of 20% of the total area of Palestine is used for agriculture (90% of which is in the West Bank, and 10% in the Gaza Strip). Rainfed agriculture is dominant, representing 81%, while irrigated areas cover 19%, mainly in the Gaza Strip and the Jordan Valley. There are 80,000 ha suitable for irrigation, of which 61,000 ha is in the West Bank and 19,000 ha is in the Gaza Strip. In 2003, about 24,000 ha of this land were irrigated, of which 12,600 ha is in the West Bank and 11,400 ha is in the Gaza Strip.

According to FAO, in 1970 agriculture was the dominant sector in the Palestinian economy, providing employment for a large part of the population, and 36% of GDP. Since then, agriculture's role in the economy has declined, and the contribution of agriculture to GDP was 3.8% in 2014. The agriculture sector remains, however, the main shock absorber, and plays a major role in poverty alleviation and in achieving a certain level of food security for a considerable portion of the population. Most Palestinians benefit from the flexibility and sustainability of the agriculture sector in meeting basic food requirements.

Agriculture has provided work for more than 39% of those who work in informal sectors, and supports a significant proportion of Palestinian families who cultivate their lands for survival.

In general, the nature of the food insecurity problem in Palestine is essentially due to reliance on imports of basic staples (wheat/rice); lack of adequate purchasing power of the poor linked to inadequate means of employment, particularly at times of border closures; inadequate food distribution due primarily to lack of geographical contiguity; and weak and inadequate domestic policies geared to increasing productivity and improving food security.

Over the last ten years, the Palestinian territories have witnessed an expansion of plant production due to land reclamation and various agricultural development projects implemented by the Ministry of Agriculture and NGOs working in the agriculture sector. Many of these interventions have focused and still focus on the horizontal expansion in agricultural production and increased agricultural cultivated areas.

13.3.2 Policy framework

The National Development Plan 2017–2022 consists of two key components. The first component is the national policy agenda, which represents a high-level policy document that sets out the national vision, priorities and policies. The second component is the 18 national sector strategies, along with three cross-sector strategies. Each strategy depicts the sector's strategic objectives, outcomes and policies that all stakeholders will seek to achieve by 2022. The national strategies also include all governmental programmes, specifying their objectives, standards, outputs and functions.

The National Agriculture Sector Strategy 2017–2022 aims to enhance resilience and sustainable development in Palestinian agriculture. It focuses on:

- Resilience: Building farmers' resilience and steadfastness on their lands;
- Gender equality: Ensuring both female and male farmers benefit from agricultural initiatives; and
- Strategic objectives: Enhancing productivity, resource management and livelihoods.

13.3.3 Institutional framework

The Ministry of Agriculture in Palestine is responsible for the development and implementation of agricultural policies and programmes. Its main goal is to promote sustainable agricultural practices, increase productivity and ensure food security in the country. The ministry works towards achieving these goals by providing technical assistance and support to farmers, promoting research and development in the agriculture sector, and implementing programmes that address the needs of rural communities.

The key areas of focus for the Ministry of Agriculture in Palestine include:

- Sustainable agriculture: The ministry aims to promote sustainable farming practices that are environmentally friendly and socially responsible. This includes promoting the use of organic farming methods, reducing the use of pesticides and fertilisers, and promoting crop diversification.
- Food security: Ensuring that all Palestinians have access to adequate and nutritious food is a top priority for the ministry. This includes supporting small-scale farmers, promoting local food production, and improving the distribution and accessibility of food in the country.
- Rural development: The ministry works to promote the development of rural areas in Palestine by providing support for small-scale farmers and promoting the creation of agricultural cooperatives. It also works to improve access to infrastructure and basic services in rural communities.
- Research and development: The ministry supports research and development in the agriculture sector in order to improve crop yields, develop new technologies and practices, and promote innovation in the industry.

Non-governmental and civil society organisations have historically played key roles in agricultural development before and after the establishment of the Palestinian National Authority. They are characterised by their long expertise enabling them to cope with changes. Civil society and non-governmental organisations working in the agriculture sector play a complimentary integral

role with the Ministry of Agriculture, including the harmonisation of their projects with the ministry's strategies and policies, as well as the provision of specific technical services for the ministry in the implementation of some development projects, such as land reclamation, agricultural roads and water-harvesting interventions.

13.4 Energy

13.4.1 Current status and trends

The energy sector in Palestine faces unique challenges due to its geopolitical context, limited resources and dependence on external suppliers.

The Palestinian territories rely primarily on Israeli imports to meet their electricity needs. In the West Bank, Israeli imports account for 99% of total supply, while in Gaza, it is 64%. This heavy reliance on external sources poses risks to energy security and resilience. Balancing Israeli imports with new sources of traditional and green energy is essential.

Gaza typically struggles to meet basic electricity needs, while seasonal power shortages are emerging in the West Bank. With demand expected to grow at significant rates, failure to invest in the West Bank's power sector would lead to deepening power shortages over time.

The energy sector faces financial weaknesses. Deficits in electricity companies ultimately strain the Palestinian Authority's budget. Tariffs do not reflect the full cost of providing service. Retail prices in Gaza have been frozen for a decade, and are insufficient to cover power purchase and generation costs.

To meet energy security objectives by 2030, the Palestinian territories require an estimated $4 billion of investment. Improving sector creditworthiness is crucial to attract private investment.

13.4.2 Policy framework

The Palestinian Energy Authority has prepared a strategy for renewable energy as an important part of the resources matrix. The goal is to generate electricity from different renewable resources which is equivalent to 10% of the power that will be produced locally by 2020. Regarding heat, the estimated exploitation of renewable resources (thermal) is about 18% of the total current energy consumption in Palestine.

An Energy Efficiency Action Plan 2020-2030 was prepared with assistance from the World Bank. It focuses on electricity, which has the largest share in the Palestinian final energy mix, aiming to reduce energy consumption and improve efficiency. It emphasises measures such as demand-side management, energy conservation and efficient technologies. The goal is to enhance energy security and sustainability, while reducing dependence on external sources.

13.4.3 Institutional framework

The Palestinian Energy Authority is established and operating in the parts of the West Bank and Gaza under the jurisdiction of the Palestinian Authority.

The Palestinian Energy and Environment Research Centre and the Palestinian Electricity Regulatory Council are the authorities responsible for promoting and supporting renewable energy in Palestine.

13.5 Environmental protection

13.5.1 Current status and trends

Within Palestine's small borders lie snowcapped mountains, woodlands, sand dunes, deserts, the Mediterranean coast and of course the Dead Sea. The country's climate ranges from semi-arid to subtropical. Because of these diverse habitats,

Palestine is home to a wide array of flora and fauna, with 47,000 species of plants and animals.

While much of Palestine's woodlands and forests were destroyed during numerous wars, people have worked hard to reforest the countryside, and now over 200 million trees grow across Palestine, including pine trees, carob and eucalyptus.

Twice a year, 500 million birds from 283 species migrate through Palestine between Europe and Africa. This creates many excellent opportunities for birdwatching. A number of mammals live in the deserts, including the Nubian ibex and the dorcas gazelle. Predators such as wolves, panthers and hyenas also live in Palestine, although they are rare.

The Palestinian environment is straining under many challenges that include the loss of natural resources, the excessive use of pesticides/ insecticides, climate change and desertification, which have already led to habitat loss and destruction, documented in many articles in peer-reviewed journals. Additional pressures on environment are caused by occupation policies, including the building of walls, bypass roads and industrial settlements.

Destructive projects before 1967 include the destruction of native species and native mixed species, as well as forestation that used only the European pine tree (Pinus halepensis) rather than native species, the draining of the wetlands in the Hula area and the diversion of water from the headwaters of the Jordan Valley (Lake Tiberias), which dried up the Jordan Valley, and destroyed and altered habitats in Palestine.

13.5.2 Policy framework

Palestine is facing substantial environmental challenges due to its delicate environmental resources, lack of sovereignty and its limited financial assets. These challenges are aggravated by many factors such as the scarcity of available water, deterioration of the water resources, soil contamination, desertification and unsustainable management of land, and air pollution. The inability to access and manage the natural resources sustainably, and to enforce laws and instructions, as a result of the Israeli occupation, are aggravating the threats of climate change especially with the high population rate, poverty level and food insecurity.

The NAP for Palestine draws a roadmap for climate change adaptation. Three climate change scenarios identified and evaluated threats and vulnerabilities based on regional and international predictions. The plan also considers measures to address the negative impacts on crucial sectors for economic growth, including agriculture, energy and industry, which would bear the worst impacts of climate change.

The State of Palestine has signed 21 treaties and protocols of international conventions regarding the environment, indicating that it seeks to embrace its strengths and opportunities even in the dire political situation.

13.5.3 Institutional framework

The Environment Quality Authority (EQA) is the umbrella for all activities and studies related to environmental planning, protection and control. The EQA's core mission is to protect the environment with all its elements and prevent environmental hazards from threatening any living organism. It seeks to maintain and safeguard the environment with plans to protect human health, curb and reduce the depletion of natural resources, combat desertification, prevent the aggravation of air and water pollution, promote environmental awareness, and ensure achievement of sustainable urban development. Such engagement, however, is not solely the responsibility of the EQA, but shared by all other Palestinian ministries, academia, and other governmental and non-governmental organisations and institutions concerned with the Palestinian environment, based on the principle of partnership and complementary work.

13.6 Rapid assessment of the WEFE Nexus in Palestine

13.6.1 Key interlinkages across the WEFE elements

All WEFE elements in Palestine face unique challenges due to its geopolitical context.

Water scarcity is a critical issue, heavily impacted by limited access to natural water sources (especially the Jordan River) and inadequate infrastructure, leading to overexploitation of groundwater.

Given the lack of reliable energy supply and high dependence on imported energy, there are challenges in meeting the energy demands necessary to process and distribute water. This dependency on energy for water management creates a feedback loop, where energy shortages exacerbate water scarcity, affecting both domestic and agricultural needs.

Agriculture in Palestine is highly water-dependent, and the sector is the largest consumer of water resources. Limited water availability and poor quality irrigation practices lead to reduced agricultural productivity, which directly impacts food security.

Expensive and unreliable energy supply often disrupts food production and distribution supply chains.

Over-extraction and pollution of groundwater, together with land-use change, are the key environmental challenges. Urban expansion and overgrazing have led to soil erosion and reduced natural water retention capabilities, further straining water and food resources.

13.6.2 Integration in policy-making and management practices

Political instability and limited control over natural resources, particularly in areas where Israel exerts significant influence, complicate policy implementation and resource management. The restrictions on access to water resources, land and energy infrastructure hinder Palestinian institutions' ability to plan and manage these sectors effectively. Additionally, the financial constraints and reliance on donor funding often dictate short-term project-based approaches, rather than promoting long-term sustainable development strategies.

A lack of a comprehensive and integrated approach in decision-making and coordination among agencies hampers the effective management of the interconnected WEFE sectors.

Current policies often prioritise short-term needs over long-term sustainability, with water and energy policies focused primarily on immediate supply issues, rather than on resource efficiency or ecosystem conservation.

Coordination among the institutions involved in managing the WEFE sectors is generally weak, with overlapping roles and mandates leading to inefficiencies and conflicts in resource allocation. This lack of institutional coherence makes it difficult to implement integrated solutions that address the interconnected challenges of water scarcity, energy dependence, food security and ecosystem degradation.

14 TUNISIA

Summary

14.1 Introduction

Tunisia experiences a Mediterranean climate, characterised by hot, dry summers and mild, wet winters. Coastal areas enjoy a more moderate climate, while the interior is subject to greater temperature extremes.

Its population has been steadily growing over the years, and in 2020 stood at approximately 11.8 million people. Urbanisation has been on the rise, with a significant portion of the population residing in cities and coastal areas.

Climate change presents significant challenges to Tunisia with rising temperatures, expected increasing frequency of heatwaves, erratic rainfall patterns and rising risk of desertification.

Tunisia faces water scarcity issues due to its semi-arid-to-arid climate and growing demand for water. Dwindling water resources, coupled with mismanagement, inefficient irrigation practices and unsustainable rates of groundwater extraction, exacerbate the problem.

Agriculture plays a vital role in Tunisia's economy and provides employment to a significant portion of the population. However, Tunisia is highly dependent on food imports, and its agriculture sector is very vulnerable to drought and faces challenges such as water scarcity, soil degradation, and the impact of climate change on crop yields.

Tunisia relies on a mix of fossil fuels, including imported natural gas and oil, to meet its energy needs. Developing RES is increasingly a priority to reduce dependence on fossil fuels, lower GHG emissions, and ensure a more sustainable energy future.

Tunisia has experienced a significant increase in its temperatures over the last 30 years, with temperatures increasing by 0.37°C per decade. Larger temperature increases were experienced in the northern areas of Tunisia (up to 2°C) and during the summer season rather than the winter. Precipitation was observed to have decreased approximately 3% over the past 30 years[69].

According to analysis from the German Climate Service Center (GERICS) of 32 global climate models, Tunisia is projected to experience mean annual temperature increases from 1.9°C to 5.3°C by the 2080s. Maximum temperatures are expected to increase by 2.3°C to as much as 6.4°C by the 2080s. The reduction in precipitation, observed over the past 30 years, is expected to continue through the end of the century.

14.2 Water resources management

14.2.1 Current status and trends

Tunisia has a great climate variability, as it changes from humid in the extreme north to extremely arid in the southern part. Rainfall is also quite variable geographically, with about 600 mm in the north, 300 mm in the centre, 150 mm in the south and less than 100 mm in the extreme southwest. Due to these precipitation patterns, surface water is higher in the northern part of the country, especially in the Medjerda River basin, which originates in Algeria.

The estimated surface water resources are 2,700 MCM and are distributed between the country's major watersheds as follows. The north covers about 26% of the total area of the country, provides regular and important surface water evaluated at 2,190 MCM from the major basins of the Medjerda River (1,000 MCM/year), the extreme north (585 MCM/year), Ichkeul and Bizerte (375 MCM/year) and Cap Bon and Meliane (230 MCM/year)[70]. These basins contribute 81% of the country's total surface water potential.

69 World Bank Group (2021): *Climate Risk Country Profile Tunisia*, Washington, DC.

70 Tunisian Institute for Strategic Studies (2014): *Etude Stratégique: Système Hydraulique de la Tunisie à l'Horizon 2030*, Carthage.

The centre covers the same area as the north and provides irregular surface water resources of 320 MCM/year from the basin rivers of Nebhana, Marguellil and Zeroud, as well as the Sahel of Sousse and Sfax. These resources represent 12% of the country's total surface water potential. The south, which covers about 62% of the total area of the country, is the poorest region in terms of surface water, and has only very irregular resources. It provides 190 MCM/year or 7% of the country's total surface water potential from chotts (seasonal salt lakes or marshes) and the Djeffara basin. Surface water resources are mainly dependent on and constrained by the irregularity in rainfall[71].

The total estimated internal renewable water resources, including the abovementioned surface water and groundwater, is 4.195 BCM/ year. Only 1.16 and 2.07 BCM/year from surface water and groundwater are used in addition to 0.09 BCM/ year of nonconventional water resources. Agriculture accounts for 80% of all water withdrawals.

The water sector in Tunisia is characterised by decreasing renewable water resources per capita, being less than 419 m^3/capita/year, and expected to be only 300 m^3/capita/year by 2030. Overexploitation of aquifers alters water security, and relatively large transfers of water resources between regions create structural constraints for a possible reallocation of water resources. Therefore, conflictual resource management with demands for local use of resources becomes essential. Minimal progress has been made in large scale use of wastewater in irrigation and the safe use of wastewater in agriculture for this purpose. Using treated wastewater for groundwater recharge remains at the pilot stage, and is being tested for two groundwater aquifers.

Overexploitation and water quality deterioration are major pressures threatening the water resources system in the country.

In 2015, 98% of Tunisian population (100% of the urban population and 93% of the rural population) had access to "improved water". Regarding sanitation, in 2015, 92% of the population (98% of the urban and 80% of the rural population) had access to "improved" sanitation according to the WHO/UNICEF JMP.

14.2.2 Policy framework

Tunisia recently adopted its Water 2050 strategy, co-financed by the African Water Facility, Kreditanstalt für Wiederaufbau (KfW) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The strategy aims to be an inclusive reference framework for all water-related interventions, and focuses on medium and long-term water resource management and multisectoral planning to ensure water availability, equitable access and sustainable use. It aligns with the African Water Vision 2025 and the strategic priorities of the African Water Facility. Priority actions under the strategy include innovative approaches and participatory strategies.

Tunisia has also recently adopted an IWRM Plan as part of its efforts to achieve SDG 6.5.1 This plan aims to lay the foundations for a transformative approach to water management and address new social dimensions that have long been overlooked. The IWRM Plan includes 13 actions aimed at improving water management over a five-year period (2023–2028). These actions address technical solutions, engineering investments and social dimensions.

14.2.3 Institutional framework

The Ministry of Agriculture, Water Resources and Fisheries in Tunisia plays a crucial role in managing and developing the related sectors integrating themes to achieve holistic and sustainable development. In terms of water resources, the ministry focuses on efficient water use, irrigation systems and water conservation.

71 Tunisia Ministry of Agriculture (2016): *Rapport National du Secteur de l'Eau*, Tunis.

It collaborates with other stakeholders to address water scarcity and ensure equitable access. Planning and investment for the allocation of drinking water in rural areas is conducted by the Directorate of Rural Engineering or Direction Générale du Genie Rurale.

The National Water Operation and Distribution Company or Société Nationale d'Exploitation et de Distribution des Eaux is responsible for the production and distribution of drinking water.

The National Office for Water Sanitation or Office National de l'Assainissement is responsible for sanitation, which includes wastewater treatment.

14.3 Agriculture

14.3.1 Current status and trends

Around 65% of Tunisia's land area is used for agricultural purposes. Permanent cultivation only exists on approximately 15% of the land. More than 75% of the farms in Tunisia are less than 10 ha in size, according to the Agency for the Promotion of Agricultural Investment or Agence de Promotion des Investissements Agricoles. Rainfed agricultural production is predominant in Tunisia. In 2018, the contribution of the irrigated sector to agricultural production was about 35%, and its contribution to the total exported agricultural products in terms of economic value was up to 25%.

Tunisia's agriculture sector contributes 9.3% to GDP and employs 15% of the labour force. The sector contributed 9.6% of total goods exports in 2016. Three crops (cereals, olive trees and fodder) occupy 80% of the area cultivated in the country. For cereals, the yield per hectare remains low at around 1.2 tonnes/ha due to its dependence on amount of rainfall. This is below the average for the Arab countries, and below half of the world average. The main irrigated crops are fruit trees (mainly olives and date palms), vegetables and cereals.

Most of the water for irrigation in Tunisia comes from groundwater extraction and dams. The use of treated wastewater is minimal.

14.3.2 Policy framework

The overall objective of the country programme of the International Fund for Agricultural Development (IFAD) and Tunisia for the period 2019–2024 is to improve the living conditions, incomes and climate change resilience of poor rural people, particularly women and youth. The strategic objectives provide continuity with those implemented in the past, considering lessons learned and responding to the Government's priorities:

- Strategic objective 1: Better access to productive infrastructure and sustainable natural resource management. The aim is to ensure the social and technical sustainability of basic infrastructure and hydraulic works within the context of climate change. The expected outcomes are improved agricultural practices, restored soil fertility, improved access to water and rational management of water resources, and a sustainable improvement in agricultural productivity.
- Strategic objective 2: Inclusion of poor rural people in more structured agricultural value chains. The country programme will support actions to strengthen the capacities of professional organisations, build storage and processing infrastructure, and rehabilitate rural roads, as well as financing economic activities and coordinating value chain platforms. The expected outcomes will be improved organisation in the targeted value chains, sustainable commercial links between smallholder producers and other value chain actors and increased agricultural incomes.

- Strategic objective 3: Economic and social empowerment of vulnerable rural women and youth. In order to address the specific problems of rural women and youth, IFAD will fund advisory assistance to set up income-generating activities and facilitate access to microfinance while strengthening the operating and coordination capacities of the main national programmes targeted to these groups. The expected outcomes are the economic and social empowerment of rural women in diversified value chains, mainstreaming of rural youth into vocational employment, and improved capacities of national and local actors for scaling up the approaches offering the greatest potential.

14.3.3 Institutional framework

The Ministry of Agriculture, Water Resources and Fisheries is the key institution for Tunisia's agriculture sector. It oversees agricultural policies, programmes and development. It promotes sustainable agricultural practices, crop production and rural development. Its key priorities are ensuring food security, enhancing productivity and supporting farmers. The ministry is also responsible for fisheries management, aquaculture and marine resources. It regulates fishing activities, protects marine ecosystems and supports the livelihoods of fishermen.

14.4 Energy

14.4.1 Current status and trends

Tunisia produces some oil and natural gas but overall relies on imports to cover 53% of its total energy supply. Natural gas is the main energy source in Tunisia's total energy supply with a share of 49% in 2022, followed by oil (40%) and biomass (9.3%)[72].

Tunisia's electricity comes almost exclusively from natural gas (96% in 2022), and the rest from solar and wind power. At the end of 2020, Tunisia had about 400 MW of installed renewable energy capacity of which 244 MW was wind power, 89 MW solar power (79 MW by private entities and 10 MW by the Tunisian Company for Electricity and Gas or Société Tunisienne de l'Electricité et du Gaz, STEG) and 62 MW of hydroelectric power, representing a combined 6% of national energy production capacity.

Tunisia plans to launch tenders for about 3.5 GW of renewable energy by 2030, or approximately 350 MW per year over the next 10 years. One third of the projects will be for wind farms and two thirds for solar PV.

14.4.2 Policy framework

The National Energy Master Plan outlines Tunisia's long-term vision for energy development. It aims to ensure a reliable energy supply, reduce carbon emissions, promote sustainable growth, and ensure a just transition that creates jobs and wealth.

The Tunisian Solar Plan is a key component of Tunisia's renewable energy strategy. It aims to reduce primary energy demand by 30% and increase the share of renewables in electricity production to 30% by 2030. The plan focuses on solar energy, including PV systems and concentrated solar power.

The National Energy Strategy integrates energy, climate, economic and social aspects. Goals include energy security, decarbonisation, economic growth and gender equality. The strategy emphasises stakeholder involvement, including the public and private sectors. It aims to create jobs, enhance energy efficiency and achieve a socially just transition.

72 IEA: Energy system of Tunisia website, https://www.iea.org/countries/tunisia.

14.4.3 Institutional framework

The Ministry of Industry, Energy and Mines oversees energy policies, mining activities and industrial development. The ministry collaborates with various agencies to achieve energy efficiency and promote RES.

The National Agency for Energy Conservation is a non-administrative public institution with financial autonomy. It focuses on energy efficiency, renewable energies and energy substitution, designing and implementing related policies.

Tunisia has a single public utility, STEG, that has the monopoly on transmission, distribution, import and export of electricity and gas. In 2017, 80.8% of the national electricity production was from STEG and 18.6% from the Carthage Power Company.

14.5 Environmental protection

14.5.1 Current status and trends

Terrestrial ecosystems consist of forest formations (green oak, cork oak, Aleppo pine and scrubland derived from degraded areas) mainly concentrated in the Tell and the Dorsale high mountain ranges. Steppe formations extend through the central-southern portion of the country. The country also possesses Saharan pseudo-steppe formations and pseudo-sylvan areas and several specific formations of wetlands (e.g. grasslands, riparian formations, peat bogs) and saline habitats (halophyte vegetation).

In summary, biodiversity resources in Tunisia are found in 69 natural ecosystems and 12 agrosystems, comprising in 3,749 terrestrial plant and animal species and 3,463 marine and aquatic plant and animal species[73].

Altogether, there are 148 protected areas in Tunisia, which cover 7.91% of terrestrial area, and only 1.04% marine[74]. Protected areas in Tunisia are under national ministry governance.

Tunisian vegetation is generally subjected to certain pressures, including forest fires, overgrazing, land clearing and soil erosion. Certain rare species (or species in the process of becoming rarefied), such as the Atlas pistachio (*Pistacia atlantica*) and carob tree (*Ceratonia siliqua*), deserve special attention for their protection. Tunisia is susceptible to losing up to half of its arable lands due to erosion and desertification by the year 2050 due to overgrazing or overcutting of timber for fuel, which are major concerns.

14.5.2 Policy framework

In 2023, Tunisia adopted an ambitious National Ecological Transition Strategy (SNTE), aiming to secure natural capital, improve resource efficiency and promote sustainable development. It reflects the country's commitment to environmental stewardship and resilience, recognising the urgency and opportunities associated with such a transition.

Tunisia's historical development model heavily relied on intensive exploitation of natural resources (soil, water, forests, coastlines, minerals). However, the strategic natural capital of the country is now threatened due to scarcity, vulnerability and the impacts of climate change.

Environmental governance in Tunisia faces challenges related to governance modes, economic and territorial planning, budget allocation, and production models.

The SNTE aims to ensure the sustainability of natural capital while improving resource efficiency in development activities. It aligns with the SDGs and Agenda 2030, and seeks to harmonise with

73 CBD: Tunisia – Country Profile website, https://www.cbd.int/countries/profile?country=tn.

74 Protected Planet (2025): Tunisia website, https://www.protectedplanet.net/en/country/TUN.

international environmental agreements. The strategy emphasises well-being (both material and immaterial), social equity, environmental considerations and the pursuit of sustainability in all dimensions.

The SNTE focuses on five axes, each comprising several measures:

- Preserving natural capital: Ensuring the sustainability of Tunisia's natural heritage;
- Resource efficiency: Enhancing resource efficiency across development activities;
- Environmental governance: Addressing governance gaps related to planning, budget allocation and technology choices;
- Sustainable consumption and production: Promoting sustainable practices in food production and waste management; and
- Participation and collaboration: Engaging all socio-economic actors (public, private, civil society, citizens).

14.5.3 Institutional framework

The Ministry of Environment and Sustainable Development plays a crucial role in environmental policy formulation, implementation and monitoring. It oversees various aspects related to environmental protection, sustainable development, and climate change mitigation and adaptation.

Within the Ministry of Environment, a Special Unit for Climate Change has been established. This unit is responsible for steering the implementation of climate-related initiatives, including the NDCs and reporting to the UNFCCC. The unit collaborates with various stakeholders to develop a long-term climate strategy and update the NDCs.

The National Agency for Environmental Protection plays a vital role in safeguarding the environment and promoting sustainable practices. It is responsible for various activities related to environmental protection, including technical, legal, administrative, training and research functions. It focuses on combating pollution, ensuring environmental sustainability and implementing policies to protect natural resources. The agency also provides citizens with means of communication to report pollution, nuisances or environmental violations around the clock.

The National Commission for Sustainable Development plays a pivotal role in coordinating and advancing sustainable development initiatives within the country. It collaborates with various stakeholders, including government agencies, civil society organisations and the private sector, to promote environmentally friendly practices, social equity and economic prosperity. The commission focuses on integrating environmental, social and economic dimensions in order to achieve the SDGs. Its responsibilities include policy formulation, monitoring progress, and fostering partnerships to address pressing challenges such as climate change, biodiversity conservation, and poverty reduction.

14.6 Rapid assessment of the WEFE Nexus in Tunisia

14.6.1 Key interlinkages across the WEFE elements

Water scarcity is the key challenge for Tunisia's agriculture sector due to low rainfall, over-extraction of groundwater and inefficient irrigation practices, directly affecting agricultural productivity, leading to reduced crop yields and impacting food security.

Tunisia relies on fossil fuels to meet most of its energy demand, including for pumping groundwater, treating wastewater and desalinating seawater. The transition to sustainable energy solutions is still in its early stages, hindered by limited infrastructure and investment.

Rising energy costs and dependence on imported fuels make food production more expensive and less competitive as energy is required for irrigation, processing and food storage.

Ecosystems are under threat from land degradation, desertification and pollution from agricultural run-off. The degradation of natural habitats reduces the capacity of ecosystems to support agriculture and water resources, creating a negative cycle that further stresses the WEFE Nexus.

14.6.2 Integration in policy-making and management practices

While efforts have been made in Tunisia to integrate the WEFE sectors, institutional and operational barriers still limit effective coordination and comprehensive resource management.

Sector-specific strategies for water, energy and agriculture have been developed, but the focus tends to be on addressing immediate sectoral needs rather than on a coherent nexus approach. For example, while IWRM policies emphasise conservation and efficiency, they do not always align with agricultural practices that require large amounts of water, nor do they fully incorporate the potential of renewable energy solutions in the sector.

While the national institutions responsible for the WEFE sectors have clear roles, coordination among them is often fragmented, leading to overlaps and gaps in policy execution. Governance issues are further complicated by political and socio-economic factors, including administrative inefficiencies, limited stakeholder engagement, lack of data-sharing, insufficient technical expertise, and financial constraints. The centralised nature of decision-making processes also restricts the flexibility needed for localised and adaptive management of resources.

Despite these challenges, Tunisia has shown a commitment to adopting integrated approaches through collaborations with international organisations and development partners.

15 TÜRKIYE

Summary

15.1 Introduction

Türkiye boasts a wide range of climatic conditions due to its vast geographical extent. Along the Mediterranean and Aegean coasts, a Mediterranean climate prevails, characterised by mild, wet winters and hot, dry summers. In the interior regions, a more continental climate with cold winters and hot summers is typical. In the eastern mountainous areas, winters can be severe, and snowfall is common.

Türkiye has a large and diverse population, with over 80 million people and a youthful demographic profile. The urban share of the population has risen from 25% in 1950 to nearly 93% today.

Türkiye is known for its numerous rivers, including the Tigris and Euphrates, which are vital water sources for the country and neighbouring nations.

Agriculture plays a significant role in Türkiye's economy, providing employment and contributing to food security. Challenges in the sector include water scarcity, soil erosion and the need for modernisation. Conventional irrigation methods are still the norm on most agricultural lands, leading to a great deal of water loss.

Türkiye's energy sector has undergone substantial growth, with increasing energy demand in recent years. The country has diversified its energy mix, including investments in coal, natural gas, and RES like wind and solar power.

As a consequence of climate change, temperatures are expected to increase in Türkiye. Depending on the global emissions scenarios, by the end of the century (2080–2099), the annual mean surface air temperature anomaly is projected to be between 2°C and even up to 9°C higher than the reference period (1995–2014). Summers are likely to become even hotter, posing challenges for agriculture, human health and energy demand.

Türkiye's precipitation patterns are anticipated to shift. Some regions may experience more intense rainfall events, leading to flooding, while others could face prolonged droughts. By 2050 and 2100, the reduction in surface waters could rise to approximately 35% and over 50% respectively in the worst-case scenarios[75].

15.2 Water resources management

15.2.1 Current status and trends

Türkiye is divided into 25 hydrological basins. Within Türkiye's borders, 16 rivers rise in the mountains and flow into the Marmara Sea, Mediterranean Sea, Black Sea and Aegean Sea. The Konya basin, Akarçay basin, Lake Burdur and Lake Van are closed basins, meaning they have no outflow to the sea. The Maritza, Orontes (Asi), Araks-Kura, Euphrates-Tigris and Çoruh basins are the primary transboundary basins.

Türkiye's mean annual precipitation is 643mm, which amounts to 501 BCM of water. Of the total amount, 158 BCM is mixed with rivers and lakes as surface water. Annual freshwater consumption is about 44 BCM, of which 74% is used for agriculture, 15% for domestic uses and 11% for industrial uses[76].

Türkiye is managing to cope with this increase in demand. In 2020, 98.7% of the municipal (urban) population and 99.3% of the rural population were served by drinking and utility water networks. Municipalities drew 6.2 BCM of water from water sources to drinking and utility water networks. Just under 40% of this water was obtained from dams, 28.1% from wells, 18.4% from springs, 9% from rivers and 4.6% from lakes[77].

Türkiye has 1,170 domestic wastewater treatment facilities in service or under construction, according

75 S. Ozkul (2009): Assessment of climate change effects in Aegean river basins: The case of Gediz and Buyuk Menderes basins. *Climatic Change* 97.

76 Euro-Mediterranean Center on Climate Change (CMCC) (2021): *G20 Climate Risk Atlas: Impacts, Policy, Economics. Turkey*, Lecce.

77 Turkish Statistical Institute (2021): Water and Wastewater Statistics website, https://data.tuik.gov.tr/Bulten/Index?p=Water-and-Wastewater-Statistics-2020-37197.

to the project Determination of the Current Status of Domestic/Urban Wastewater Treatment Plants and Determining the Need for Revision, and 10.5 MCM of wastewater is treated daily. A total of 29.6 MCM of water was reclaimed and utilised from home and urban WWTPs.

15.2.2 Policy framework

In respect of developing national water resource policy, National Basin Management Strategy Document has been prepared and published in 2014 to draw the framework of national water policy. Based on these regulation and documents, IWRM approach has been started to be implemented by the relevant authorities. Stakeholder consultation was ensured at both central and local levels via Basin Board meetings in the basins and Provincial National Water Board meetings in the provinces.

The Turkish National Water Plan 2019–2023 demonstrated a participatory and integrated approach for IWRM, in terms of both water quality and water quantity. It was succeeded by the Water Efficiency Strategy Document and Action Plan 2023–2033.

This is structured around four main thematic pillars:

- Urban water use efficiency;
- Agricultural water use efficiency;
- Industrial water use efficiency; and
- Water-use efficiency across all other sectors.

The document includes strategic goals on reducing municipal-level water loss to 25% by 2033, and 10% by 2040; raising irrigation efficiency to 60% by 2030, and up to 65% by 2050; promoting alternative water sources – grey water reuse, rainwater harvesting, treated wastewater recovery – and facilitating renewable-energy-powered, modern irrigation systems; rolling out volume-based water pricing; advancing industrial water recovery, with targets of up to 50% water reuse; and scaling research and development, data systems integrations, and basin-scale water footprint monitoring.

The “Drinking Water Safety Plan from Source to Tap” project was conducted in a designated province as a pilot programme between 2020 and 2023. The project aimed to create a guide for preparing drinking water security plans in other municipalities and to develop emergency action plans for drinking water, considering various risks and corporate responsibilities. This initiative aimed to enhance resilience to hazards like earthquakes, floods, droughts, chemical, biological, radiological, or nuclear incidents, pollution, and migration, and ensure quick restoration of drinking water security. Legal regulations will mandate all Turkish municipalities to create drinking water security plans using this guide, contributing to a national-scale implementation. This project marks the first step towards fulfilment of Türkiye’s National Water Security Plan.

Drought Management Plan studies have been completed in 23 basins as of 2023, while revision studies are ongoing in the remaining 2 basins.

Flood Management Plan studies were completed in 23 basins by 2020, with one additional basin completed in 2023.

15.2.3 Institutional framework

The Ministry of Agriculture and Forestry of Türkiye, through the General Directorate of Water Management, is the main institution responsible for implementing, coordinating and monitoring national IWRM plans. The work of the General Directorate of Water Management at the provincial level is supported by the decisions of the Provincial Water Management Coordination Board. Execution-oriented works and procedures are carried out by regional directorates of other related organisations of the Ministry (General Directorate of State Hydraulic Works [DSİ], General Directorate of Forestry, General Directorate of Nature Conservation and National Parks, etc.).

The DSİ is the national investment agency responsible for the development of water resources at the national level. It is a legal body under the Ministry of Agriculture and Forestry. Large-scale hydraulic facilities (such as dams, transmission lines, irrigation and flood control structures) are planned and built by the DSİ, then transferred to the appropriate organisations, such as water and sewerage administrations and irrigation unions, for operation and maintenance. The DSİ is also in charge of the development of hydropower projects and the implementation of flood prevention measures.

Water delivery to non-metropolitan rural areas is the responsibility of Special Provincial Administrations linked to the ministry.

The Disaster and Emergency Management Authority, which is part of the ministry, manages flood response in partnership with the DSİ.

The National Water Board was established in 2023 in order to ensure coordination and cooperation at the highest level to provide a sustainable structure for water-related policies, to ensure effective management and efficient use of water resources, and protect water resources within the framework of a holistic basin management approach. Not only the Ministry of Agriculture and Forestry, but also other relevant ministries including the Ministry of Environment, Urbanisation and Climate Change and the Ministry of Energy and Natural Resources, are represented in the National Water Board.

The board is authorised to:

- Formulate short- and long-term plans, policies and strategies on water supply based on the water-food-energy-ecosystem relationship;
- Make recommendations on measures to be taken and policies to be implemented;
- Take decisions to solve the problems encountered in the implementation of the plans;
- Take decisions for the effective and efficient use of public resources;
- Evaluate and decide on the supply and demands for water; and
- Decide on the national water plan, basin-scale management plans, provincial water efficiency plans and drinking water safety plans.

The Ministry of Environment, Urbanisation and Climate Change oversees environmental protection and enhancement. This ministry establishes environmental pollution prevention and protection concepts and policies, develops criteria and standards, and prepares appropriate initiatives. It also coordinates climate change negotiations, as well as adaptation and mitigation programmes.

To safeguard and improve public health, the Ministry of Health has specific duties related to drinking water and bathing water quality.

The Ministry of Energy and Natural Resources oversees protecting and developing geothermal sources and natural mineral waters, as well as developing hydropower projects in collaboration with the DSİ.

The Ministry of Foreign Affairs follows the global agenda regarding water, and monitors and participates in processes related to water, especially transboundary waters. Transboundary waters are handled by the Transboundary Waters Department within the ministry.

Local governments are overseen by the Ministry of Interior, which also has the authority to audit local governments regarding malpractice.

Given that industrial water demand accounts for 13% of overall consumption, the Ministry of Industry and Technology plays a major role in industrial water and wastewater management. Its tasks include developing and promoting the reuse of treated wastewater, implementing actions and establishing incentive mechanisms, evaluating sectoral “water footprints”, studies and plans regarding remote sensing, sensors and informatics applications to conduct research on the use, benefits and development aspects of remote sensing. The ministry is also responsible for the

repair, maintenance and adjustment of water metres.

15.3 Agriculture

15.3.1 Current status and trends

Türkiye's agriculture sector employs 18% of the workforce, provides 10% of exports, and 7% of GDP in 2020. It typically exports more agricultural products than it imports. Türkiye is a major producer of wheat, sugar beets, milk, poultry, cotton, tomatoes, and other fruits and vegetables. As of 2021, Türkiye is the world's largest producer of hazelnuts and apricots, and the world's third-largest producer of olive oil, with 193,500 tonnes of virgin olive oil produced in 2019 according to the International Olive Council.

Between 1950 and 1965, open irrigation canals were constructed. Irrigation systems with branch canals were introduced after 1965, and were constructed between 1970 and 1980. By 1990, a low and medium pipe network with advanced pipe technologies was being used. DSİ shifted its policy from a classical open channel distribution network to more efficient systems. As of 2014, 9% of existing canals are open canals, 3% are branch canals and 88% are piped. In traditional irrigation systems such as surface irrigation, water is often used inefficiently due to leakages, evaporation and operational losses. Approximately 81% of Türkiye's total irrigated area is irrigated by surface irrigation and 19% using pressurised irrigation methods. The Ministry of Agriculture and Forestry aims to increase the use of modern irrigation systems, from 29% at present to 94% following the completion of ongoing projects.

There are 861 dams in operation in Türkiye. Among them, the Atatürk Dam has a surface area of 817 km^2, Keban Dam 675 km^2, Ilısu Dam 313 km^2, Karakaya Dam 268 km^2 and Hirfanlı Dam 263 km^2.

There have been several major regional water development projects, including the Southeastern Anatolian Project which started in 1977. It is designed as an integrated development project that combines economic, social and cultural dimensions with agricultural modernisation. The project involves 22 large dams, 19 HPPs and large-scale irrigation infrastructure for irrigating about 1.7 million ha (1.08 million ha on the Euphrates, 600,000 ha on the Tigris). So far, 19 dams have been completed as part of this project. Irrigation investments, which are the major axis of the project and the essential condition for its completion, have made significant progress. By 2019, 40% of the planned irrigation projects were in operation, and a further 9% were under construction. Another mega project which has been Konya Plain Project, aiming to meet the demand for irrigation, domestic and industrial water use, to prevent excess groundwater extraction, ensure balance in the groundwater table, increase agricultural yields, introduce modern irrigation systems, promote stockbreeding, and protect the environment. When the project is completed, 1.1 million ha will be equipped with irrigation facilities and 164 MCM of water will be supplied for domestic and industrial needs.

15.3.2 Policy framework

The principal objectives of Turkish agricultural policy are:

- Ensuring food security for a growing population;
- Increasing productivity and reducing vulnerability to adverse weather conditions;
- Improving the level of self-sufficiency;
- Raising farm incomes and providing stability;
- Enhancing competitiveness;
- Developing rural areas;
- Ensuring safe food production; and
- Aligning agricultural and rural development policies with those of the EU.

In 2021, the Green Deal Action Plan was adopted, aiming to increase the sustainability of agriculture. Key actions include:

- Reducing pesticide, anti-microbial and chemical fertiliser use;
- Promoting organic production;
- Increasing renewable energy use in agriculture; and
- Improving waste and residue management.

Türkiye's Agricultural Drought Combat Strategy and Action Plan aims to minimise the effects of droughts on agriculture by emphasising increased use of irrigation and water resources. It also focuses on risk assessment through monitoring activities conducted by the Agricultural Drought Management Coordination Board.

Key components of this strategy include:

- Encouraging the adoption of efficient irrigation systems to optimise water use;
- Regular monitoring and assessment of drought risks;
- Water resource management and Ensuring sustainable water availability for agriculture;
- Private sector participation through involving farmers and the food industry in policy processes; and
- Investing in data collection and research to inform decision-making.

15.3.3 Institutional framework

The Ministry of Agriculture and Forestry is the central authority responsible for agricultural policies, regulations and development. It oversees various aspects of agriculture, including crop production, livestock, forestry and rural development. The ministry collaborates with other relevant bodies to implement policies that enhance productivity, sustainability and food security.

The General Directorate of Agricultural Research and Policies focuses on agricultural research, technology transfer and policy development. It aims to improve agricultural practices, enhance crop varieties and promote sustainable farming methods. It plays a crucial role in advancing innovation and productivity in Turkish agriculture.

The General Directorate of Rural Services (GDRS) is responsible for rural development, infrastructure and services. It works to improve living conditions in rural areas, including access to water, roads and electricity. The directorate supports farmers, cooperatives and local communities through various programmes.

The DSİ manages water resources, irrigation and drainage systems. It plays a critical role in ensuring efficient water use for agriculture. The agency develops and maintains irrigation infrastructure, reservoirs and dams.

The Agricultural Credit Cooperatives provides financial services to farmers, including credit, loans and insurance. It supports agricultural production and investment. The cooperative system facilitates access to affordable credit for small and medium-sized farmers.

15.4 Energy

15.4.1 Current status and trends

Since 2000, Türkiye's total energy supply has more than doubled. Oil, coal and natural gas cover 82% of the total supply in roughly equal shares, with the rest coming from wind, hydro, solar and biomass. Türkiye's ability to meet energy demand with its own resources is gradually decreasing, and its dependency on imported energy is now 72%.

In electricity generation, coal is the dominant fuel with a share of 35%, followed by natural gas (23%) and hydropower (20.5%), with the rest being RES

(wind, solar, geothermal, biomass)[78].

Türkiye has a significant hydraulic power potential of 433 billion kWh/year, its technical potential is 216 billion kWh/year and its economically available potential is 160 billion kWh/year. The country has more than 600 HPPs. Türkiye has developed 42% of its technical hydroelectric power potential. A nuclear power plant is also under construction.

According to its revised NDC, Türkiye commits to a 41% reduction in GHG emissions by 2030 compared to business-as-usual levels, and intends to peak its emissions by 2038 at the latest. The long-term goal is to achieve net-zero emissions by 2053.

15.4.2 Policy framework

The guiding principles of Turkish energy policy revolve around market reform, energy security, diversification of energy mix, reducing import dependency, energy efficiency and liberalisation.

The National Energy Efficiency Action Plan 2017–2023 aimed to reduce Türkiye's primary energy consumption by 14% by 2023, through 55 actions addressing key energy sectors (buildings and services, energy, transport, industry, technology, agriculture, and cross-cutting areas). The plan projects a cumulative energy savings of 23.9 million tonnes of oil equivalent by 2023, requiring an investment of $10.9 billion. The cumulative savings by 2033 are estimated at $30.2 billion.

The National Renewable Energy Action Plan for Türkiye focuses on promoting RES, including solar, wind, hydro and geothermal power. The plan aims to enhance Türkiye's energy security and sustainability by increasing the share of renewables in the energy mix. Key targets include increasing solar power capacity to 10 GW and wind power capacity to 16 GW by 2030.

The 12th National Development Plan (2024–2028) will harmonise climate targets with economic growth, ensuring a balanced approach to energy and sustainability.

15.4.3 Institutional framework

The Ministry of Energy and Natural Resources (MENR) is the primary policy institution for the energy sector in Türkiye. It is tasked with determining the country's short- and long-term energy needs and assisting in the formulation of the necessary policies to ensure adequate supply to meet demand. Within the MENR, several general directorates oversee various elements of the energy sector, including the following:

- The General Directorate of Energy Affairs undertakes measures related to the production, transportation and distribution of energy resources in accordance with laws, and supports and coordinates research and development efforts.
- The General Directorate of Nuclear Energy and International Projects coordinates among government ministries and other stakeholders to oversee the country's nuclear power plans as well as its international projects. Currently, it is also responsible for implementation of transit pipeline agreements within the scope of international projects.
- The General Directorate of Foreign Relations manages the MENR's international energy relations.
- The Directorate for Strategy Development coordinates general directorates of the MENR and affiliated and related institutions to prepare policy documents such as the MENR's Strategic Plan. In addition, the directorate prepares the MENR's budget.
- The Department of Energy Efficiency and Environment drafts action plans, regulations

78 IEA: Energy system of Türkiye website, https://www.iea.org/countries/turkiye.

and legislation as it relates to energy efficiency policy; prepares harmonisation and impact assessments of current and new legislation within the scope of the environment-energy relationship; and calculates GHG emissions for public electricity and heat production in the National Inventory Report.

- The Department of Natural Resources promotes, and coordinates studies related to the research and development of natural resources, and monitors technological research and development activities in the field and reports the results to relevant authorities.

15.5 Environmental protection

15.5.1 Current status and trends

Despite lack of data, the invertebrates constitute the largest number among the identified living species. The total number of invertebrate species in Türkiye is about 19,000, of which about 4,000 species/subspecies are endemic. The total number of vertebrate species identified to date is near to 1,500; over 100 species are endemic, including 70 species of fish. Anatolia is the home of the fallow deer and the pheasant. Türkiye's location on two major global bird migration routes makes it important in terms of the feeding and breeding area provided for birds[79].

Türkiye also has a rich plant biodiversity and a high rate of endemism. The country has approximately 11,000 gymnospermous and angiospermous plant species, with one third of them endemic to Türkiye. Eastern Anatolia and Southern Anatolia, among the geographical regions, and the Irano-Turanian and Mediterranean regions, among the phytogeographical regions, are rich in endemic plant species.

Major pressures on Türkiye's agricultural biodiversity include the inappropriate use of farmlands; unsuitable irrigation and farming methods; unconscious use of agricultural inputs; cross-breeding of local races with foreign ones of economic value; and deficiencies in land registry and cadastre areas. Threats to the steppe ecosystems consist of the destructive effects of infrastructure and superstructure works; overgathering of plants of economic value; and wrong and unconscious deforestation and overgrazing.

15.5.2 Policy framework

The National Biodiversity Strategy and Action Plan (NBSAP) outlines Türkiye's approach to conserving and sustainably using its biological wealth. It provides a comprehensive strategy for biodiversity conservation, considering ecosystems, species and genetic diversity. The plan emphasises the need to maintain a healthy environment and address ecosystem degradation caused by human activities. Türkiye signed the CBD in 1992 and ratified it in 1996, committing to global efforts for biodiversity conservation.

The 12th National Development Plan will harmonise climate targets with economic growth, ensuring a balanced approach to biodiversity conservation and sustainable development.

Türkiye has also developed and implemented strategy documents on mitigation and adaptation to climate change, conservation and sustainable use of biodiversity, erosion control and combating desertification, and reforestation and afforestation.

15.5.3 Institutional framework

- The Ministry of Environment, Urbanisation and Climate Change is the central authority in Türkiye responsible for environmental policies, regulations and development. It oversees various aspects of environmental protection, urban planning and sustainable development.

79 CBD: Türkiye – Country Profile website, https://www.cbd.int/countries/profile?country=tr.

The ministry collaborates with other relevant bodies to implement policies that enhance environmental quality and address pollution.

- The General Directorate of Environmental Management under the ministry focuses on environmental management, pollution control and conservation. It plays a crucial role in enforcing environmental regulations, monitoring air and water quality, and promoting sustainable practices.
- The Environmental Agency operates under the ministry, and aims to enhance environmental protection and carry out initiatives related to waste management.
- The Special Environmental Protection Agency focuses on protecting special protection areas.
- The EIA Council evaluates and approves or rejects EIA reports for major projects. It ensures that proposed projects consider environmental risks and mitigation measures.
- At the regional level, the Provincial Directorates of Environment and Urbanisation implement environmental policies and monitor compliance, conduct inspections and address local environmental issues.

15.6 Rapid assessment of the WEFE Nexus in Türkiye

15.6.1 Key interlinkages across the WEFE elements

Hydropower plays a significant role in Türkiye's energy sector, accounting for about 20–25% of its electricity generation. However, fluctuations in water availability, exacerbated by climate change, directly affect the stability of energy supply from hydropower, especially during drought periods.

Agriculture is the largest consumer of water in Türkiye, particularly in the arid and semi-arid regions of Central Anatolia and the southeast, where irrigation is critical. While the Southeastern Anatolia Project, a massive water management and agricultural development programme, has significantly boosted agricultural productivity through irrigation, it also strains water resources.

Riparian biodiversity and related ecosystem services can be threatened by hydropower dams which alter river flows. Over-extraction of water for agriculture, together with urbanisation have significantly affected wetlands and forests.

15.6.2 Integration in policy-making and management practices

Türkiye's policy landscape often lacks full alignment. For instance, energy policies promoting hydropower development do not always consider the impact on water availability for agriculture or the implications for downstream ecosystems.

The new Water Law is expected to play a critical role in bridging policy gaps by providing clearer regulations on water use across sectors.

Some coordination exists among the institutions responsible for the WEFE sectors, guided by inter-ministerial committees and national strategies, but it often falls short due to administrative silos and competing sectoral interests. For example, the Southeastern Anatolia Project integrates water, energy and agriculture policies for regional development, but these efforts frequently encounter issues of resource allocation and prioritisation.

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