

# Natural Resource Nexuses in the ECE region



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## Foreword

The 2030 Agenda for Sustainable Development, with its seventeen Sustainable Development Goals (SDGs), provides an ambitious and comprehensive framework that opens new perspectives for policymaking and international cooperation. While progress in its implementation is being made, current efforts are far below the scale needed to deliver the SDGs within the next ten years. Ambitious action becomes even more important in the context of the response to the COVID-19 pandemic: the SDGs are vital for a recovery that leads to greener, more inclusive economies and stronger, more resilient countries.

ECE supports its member States in the implementation of the 2030 Agenda through concrete and results-oriented activities in the areas of its eight sub-programmes: environment, transport, statistics, economic cooperation and integration, sustainable energy, trade, timber and forestry, and housing, land management and population. This multi-sectoral structure has allowed ECE to address SDG implementation in an integrated manner, in line with the interlinked character of the SDGs, and to adopt a new way of working that cuts across sectoral boundaries. Four nexus areas have been defined where multiple SDGs converge:

- Sustainable use of natural resources
- Sustainable and smart cities
- Sustainable mobility and smart connectivity
- Measuring and monitoring progress towards the SDGs.

In each of these areas, a cross-sectoral, inter-divisional team of ECE experts has undertaken an in-depth substantive analysis of current and future challenges and needs of ECE member States and identified ways and means to address them, thus assisting member States to design and implement integrated policies in these areas. The findings of these analyses and corresponding policy recommendations are set out in a series of four flagship publications.

This report on the *Natural Resource Nexuses in the ECE region* discusses the complex interactions and feedback loops between human and natural systems affecting the natural resource base such as energy, food, land, materials, and water. Two other sectors which are relevant to the nexuses, namely, transport and trade, are also considered here. The nexus approach is a way of ensuring more integrated and sustainable perspectives of natural resource use beyond the traditional sectoral “silos” which can be applied at all scales. This report identifies and analyses seven nexus hotspots which showcase specific challenges and opportunities for a nexus approach, considering core ECE expertise and products within a broader analytical framework, including regional megatrends and the SDGs.

I trust that these flagship publications will offer useful guidance to governments and other stakeholders engaged in developing integrated solutions to the multifaceted challenges of our time and in building back better from the COVID-19 pandemic.

[Signature]

Olga ALGAYEROVA

Under-Secretary-General of the United Nations,  
Executive Secretary of the United Nations  
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# Delivering Nexus Competences for Natural Resources in the ECE region

## Introduction and background

Increasing demand, changing climates and technologies, urbanisation, growing populations, societal demand and inequalities, globalisation and other megatrends are putting enormous pressure on natural resources, in the United Nations Economic Commission for Europe (ECE) region and elsewhere. There are many complex policy issues and difficult choices to be made regarding their conservation and use. These choices necessitate a comprehensive nexus approach that can address the many interactions and trade-offs involved.

These challenges are recognised at the international level where, amongst other things, the integrative character of the 2030 Agenda for Sustainable Development calls for an assessment of the linkages and complementarities but also of the possible conflicts that exist between different Sustainable Development Goals (SDGs) and targets. Many other policy instruments and commitments recognise the interlinkages between individual sectors.

The ECE has a specific contribution to make on these questions, as its subprogrammes work on many aspects of natural resources that can be brought together through a nexus approach.

The study on natural resource nexuses in the ECE region aims to:

- 1 Identify and briefly describe some of the current and future trends and challenges concerning the sustainable use and management of natural resources in the ECE region,
- 2 Consider the potential for further strengthening the nexus approach to deliver social, environmental, and economic benefits,
- 3 Suggest a direction of work and next steps for the ECE to address a more sustainable natural resource use and the management challenges facing the region.

This Summary presents briefly the thinking and analysis contained in the full study and leads up to the recommendations which are presented at the end of the Summary.

## What is Natural Resource Nexus?

A nexus can be defined as a set of complex interactions and feedback loops between human and natural systems affecting the natural resource base. The resource base, in turn, refers to both natural and socio-economic resources as they relate to a given environment, such as interactions between energy, food, land, materials and water (see Figure 1).

The **Natural Resource Nexus** for this report is one that integrates natural resources management and governance, and recognises the interdependencies and feedback loops between:

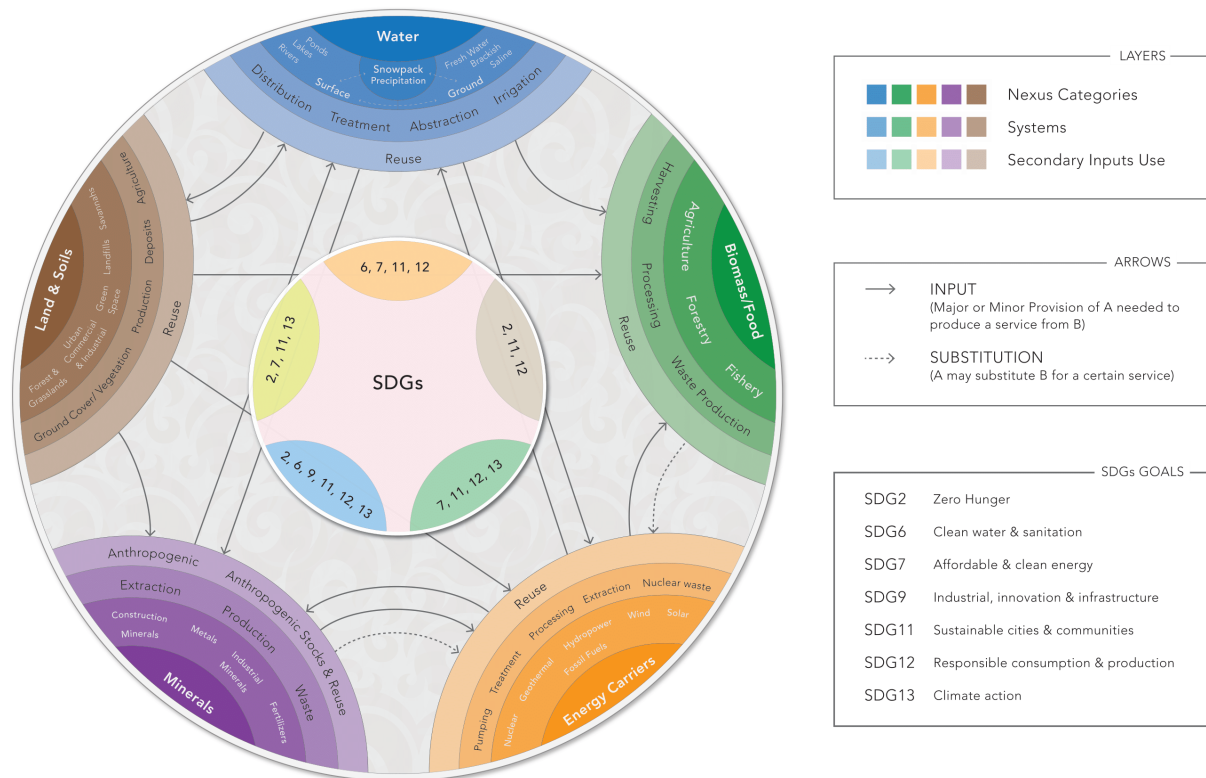
- supply and demand of five resources: energy, food, land, materials and water.
- megatrends that drive natural resources use.
- risks and opportunities generated by these megatrends.
- broader nexus variables (e.g., technology, governance, social and political factors).

The nexus approach is a way of ensuring more integrated and sustainable perspectives of natural resource use beyond the traditional sectoral “silos” which can be applied at all scales. Underlying the



thinking of this report is the belief that the nexus approach can generate relevant information about critical interlinkages that will enable decision-makers to plan for robust governance and management across resources and spatial scales. The nexus approach also provides opportunities to identify and promote integrated planning, management, and governance of natural resources.

Figure 1. The Nexus: interlinkages across resources and the SDGs.



Source: Bleischwitz et al. (2018).

## Taking a regional perspective to the Natural Resource Nexus

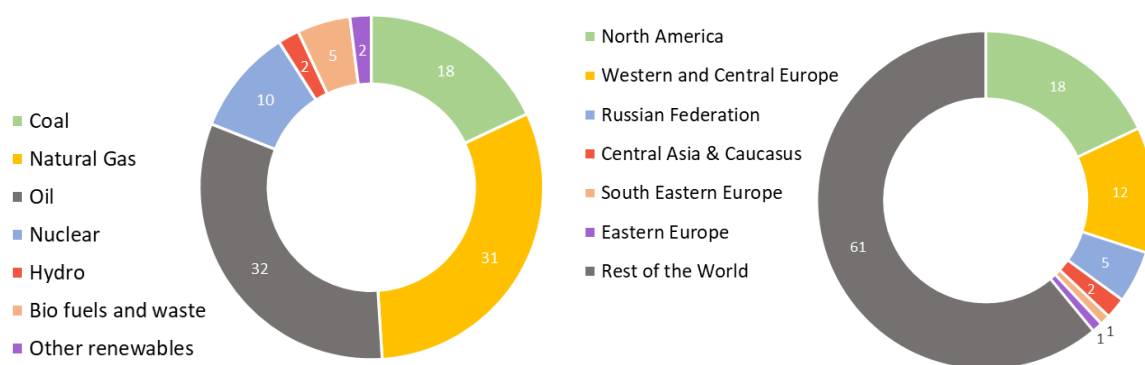
The study reviews the situation, trends, challenges, and main interactions for the five natural resources of the Nexus from the perspective of the ECE region. Two sectors which are very relevant to the Natural Resource Nexus, namely, transport and trade, both of which are addressed by major ECE subprogrammes, are also considered.

### Energy

The ECE region accounts for 39 per cent of the global primary energy consumption and has significantly higher primary energy supply per capita than the global average, although there are significant variations within the region (see Figure 2).

Fossil fuels dominate the energy mix. Although the region has tremendous potential for sustainable renewable energy, so far, wind, solar, and geothermal with hydropower, biofuels and waste account for only 9 per cent of total primary energy supply (TPES). However, the share of renewable energy in total final energy consumption nearly doubled from 1990 to 2014 across the ECE region.

Figure 2. ECE energy mix (%) and regional share of global TPES (%), 2014.



Source: ECE (2017).

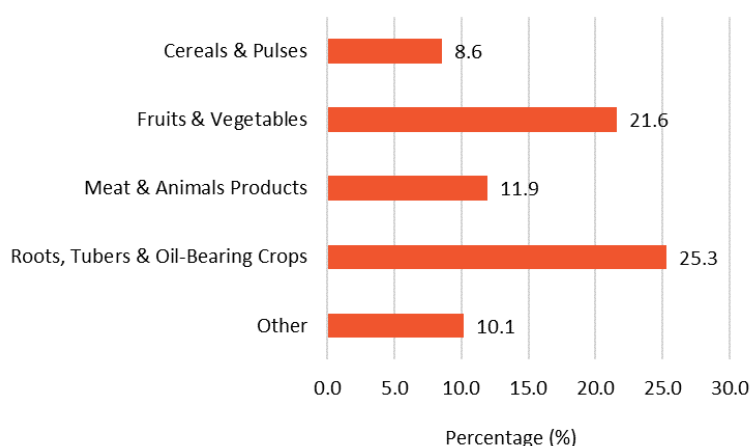
The ECE region has achieved 100 per cent access to electrical power networks and 98 per cent access to clean cooking fuels, but there are significant quality and affordability challenges. The rate of progress in improving energy efficiency and productivity is insufficient to meet Goal 7 (affordable and clean energy) of the SDGs.<sup>IV</sup>

## Food

To be able to feed the 9 billion people expected to live on the planet in 2050, food production would have to increase by more than 50 per cent, and food loss and waste have to be reduced by 20 to 40 per cent. While food security in the ECE region has improved substantially over the past two decades, recent estimates suggest 1.8 per cent of the total population in the ECE region (or 16.5 million people) are exposed to a severe form of food insecurity, while up 11 per cent (affecting more than 100 million people) may be exposed to moderate food insecurity.

The agricultural sector is moreover one of the primary land users in the ECE region, shaping landscapes throughout the region. There are however significant sub-regional variations, for example, while in 2014 agriculture used 66 per cent of the total water used in Europe, in the Mediterranean region this share was around 80 per cent. These issues are exacerbated by the fact that 88 million tonnes of food is wasted annually in the EU, the majority from households and processing. However, from an economic perspective, the agricultural sector creates value-added, trade and employment.

Figure 3. Global food loss and waste from post-harvest to distribution, by commodity group.



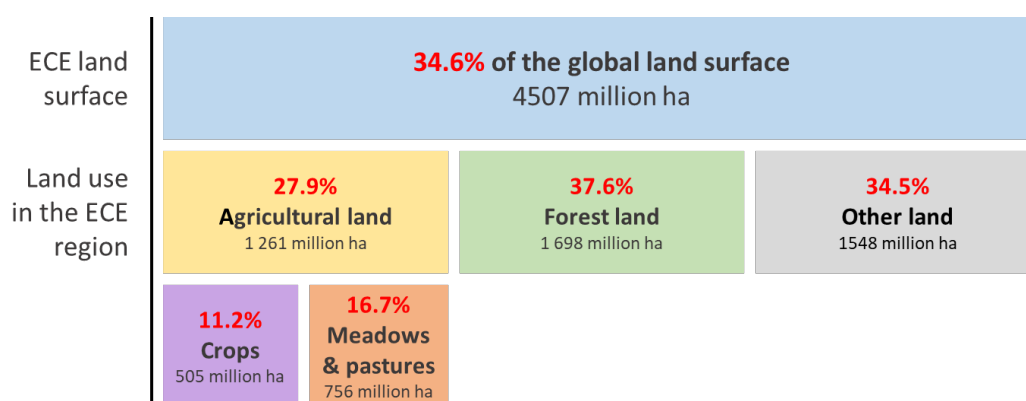
Source: FAO (2019).

There are also many nexus interactions between food supply and other natural resources, including the energy demand from intensive agriculture, energy supply from agriculture (e.g., renewable resources such as biogas and biomass), water demand from agriculture and water pollution by agriculture, as well as soil loss. These interlinkages highlight that the environmental impact of the agricultural sector needs to be significantly reduced.

## Land

Agriculture (croplands and pastures) accounts for less than 30 per cent of land use in the ECE region, although there are significant sub-regional variations. However, the expansion of the agricultural area in the ECE has been slowed by increasing productivity and food imports. The forest area in the ECE region has been increasing. Forests are also an attractive area from a nexus perspective, as they comprise several resources, such as land, water, materials, and energy, and are exposed to a wide range of often conflicting demands from industries, as well as societal demands.

Figure 4. Land use in the ECE region.



Source: FAOSTAT.

Land use interacts with all other natural resources: watershed management is a significant objective of land use planning, land use policy determines the availability of energy and material sources, whether from renewable or non-renewable sources. Biodiversity is also strongly influenced by land-use decisions.

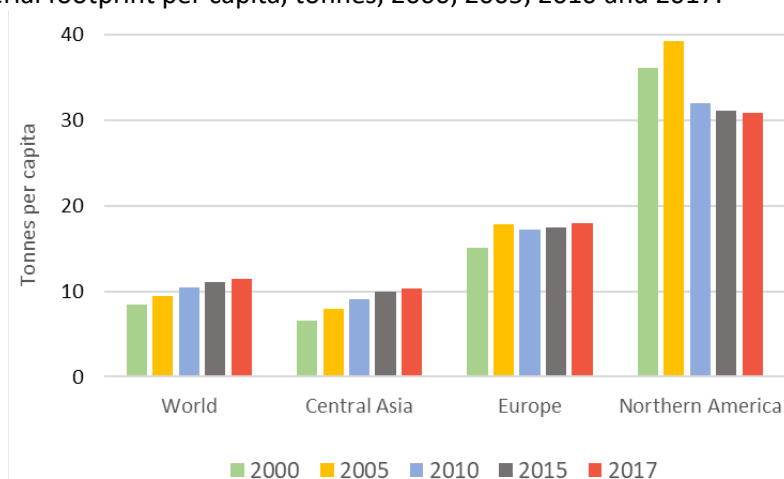
## Materials

The global use of materials (here defined as metal ores, non-metallic minerals, fossil fuels and biomass) has almost tripled since 1970 and has been accelerating. For the ECE region, material production has increased from around 13 billion tonnes in 1970 to approximately 20 billion tonnes from 1998 and onwards. The total material footprint generated by the ECE region has been about 25 billion tonnes from 2010 (see Figure 5). Material use contributes significantly to climate change, while the extraction and production of materials have significant effects in terms of land use, eutrophication, and acidification, as well as freshwater and terrestrial ecotoxicity.

The most substantial growth in materials use is projected to be in emerging and developing economies. In contrast, while there are no specific estimates on material use available for the ECE region, recent estimates for the OECD region demonstrate a rather stable trend, where decoupling has resulted in material use not increasing as rapidly as in other regions.



Figure 5. Material footprint per capita, tonnes, 2000, 2005, 2010 and 2017.



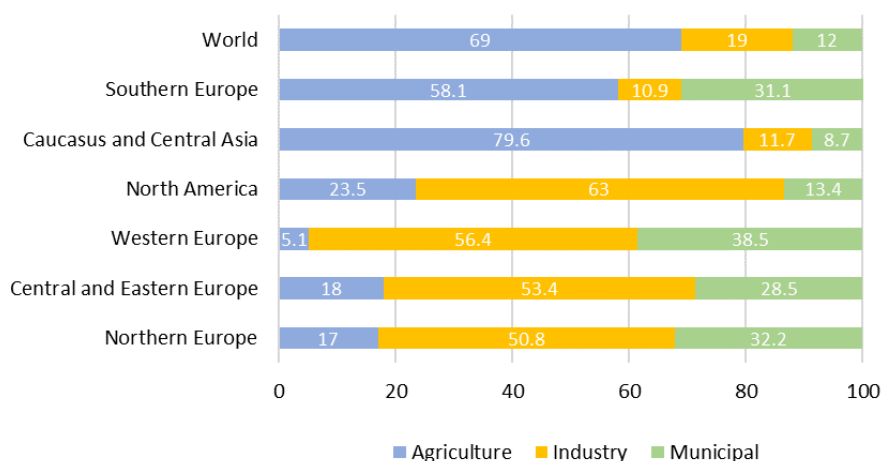
Source: ECE (2019).

## Water

While water from rivers, groundwater aquifers, and glaciers make the ECE region rich in freshwater there are areas of high-water stress, such as Central Asia, the Mediterranean and the Western United States. Fresh surface water use in the ECE region has stabilised and since 2011 surface water withdrawal in the region shows a downward trend. Careful water use by agriculture in some areas and integrated water resource management have contributed to this downward trend. Groundwater is the source of a much larger freshwater volume than surface water and is increasingly essential for water security in many countries. Groundwater withdrawal in the ECE region also stabilised, and from 2012, a declining trend is seen for the region. Transboundary cooperation is crucial for water management in the ECE region.

The variations in water use across sub-regions and sectors (see Figure 6) imply that reconciling different water uses at the basin level and improving policy coherence nationally and across borders will remain a priority in the ECE region.

Figure 6. Water withdrawals by region and type, 2015.



Source: FAO AQUASTAT.

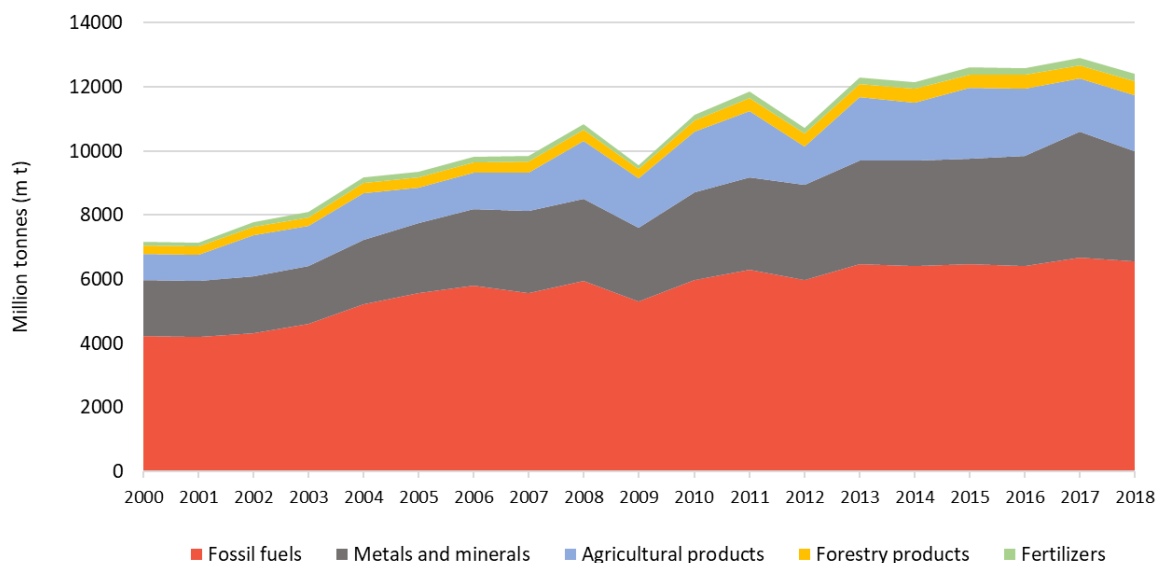
## Interlinkages with transport and trade sectors

Next to natural resource nexuses there are other nexus approaches undertaken by ECE. For instance, a nexus on sustainable transport, a nexus on smart and sustainable cities, and a nexus on monitoring the SDGs. Interlinkages between the natural resource nexus, and transport and trade, both of which are addressed by ECE subprogrammes, exist.

Not only do transport and trade have a significant direct impact on natural resource use, they also act as the interconnection between the resource nodes. For instance, globalisation has resulted in a global economy that is inherently interlinked, where integrative supply chains cross national and regional boundaries, making up a complex web of sectoral interactions at the global scale (see Figure 7). Transport and trade make this possible and are critical drivers of economic development, globally and regionally.

The increase in demand for natural resources means resource production must increase, and trade also must expand, as availability of supply and consumption are rarely in the same location. For example, an estimated 15 per cent of the globally produced resources become part of direct trade. For fossil fuels and metals, around half of the production of these commodities are traded. But directly traded resources are dependent on even higher volumes of resource production. The output of 10 billion tonnes of directly traded goods in 2010 required 30 billion tonnes of total resource production. These numbers show how relevant transportation and trade are as enablers of natural resource use and as fundamentally relevant for the study of the Natural Resource Nexus.

Figure 7. Global growth in the volume of natural resource trade, 2000-2018.



Source: Resourcetrade.earth.

## Looking ahead: global and regional megatrends

The megatrends listed below are only a small selection of issues that are commonly discussed and considered in relation to natural resource use. It is not an exhaustive list and principally serves the purpose of highlighting that nearly all trends and forecasts point in the same direction, namely, that the world and the ECE region will probably continue to utilise finite natural resources at unsustainable levels in the decades to come. However, the megatrends also serve to demonstrate some of the more complex interdependencies underlying natural resource use. These megatrends suggest that radical steps are needed to change the current trajectories.

## ► Continued population growth and urbanisation

Today there are 7 billion people on the planet, but around 9 billion are expected by 2050, and about two-thirds of the global population is projected to be living in urban areas at that point. For the ECE region, the forecast is that the population will be 16 per cent larger by 2030 as compared to 1994. It is, however, a heterogeneous picture. For instance, twenty countries, many of them in Eastern Europe, will see their populations decline by 2030. While the expected population growth in the ECE region varies across countries, the overall trend is nevertheless likely to have a significant impact on the region in terms of land use (e.g., the share of peri-urban areas in land use is growing faster than that of any other type of land use in Europe). Population growth will also have an impact on natural resources supply patterns (e.g., changing food demand may drive countries in the ECE region to seek resources elsewhere).

## ► Increasing competition for natural resources

The demand and use of material resources has increased by more than ten times since 1900 and is set to double again by 2030. Advanced economies remain resource-intensive – even if the resources originate, and are processed, in other regions. Thus, setting aside environmental implications, natural resource use will be characterised by increased global resource demand and increased uncertainty about resource supplies, although the potential for substitution and increased efficiency should not be underestimated. Despite improvements in resource efficiency, use and recycling, the ECE region may be impacted by the increased global demand and related competition for natural resources. This competition may have significant implications in the form of price rises and sectoral shortages.

## ► Continued economic growth

Economic output is expected to triple by 2050. However, future economic growth may contribute to increased resource scarcity. Economic growth generally also implies increased resource use and environmental degradation, implying a need to decouple natural resource use and environmental impacts from economic growth. The interdependence of economic systems furthermore means that individual countries and regions, including the ECE region, are increasingly affected by global economic activity. Thus, although resource efficiency is increasing, it is expected that economic growth will drive resource use and emissions to higher absolute levels.

## ► Increasingly severe effects of climate change

World leaders are committed to keeping the average global temperature rise compared to pre-industrial levels below two degrees Celsius, a threshold at which significant and irreversible environmental changes are likely to occur, although it is considered doubtful that this objective will be achieved. At the same time, the demand for natural resources is also expected to increase. Increasing demand for food will, in turn, have a significant knock-on effect on energy and water demand. In contrast, climate change may, in turn, reduce agricultural productivity by up to a third. Possible action to prevent this, in addition to GHG emission reduction, could include increased investments in agricultural productivity and increased agricultural area, reduction of food loss and waste, and changed consumption patterns. In a nutshell, in the absence of decisive action, climate change is expected to increasingly affect natural ecosystems and biodiversity, economic growth, and global food security as well as threaten human health.

## ► Growing pressures on ecosystems

Global and regional assessments indicate that biodiversity loss and ecosystem degradation will continue in the coming decades. For example, population growth, increasing demand for food, and climate change are expected to create significant threats to freshwater availability. The demand for goods and land has also resulted in alarming levels of tropical deforestation in recent decades. Likewise, drylands and wetlands are threatened by loss of biodiversity, and their transformation into cropland continues at alarming rates, resulting in water stress and soil degradation. All-in-all, these drivers of biodiversity loss will work against biodiversity protection measures. Continued ecosystem degradation will in turn also affect those ecosystem services that provide for our food, water, and other natural resources, creating a negative feedback loop that may generate regional instability and increasing risks of conflict. Having this in mind, crossing critical ecological tipping points could cause unparalleled environmental, social, and economic problems throughout the ECE region.

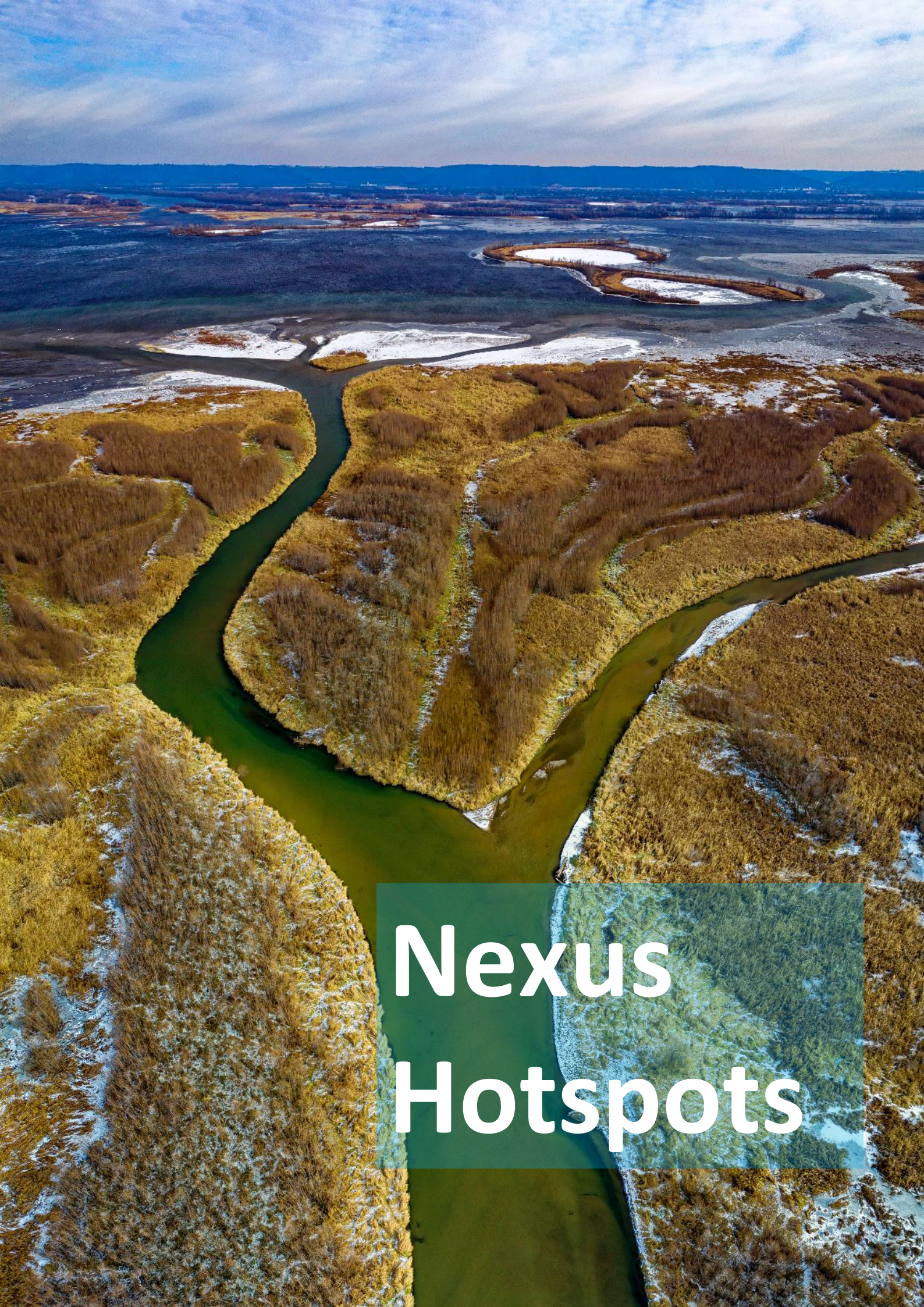
## ► Increasing environmental pollution

The significant increase in global production and consumption of natural resources, together with an increasing demand for food and energy, has had a massive impact on the environment. Environmental pollution is often a transboundary problem, significantly affecting water, soil, and air quality on the global level. Air pollution, unsafe water supply, poor sanitation and hazardous chemicals exert considerable pressures on human health and well-being. While there are some sub-regional variations, forecasts suggest that atmospheric pollution will continue to increase. Also, the release of pollutants to aquatic systems and soils as well as the eutrophication of aquatic ecosystems is expected to continue.

## ► Impact of the COVID-19 pandemic

The health challenges of COVID-19 for the ECE region and worldwide are daunting, with a serious potential loss of life, but also with significant short- and long-term impacts on socio-economic and environmental activities. Current demand and resource use trajectories are changing almost every day, and it is still too early to make any conclusive remarks with regards to how the future may look. It is however certain that things will change, at least in the short-term, and that these changes will have significant effects on natural resource use, globally. We have for instance seen global air traffic dropping by 60 per cent, significant improvements in air quality (e.g., falling nitrogen dioxide emissions) due to a reduction in road traffic, and a 25 per cent decline in energy demand in countries that have been in lockdown. Some products face shortages, others have exhibited high levels of food wastage due to falling demand. The structure of value chains, even of whole economies, may change in the post-COVID-19 recovery process and experiences gained during the pandemic period. While we may return to previous levels of economic activity as restrictions ease, serious questions concerning the recovery and future socio-economic models are now being discussed across the region. Discussions include the future of tourism and travel in general, the structure of supply chains, and increasing national self-sufficiency in certain goods, all of which could influence supply and demand of natural resources.





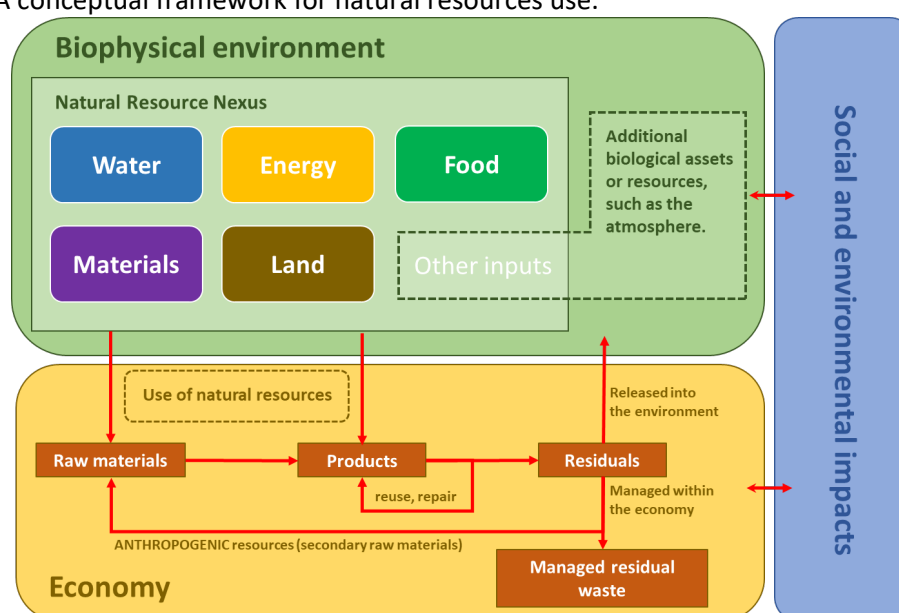
# Nexus Hotspots



## The Nexus Hotspots

The introduction briefly outlined the main characteristics of the natural resources nexuses in the ECE region, and of the necessity for a nexus approach, abandoning the silo approach which still prevails in many organisations including, until now, the ECE, which is still primarily structured along traditional and linear sectoral divisions. Underlying the thinking of this section, and the study as a whole, the nexus approach can generate relevant information about critical interlinkages that will enable decision-makers to plan for robust governance and management across resources and spatial scales (see Figure 8). The outcomes should be consistent with planning frameworks such as national development plans, sustainable development strategies, energy or agricultural transitions, or national forest programmes, all of which by their nature take a holistic approach.

Figure 8. A conceptual framework for natural resources use.



Source: own figure.

The study identifies and analyses seven nexus hotspots which showcase specific major challenges and opportunities for a nexus approach, considering core ECE expertise and products within this broader analytical framework, as well as regional megatrends and the SDGs. Focusing on nexus hotspots makes it possible to focus on solutions as well as to identify the knowledge demands, resource constraints and governance challenges that are unique to each hotspot. The nexus hotspots furthermore serve to present lessons learnt from the interdisciplinary nexus team while acting as case examples from a natural resource use perspective. Having this in mind, the hotspots in this publication showcase both ongoing work by the ECE as well as other areas of work seen as relevant from a nexus perspective. The nexus hotspots presented below are by no means an exhaustive list. Within ECE and in countries, many more linkages and nexus areas related to natural resource use can be identified. Moreover, the hotspots below also cover interlinkages across the nexus nodes, thus going beyond the Natural Resources Nexus to cover trade and transport.

This section briefly presents the hotspots which are explored in some detail in the full study. Recommendations arising from work on each hotspot are brought together at the end of the Summary.





## 1. The Food Loss and Waste Challenge

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There is significant loss and waste of food at all stages of the value chain, increasing the strain on natural resources and land, and increasing pollution and emissions unnecessarily. Understanding the scope of the food loss challenge can help guide actions to reduce food loss and waste as well as contribute to improved food access and security.

The food loss challenge is a nexus hotspot as it highlights the interdependencies and connections across different sectors at different levels of a supply chain, and there is the potential for significant savings, at an acceptable cost.

Preventing and reducing food loss and waste along the entire food value chain is a key priority to improve food security, the sustainability of food systems and address environmental challenges. This has been clearly recognised by the 2030 Agenda. However, for the food loss and waste challenge hotspot, no single innovation is likely to lead to a step-change in improved sustainability. The treatment of food loss and waste is instead a cross-cutting nexus issue which spans the globe and therefore must be addressed through a multi-sectoral approach

The ECE contributes to addressing the food challenges through its many efforts to develop impactful solutions with all stakeholders to keep as much food as possible in the human consumption chain to prevent, redistribute and revalue food loss along the value chain. This is done through constantly adapted quality standards for the safe and transparent trade of food and agricultural produce as well as a dedicated ECE food loss measurement methodology and the international Code of Good practice to avoid food loss, a handling guide for entire supply chains. In addition, ECE, together with other UN agencies and the private sector, has developed a new interactive trade and data measurement food loss management system (FeedUP@UN), supported by a blockchain, as part of a broader effort to prevent and reduce food loss and revalue food which would otherwise have been lost. Other examples include the UN/FLUX fisheries data management standard, developed by UN/CEFACT. In addition, ECE is also working on policy recommendations to assist governments in their transition to meaningful food loss and waste policies and circular economy approaches.



## 2. Life Cycle of Vehicles

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Vehicles use large volumes of natural resources, at every stage of their life cycle. This can be reduced if technical and policy choices are based on objective and comprehensive information through life cycle analysis.

Focusing on the life cycle of a product – as a nexus hotspot – is based on life cycle assessments being able to minimise natural resource use and environmental/climate impacts by accounting for the entire value chain, from production and trade of materials through manufacture and use of the vehicles, to recycling and re-use of the many components.

ECE contributes to the transport challenge in several ways. The Working Parties of the Inland Transport Committee (ITC) deal with intersectoral topics, such as pollution, energy, and noise, amongst other things. The work being carried out through these intergovernmental decision-making bodies contributes towards improving the environmental performance and energy efficiency of the transport sector. Examples include globally harmonised UN regulations, developed at the ECE, on the recyclability of motorised vehicles, which help to reduce the environmental footprint and life cycle impact of vehicle production and disposal, as well as ECE recommendations on fuel quality, which has

just been revised to adjust to the latest vehicle emission standards. Another example is the Transport, Health and Environment Pan-European Programme (THE PEP), which deals with the interlinkages between transport, health, and the environment.



### 3. Land Value Capture

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The value that is attached to land reflects how the public utilise natural resources (principally land) to generate social and economic benefits, as well as social priorities and resolve competing demands.

Land value capture (also known as value sharing) is a land-based tool or policy approach, that can be used to increase the value of urbanisation to support public investments. Land value capture is basically a process by which increasing land prices, generated through the provision of urban infrastructure and/or services, are used to finance these developments. It is a useful nexus hotspot to influence competing land demands and thus also natural resource use. It is included as an example of a financing tool for land-use planning that can reduce natural resource use. The concept can also be applied to ecosystem services in natural resource areas, although this aspect has not yet been addressed in an ECE context.

The ECE contributes to the housing and urban development challenges of the ECE region in several ways. The ECE Committee on Urban Development, Housing and Land Management has, amongst other things, recently called attention towards the use of land value capture in the provision of affordable housing. The Committee is furthermore active in the transition towards energy-efficient housing, has issued an action plan for energy-efficient housing in the ECE region in 2010. The work on energy-efficient housing, smart cities and land management addresses many of the intersectoral challenges and opportunities facing the housing sector, in particular the transition towards a carbon-neutral and circular economy, where new, innovative and integrative solutions are needed. Reducing the environmental footprint of urban areas and housing will, in the end, have a huge impact on natural resource use in the ECE region and globally. ECE has taken up land value capture as an innovative approach to finance transport infrastructure.



### 4. Natural Resource Use in Transboundary Basins

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Natural resource use is frequently coordinated in a holistic manner at the river basin scale. However, many basins include the land of several countries. For that reason, in many cases, it is not possible to promote sustainable and integrated natural resources management without also addressing transboundary coordination.

Reviewing natural resource use in a transboundary basin – as a nexus hotspot – addresses complex intersectoral dynamics as well as inherent transboundary complexities underlying natural resource use.

The ECE's work in this area is principally carried out under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention), which aims to ensure the sustainable use of transboundary water resources. The Water Convention effectively provides a legal and intergovernmental framework for promoting an intersectoral approach to water management, which, amongst other things, includes the implementation of integrated water resources management. The Protocol on Water and Health to the Water Convention is a legally binding instrument in the pan-European region that aims to stimulate national action to protect

human health by better water management and by reducing water-related diseases. Specifically, the Protocol promotes intersectoral dialogue on water, sanitation, hygiene, and health at the national level, bringing together environment, health, regional protection, social protection and other sectors. The ECE contributes to the water management challenges in several ways. One objective of the work has been to address the water-food-energy-ecosystems Nexus: The transboundary basin nexus assessment methodology provides for a participatory assessment of natural resource use and management issues in transboundary basins, as well as for identification synergy opportunities and solutions to the trade-offs. This work has principally been done through the Task Force on the Water-Food-Energy-Ecosystems Nexus. The Working Group on Integrated Water Resources Management (IWRM) and the Working Group on Monitoring and Assessment under the Water Convention focus explicitly on the integrated management of transboundary water resources and on establishing programmes for monitoring the conditions of transboundary waters.



## 5. Measuring the use of natural resources with the System of Environmental-Economic Accounting

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This hotspot is about the role of data in natural resource management and the need for integrated monitoring, based on comprehensive and integrated data systems.

The System of Environmental-Economic Accounting (SEEA) is an international statistical standard of an accounting system that provides a systematic way to measure and report on stocks and flows of natural capital. The underlying idea is that the environment should be recognised as an asset that is maintained and managed, and its contributions should be integrated into commonly used frameworks, such as the System of National Accounts. The SEEA is a useful nexus hotspot to demonstrate the added value of integrating data, which would be a necessary step for considering any nexus topic.

ECE contributes to the data challenge in several ways. One objective of ECE has been to promote the SEEA and to support countries in its implementation. This is – amongst other things – achieved through an annual joint seminar with OECD on the implementation of SEEA, as well as assisting countries in developing methodologies to produce and share specific environmental indicators, such as indicators produced from SEEA. ECE is also regularly engaged in addressing the lack of environmental data throughout the ECE region, for example, through the implementation of the Shared Environmental Information System (SEIS) in Central Asia and Europe. The Steering Group on Statistics for SDGs of the Conference of European Statisticians has been involved in issuing guidance to national statistical offices on producing statistics for the SDGs, highlighting efforts to support the establishment of national mechanisms that can tackle an integrated policy agenda.



## 6. Forest Landscape Restoration

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There are millions of hectares of degraded land in the world, including the ECE region. Significant efforts are needed to restore this land to a sustainable state. Forest landscape restoration is a nature-based solution to regaining environmental sustainability and enhancing human well-being through multi-functional healthy landscapes. It is a promising systemic approach which may help to reconcile fundamental trade-offs at a landscape level. Regaining landscape sustainability, conserving biodiversity, and improving food and water security, increasing climate resilience and reducing disaster risks are among multiple benefits of forest landscape restoration.

As a nexus hotspot, forest landscape restoration is convincing, although its primary objective is to restore forests, it focuses more broadly on landscapes, representing a mosaic of interacting land uses and sectors under different governance systems.

The ECE has worked on matters related to forests jointly with FAO since 1947. Through the work of the joint ECE/FAO Forestry and Timber Section, it contributes to addressing the forest land degradation challenge in several ways. For instance, the ECE runs the Secretariat of the ECCA30 initiative with the IUCN, FAO, World Bank, and World Resources Institute. ECCA30 initiative was launched in 2019, seeking to bring 30 million ha of degraded and deforested land in Europe, the Caucasus and Central Asia into restoration and accelerating the achievement of the global Bonn Challenge target of 350 million hectares, by 2030.

The Joint Section has also carried out studies providing the first overview of the state of forests in the Caucasus and Central Asia and of the potential to restore forests in the Caucasus and Central Asia and Eastern and in South-Eastern Europe. It assisted member States in developing their Strategies on Landscape Restoration and Greening Infrastructure and National Forest Programmes, and built their capacity in understanding mechanisms for financing forest landscape restoration.

In addition to the work on forest landscape restoration, the Joint Section has recently integrated the analysis of circularity concepts and their links to forest-based sectors, in its work (e.g., through organisation of discussion panels and preparation of stock-taking documents). Furthermore, the Section has recently integrated the circular concepts in its work on forests. The promotion of integrative management approaches and measures towards a circular economy demonstrates ongoing efforts to address the intersectoral challenges facing the forest-based sector and the need for integrative solutions.



## 7. Integrated Management of Energy Resources

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The concept of an integrated sustainable energy system can be described as a system that allows infrastructure and energy generation capacity to be used more efficiently. One key reason for choosing integrated management of energy resources as a nexus hotspot is due to the application of a systems approach as a relevant nexus perspective on natural resources use.

The ECE contributes to the sustainable energy challenge in several ways. For instance, the ECE has recently completed the first phase of a project that seeks to help countries develop, implement, and track national sustainable energy policies. The project basically supports countries in the ECE region to reach sustainable energy objectives, including the development of an early-warning system to monitor progress. Other efforts support the uptake of renewable energy and improve energy efficiency in the region. The United Nations Framework Classification for Resources (UNFC), is another example of how the ECE provides guidelines and best practices for the energy and mineral sectors which fully integrate social and environmental considerations as part of achieving affordable and clean energy. For example, under UNFC, new standards for the assessment of solar and wind energy resources have recently been developed. From a nexus perspective, it is also interesting to note a project on integrated energy and water resource management project in South-East Europe and Central Asia, highlighting an increased awareness about water-energy intersectoral links and impacts. To provide comprehensive support to integrated resource management, ECE is developing the United Nations Resource Management System (UNRMS).

## The Nexus Hotspots and the Circular Economy

The Circularity Gap Report presented at the 2019 World Economic Forum Annual Meeting in Davos estimates that only 9 per cent of the global economy is circular today. This emphasises the need for efficient and integrated management of natural resources (energy, food, land, materials, and water) to address some of the most significant societal challenges, such as climate change, economic, environmental and social security. Innovative approaches, such as a circular economy, may become key to encourage nexus thinking along value chains, providing opportunities for the development of cross-sectoral policies.

Box 1. Nexus hotspots on food and energy from the circular perspective.

### Reduction of food loss and waste through a circular approach

In a circular economy, natural resources use is based on closed-loop systems to ensure resources are conserved with given product life cycles. With regards to food waste management, the concept of the circular economy has the potential to place greater responsibility on retailers and food sellers to ensure that food waste and loss are minimised. By fighting food waste and loss through a circular economy model, it is possible to factor in socio-economic and environmental effects associated with any food loss and waste reduction strategy, considering different regional specificities as well as infrastructure, energy, markets, and education as part of a complex and interlinked food system.

### Circularity in an energy system

Energy systems are particularly problematic from a circular perspective, as energy production often involves using natural resources (e.g., biomass and coal), whether they are renewable or not. The same applies to other energy sources, such as hydro, wind and solar power, which require large areas of land that may affect environmental conditions and compete with other land use (e.g., food production). Furthermore, in most cases, energy, once used, cannot be reused or recycled. Moreover, energy systems are capital intensive and have lifetimes of forty years or more, with hydro-electric dams having more than 100 years of life. This emphasises some basic challenges underlying circularity. From a nexus perspective, it further demonstrates that balancing energy demand and supply will not only require increasing resource-efficiency and improved natural resources management but also taking a systems approach whereby all relevant sectors are involved in the implementation of integrated solutions.

The examples in Box 1 have been limited to two of the hotspots in this report but are applicable across all of them. The complementary approaches of the circular economy and nexus thinking provide new opportunities and innovative solutions better able to address complex societal challenges. In a nutshell, nexus policies are on the one hand, not only a means of signalling interactions between policy domains but also a participatory approach oriented towards finding consensus on natural resource use. On the other hand, the circular economy transforms other materials (such as waste) into opportunities, allowing for materials previously discarded to become a resource within the economy. From this perspective, the nexus approach and the circular economy are mutually reinforcing.



An aerial photograph of a dense forest, showing a variety of green trees and some patches of brown and orange, possibly indicating dead trees or autumn foliage. A semi-transparent dark green rectangular box is overlaid on the bottom portion of the image, containing white text.

**Pathways to  
integrative natural  
resource management**



## Pathways to integrative natural resource management

Integrated natural resource management can benefit greatly from nexus thinking. The interlinked nature of the SDGs, including the ones related to natural resources, requires an implementation approach that is holistic, multi-sectoral and multidimensional – essentially a nexus approach. Moreover, understanding the interconnections in the Nexus between the natural resources and their respective sectoral interdependencies can be one of the keys to the successful implementation of a circular economy framework.

The report offers suggestions for possible next steps in the ECE region. It aims to describe an ambitious but realistic pathway for the ECE region to incorporate the nexus approach wherever it is appropriate and thereby increase the effectiveness of policy instruments and their implementation/application to address complex natural resource issues. The nexus approach offers opportunities to improve policy coordination and coherence. Even more, expanding nexus frameworks that consider interactions between sectors, across scales, between sub-regions, and linkages with the SDGs, could help ensure sustainable natural resource management and use as well as an integrated SDG implementation.

### Tools already offered by the ECE

The ECE has already tools in various subprogrammes which can be applied to address nexus issues. They have several common features:

- are based on in-depth analysis of the complex interactions, using the best available data.
- take a holistic and long-term approach, considering not only intersectoral impacts but also environmental, social and economic dimensions when seeking the optimal path forward.
- have a participatory element, with the consultation of stakeholders.
- contribute to achieving the SDGs and targets of Agenda 2030, and are in conformity with the principles of the United Nations.
- have emerged from a “bottom-up” process, wherein subprogrammes or lower-level expert or intergovernmental bodies have realised that a nexus approach is necessary to address the complex issues in their sector.

The tools include conventions, a charter and a policy platform, standards and good practice guidance, strategies, an accounting system, data connected tools and dedicated projects and capacity-building. Their formal structure varies widely, as does the extent to which they are taken up by policymakers and stakeholders.

From the nexus hotspots, it would further appear that there is scope for ECE bodies and communities to learn from each other’s experience in applying the nexus approach to natural resources, and for the ECE region itself to reinforce its leadership in these efforts, without imposing artificial homogeneity. Indeed, this has been one of the reasons for preparing the present study.

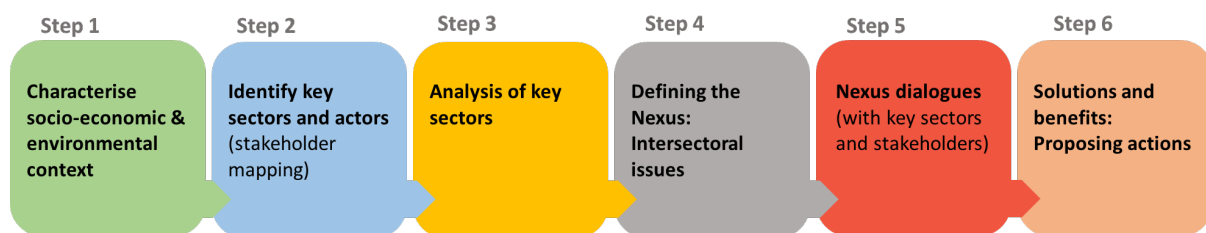
### Developing innovative nexus-relevant tools

Given the bottom-up nature of the ECE’s nexus-relevant tools, it is possible that there are some natural resource areas where a nexus approach would be appropriate, but which have not yet been developed. Where this is the case, to benefit from experience within the ECE, a process that can identify “nexus pathways” has been developed, based largely on experience with water and energy-related nexus activities that have been carried out (see Figure 9).<sup>i,ii</sup> The approach has been left

intentionally broad as it is foreseen that it could be applied at many levels, ranging from the identification of new nexus-relevant activities for the ECE to helping politicians, decision-makers and project managers consider intersectoral issues within the scope of their activities.

This standardised approach would aim at identifying, assessing, and classifying synergies and trade-offs between the natural resource that is being examined and other sectors. This process should ideally identify gaps and barriers that exist both for the natural resource that is being analysed and the sectors involved. Following below is a proposed step-by-step process for how this could be achieved, as adapted from existing ECE practice.

Figure 9. Identifying a nexus pathway.



Source: ECE (2018a), and ECE (2018b).

The process has been left intentionally open to allow for modification and application to varied scales, contexts, and nexus challenges. However, the aim of the process should ultimately be to propose actions that can address interlinkages and propose actions and measures that can mitigate any negative impacts generated by these interlinkages. The analysis, as well as the development of possible actions, should ideally be anchored in a multi-stakeholder dialogue, both to collect data but also ensure that proposed actions are accepted and taken up.

### Building capacities for nexus implementation

The establishment of a nexus team on natural resource use in the ECE and the development of this report has demonstrated the potential added value in taking a nexus approach further within the UN development system in the ECE region. Both at the country level in United Nations Country Teams (UNCTs), and in government administrations. In practical terms, embedding nexus thinking and the establishment of nexus teams at the country level, whether within institutions or across sectors, to identify synergies and trade-offs, facilitate cross-sectoral coherence, can help to ensure sustainable natural resource management. The nexus approach provides some of the tools needed for countries to improve institutional and national capacities to tackle intersectoral challenges with regards to key societal challenges for natural resource management.

First, there are many ECE countries which do not yet have the capacity to implement activities which are often different from existing practice, especially when they call for breaking down traditional institutional boundaries, for instance among ministries. It is often these countries which have the most need for a nexus approach. For that reason, the development of nexus tools addressing natural resource use needs to be accompanied by capacity-building efforts. ECE has considerable experience in this type of activity, notably in the Caucasus and Central Asia, and is well placed to deliver this work.

Second, capacity building and sustainable development education should be cornerstones of operationalising nexus approaches and methods that advance the sustainable management of natural resources. This can only be achieved by creating an enabling environment and building nexus competences and knowledge on how to apply nexus concepts and methods in practice. One key recommendation would thus be to develop a learning programme and strategy as part of any

continued efforts to apply a nexus approach at the ECE, including the involvement of relevant UN Country Teams.

## Nexus principles for the sustainable use of natural resources

The nexus approach offers a window of opportunity for understanding, and in some cases resolving the trade-offs underlying unsustainable natural resource use as well as the interdependencies across sectors, stakeholders, and natural systems. The nexus hotspots in this report demonstrate that systemic thinking and integrated solutions need to guide the development and implementation of nexus solutions as they relate to natural resource use. Perhaps more importantly, there is a demand for solutions that are applicable across regions and their related nexuses.

One additional way forward in building capacities for nexus implementation would be to develop nexus principles that can be context-specific and applicable to any scale. For instance, every country may require different nexus approaches, including different methods for addressing variations within countries (e.g., related to consumption patterns and resource use intensities) that in turn, require specific nexus solutions. Although solutions may vary significantly depending on the context, taking a full life-cycle view and circularity, as some of the possible principles, could help in identifying approaches that ensure the sustainable use of natural resources.

## Recommendations

On the basis of the analysis of the study, and the experience of ECE channelled through the natural resource's nexus team, the following recommendations are proposed.

### 1. Addressed to member States: governance, participatory decision-making, and the rule of law

1. Promote integrated approaches to natural resources through mutual reinforcing and cross-referring at applicable levels of policy and decision making.
2. Recognise the added value in taking a nexus approach when considering key societal challenges regarding natural resource management as well as the need for improved institutional and national capacities to tackle these intersectoral challenges.
3. Encourage effective public access to information using Open Data, the interoperability of information systems and new and emerging digital technologies across different domains to identify nexus hotspots, inform decision-makers and raise public awareness.
4. Promote legal obligations and good practices for inclusive and effective public participation in decision-making and for multi-stakeholder dialogues to address the most sensitive areas of decision-making (e.g., energy, water, land, food, and materials).
5. Apply effective and systematic strategic environmental assessment and environmental impact assessment.
6. Encourage the development and use of eco-labelling, eco-auditing, and other means to support sustainable consumption and production.
7. Promote legal obligations and good practices for the protection of environmental defenders against penalisation, persecution, or harassment for exercising their rights in relation to the use of natural resources.

## 2. Addressed to ECE policy level bodies: strengthening ECE's contribution to the nexus approach for natural resources

1. Improve existing tools, possibly broadening their scope or how they complement and reinforce each other to form effective toolkits, raising their ambitions, or developing new partnerships inside or outside ECE region (see recommendation set 3).
2. Engage in an internal consultation process to further refine and agree on how the nexus approach could benefit the organisation and its respective sub-programmes, including efforts to get the units to communicate and cooperate more regularly on intersectoral issues (this consultation process is being implemented in parallel with the preparation of this study).
3. Develop new tools, with consideration of combining/incorporating existing ones, developed by sectors, where their usefulness is clear, after a review of ECE's activities to determine where new tools would be appropriate.
4. Build in-house capacity and knowledge for ECE staff to develop and implement a nexus approach in their respective areas of work, using tools supplied by ECE and/or partner organisation.
5. Engage relevant partners and countries in a dialogue to explore how the nexus approach could enhance regional cooperation and communication on nexus-relevant topics.

## 3. Addressed to ECE subprogrammes and expert bodies, and the appropriate expert communities in member States: developing and strengthening the activities described under the nexus hotspots

### 3.1. Food loss and waste

1. Work with more integrated approaches to food loss and waste with relevant intergovernmental bodies on water, land, and energy as well as through projects.
2. Identify needs gaps in the ECE inventory of guidelines and methodologies on food loss and waste and define inter-disciplinary approaches.
3. Identify new partnerships with all stakeholders to further interdisciplinary work on food loss and waste.
4. Extend assistance to the implementation of the standards and guidelines by all ECE countries considering inter-disciplinary approaches and linkages.
5. Raise awareness of food loss and waste all over the ECE region.
6. Build capacity, especially in the Caucasus and Central Asia, with the aim of improving quality, handling and transport of food and setting clear (numerical) targets for the reduction of food loss and waste.
7. Develop plug-ins into the ECE Smart Food loss management tool (FeedUP@UN) to integrate all available ECE tools, standards, and conventions.

### 3.2 Life cycle of vehicles

1. Invite participation of representatives of the transport sector in work on land use planning
2. Find synergies between ECE work on energy scenarios and transport infrastructure and technology
3. Use expertise from the Transport subprogramme to identify the contribution of the transport sector to pollution emissions in the ECE region, in the light of relevant ECE environment conventions, and consider how the situation could be improved and what ECE's role should be in this area.

4. Identify gaps in the ECE system of transport-related regulations regarding this nexus hotspot. For instance, is there a need for an official standard for Sustainable and Resilient Infrastructure?
5. Strengthen the work on the implementation of the standards and guidelines, including monitoring their use, and building capacity where necessary.

### 3.3 Land value capture

1. Arrange systematic comparisons of land-relevant instruments under ECE bodies, for instance, national forest programmes and integrated water resources management, with concepts of land-use planning and river basin management plans. The various strategies and approaches should be mutually reinforcing and cross-referring.
2. Monitor to what extent the concept of land value capture is being applied, and identify possible obstacles, and lessons learned.
3. Collect examples of good practice regarding land value capture, and prepare guidelines
4. Improve awareness of the potential of land value capture.
5. Implement capacity-building adapted to local circumstances in the Caucasus and Central Asia, where urbanisation is proceeding rapidly.

### 3.4 Natural resource use in transboundary basins

1. Develop cross-cutting activities building on current ones which can contribute to natural resource management in transboundary basins, in the following key areas: water-forestry, water-energy, water-energy-land use-ecosystems, climate adaptation and mitigation strategies, financing sustainable development in shared basins.
2. Promote ECE multi-lateral environmental agreements as nexus tools.
3. Promote the application of the ECE nexus assessment methodology for transboundary basins (ECE, 2018a, 2018b) and the ECE toolkit for sustainable renewable energy planning in transboundary contexts (ECE, 2020a, 2020b).
4. Invite extended participation from both inside and outside ECE to use the Task Force on the Water-Food-Energy-Ecosystems Nexus for identifying nexus solutions and investments (synergic actions), sharing of experience and capacity building.
5. Organise joint sessions or back-to-back events between ECE bodies, e.g., between the Working Group on Integrated Water Resource Management and relevant sectoral committees.

### 3.5 Measuring the use of natural resources with the System of Environmental-Economic Accounting (SEEA)

1. Support the implementation of SEEA and production of underlying data (with specialist agencies, notably in ECE). Further, develop methodologies for SEEA-based indicators, and carry out capacity building activities, together with national and international partners in the region.
2. Develop a proposal to use big data and environmental monitoring data in real-time and pollutant release and transfer registers, to provide information on the flows (e.g., energy, waste and air pollution), and thus help to manage natural resources more efficiently.
3. Systematically review the data situation for all nexus hotspots, possibly helping to gather or mobilise data, and/or integrating data used/generated in the nexus work into the Conference of European Statisticians (CES) data structure.

### 3.6 Forest landscape restoration

1. Improve methodology, monitoring and knowledge on landscape degradation in the ECE region.
2. Develop methodology and good practice guidance in forest landscape restoration tailored to the ECE region.
3. Support the cooperation of the Joint ECE/FAO Forestry and Timber Section, with other ECE units (water, energy, land) as well other partners (e.g., IUCN and the World Bank) in promoting forest landscape restoration.
4. Assist countries of the region, notably of the Caucasus and Central Asia, and Eastern and South-East Europe in implementing their commitments with regard to forest landscape restoration (e.g. under the ECCA30/Bonn Challenge), including in their work on mobilisation of resources for that purpose. Support development of National Forest Programmes and financing strategies as an inclusive tool to promote the involvement of other sectors in sustainable forest management, including forest landscape restoration.
5. Review and update the Rovaniemi Action Plan for the Forest Sector in a Green Economy (2013), which is based on a nexus approach, and as part of the ECE move towards a circular and bio-based economy.
6. Continue to monitoring the sustainability of forest management in the region, and support member States in achieving sustainable forest management.

### 3.7 Integrated management of energy and mineral resources

1. Promote the implementation and use of the UN Framework Classification of Natural Resources (UNFC), including capacity building, and consulting other relevant ECE bodies (e.g., forest, water, statistics).
2. Strengthen the integrated and holistic management of energy and mineral resources through the application of United Nations Resource Management System (UNRMS).
3. Adopt circular economy principles, and natural resources use based on closed-loop systems ensure resources are conserved within given product life cycles.
4. Provide a focus on the critical materials required for sustainable energy.
5. Application of UNFC and UNRMS in sustainable resource management could be useful for Micro, Small, and Medium Enterprises (MSMEs) to build innovative business models and to gain from the new avenues that are being opened in a post-COVID-19 world.
6. Take actions to increase women entrepreneurship in sustainable resource management value networks.
7. Review the status and possible availability of renewable energies, including links to agriculture, forestry, and water.
8. Include energy aspects in Environmental Performance Reviews (EPRs).
9. Ensure “Social License to Operate” in sustainable resource management through responsive, inclusive, participatory, and representative decision-making at all levels.
10. Support the adoption of UNFC and UNRMS through the creation of International Centres of Excellence in Sustainable Resource Management.



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