Economic Commission for Europe

Committee on Environmental Policy Conference of European Statisticians

Joint Task Force on Environmental Statistics and Indicators

Eighteenth session

Geneva, 18 and 19 October 2021

Item 5 of the provisional agenda

Ongoing developments with relevance for the work of the Joint Task Force

Next pan-European environmental assessment – draft elements – *as of 12 October 2021*

Note by the Secretariat

Summary

The Working Group on Environmental Monitoring and Assessment has been tasked by the Committee on Environmental Policy with leading a process of consultation on the regular pan-European environmental assessment (ECE/CEP/2017/2, annex II, para. 2 (b)) for consideration by the Committee and leading up to the next Environment for Europe Ministerial Conference.

At its twenty-fifth session (Geneva, 13–15 November 2019), the Committee welcomed the information provided by the secretariat and the United Nations Environment Programme (UNEP) on the next pan-European environmental assessment. Furthermore, it requested the secretariat and UNEP, working in close cooperation with the European Environment Agency, to prepare a limited indicator-based and thematic assessment, and to regularly inform the Bureau of progress made (ECE/CEP/2019/15, para. 37 (k)). At its twenty-sixth session (Geneva and online, 9 and 10 November 2020), the Committee rescheduled the next Ministerial Conference, to be held in Nicosia, for 5–7 October 2022 (ECE/CEP/2019/15, para. 19 (a)).

The present document summarizes progress made in preparing the next pan-European environmental assessment.

Introduction

The mandate for this work is included in the first chapter of the annexed draft elements of the next pan-European environmental assessment. The structure of the assessment is as set out in the Updated draft outline of the next pan-European assessment (ECE/CEP/AC.10/2020/6/Rev.1). The annex to the present document presents the draft assessment as developed so far. The structure of the annex largely corresponds to that of the final assessment report.

Austria, Germany, the Netherlands, Norway, Serbia and Switzerland contributed financially to supporting the preparation of the next pan-European environmental assessment. With these resources, consultants and institutions have been contracted to prepare thematic sections of the assessment. A critical step in each section's development is selection of suitable indicators on which to base the assessment.

The secretariat has provided indicator selections and other draft elements to the Working Group on Environmental Monitoring and Assessment and other experts to seek their views. Initial elements were presented to the Working Group at its twenty-second session (27 October 2020) and then to the twenty-third session (4–5 May 2021). Later, further elements were posted on the ECE Statistical Division wiki website[1] to allow for their review.

Some data series used in the assessment will be revised as data for 2020 become available.

The table below illustrates progress made in developing the thematic sections.

Progress in developing thematic sections

Chapter and theme	*Consultant contracted*[a]	*Indicators*	*Draft section*	*Contract completed*
A. Atmospheric air	Yes	Agreed	See annex	Yes
B. Climate change	Yes	Agreed	See annex	Yes
C. Fresh water	Yes	–	–	–
D. Coastal waters, marine ecosystems and seas	Yes	Agreed	See annex	Yes
E. Biodiversity and ecosystems	Yes	Agreed	See annex	Yes
F. Land and soil	Yes	Agreed	See annex	Yes
G. Chemicals and waste	Yes	Agreed	See annex	Yes
H. Environmental financing	Yes	–	–	–
A. Greening the economy in the pan-European region: working towards sustainable infrastructure	Yes	Yes	See annex	–
B. Applying principles of circular economy to sustainable tourism	Yes[b]	Yes	See annex	Yes

[a] Consultant or institution. [b] A follow-up contract is due to review inputs.

[1] Available at https://statswiki.unece.org/. Credentials to access the consultation page are available from the secretariat.

Annex

Draft assessment

Foreword

To be added. .

Acknowledgements

To identify donors, authors, reviewers, etc. .

Key findings and policy messages

Renamed as “Highlights” overleaf. Further sections are needed to cover freshwater, environmental finance and the two conference themes. .

Highlights

1. Greenhouse gas emissions

All pan-European countries commit to reduce greenhouse gas emissions, but net emissions in the region are still rising. Efforts and achievements are unevenly distributed throughout the region.[2] Reductions, which are mostly achieved in the western part of Europe (2014–2018), are three times less than the increase in emissions in the rest of the region. National commitments under the Paris Agreement were renewed by 35 countries in the region with more ambitious targets. However, some countries still do not have firm, quantifiable commitments or mechanisms to follow the progress towards them, which results in significant data gaps.

Recommendation: Governments in the pan-European region should establish the conditions for medium- and long-term sustainable mobilization of funds for climate action both by accelerating the use of available regional and global funds and mechanisms and by creating national financial instruments.

	European Union	Western Europe	Central Asia	Eastern Europe	South-Eastern Europe	**Pan-European region**
Greenhouse gas emissions (2014–2018) (percentage change)	→ (-0.3%)	↗ (-9.2%)	↘ (+13%)	↘ (+4.0%)	↘ (+12%)	↘ (+1.7%)

Note: trend is ↗ improving (emissions falling), → stable or ↘ worsening.

2. Decarbonization

Decarbonization is becoming a strong narrative across the pan-European region, but action lags behind. The use of renewables was increased in 29 countries in the pan-European region in the period 2013–2017, but the region still largely relies on fossil fuels – some 78 per cent of the total final energy consumption in average comes from fossil fuels. The penetration of renewables in the energy mix rises more slowly than the increase in the total final energy consumption in the region. Despite the example of the Montreal Protocol on Substances that Deplete the Ozone Layer, which has had positive effects on human health and the environment, the phasing out of hydrochlorofluorocarbons present as coolant in refrigerators and air conditioning systems remains incomplete, especially in countries with economies in transition.

Recommendation: Governments in the pan-European region should eliminate or reform harmful subsidies and incentives, and to develop effective positive incentives to deepen decarbonization, by phasing out fossil fuel subsidies and shifting promotion of investments towards renewable energy.

	European Union	Western Europe	Central Asia	Eastern Europe	South-Eastern Europe	**Pan-European region**
Renewable energy share in total energy consumption (2014–2018) (latest rate)	→ (18%)	↗ (18%)	↗ (4%)	→ (4%)	→ (14%)	→ (13%)

Note: trend is ↗ improving, → stable or ↘ worsening.

[2] Throughout the assessment, where feasible and relevant, the following subregions are referred to: (a) European Union, comprising 27 member States, i.e., without the United Kingdom of Great Britain and Northern Ireland; (b) Western Europe, comprising non-European Union high-income countries and including Israel; (c) Central Asia, comprising Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan; (d) Eastern Europe, including the Caucasus and the Russian Federation; and (e) South-Eastern Europe, comprising Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia and Turkey.

3. Ecosystems

The status of ecosystems remains a cause for concern, with no evidence of a clear positive trend. Only a minority of the habitats assessed at the European Union level have a good conservation status, and the overall picture is likely to be similar in the remaining region. The relative share of the particularly biodiversity-rich primary forests has declined significantly over the same period.[3] Forest fragmentation remains an important pressure. There are significant variations in the proportion of sustainable fish stocks. The Mediterranean Sea and Black Sea remain highly overfished, whereas signs of recovery of fish stocks can be observed in the North-East Atlantic Ocean and the Baltic Sea as a result of improved management decisions.

Recommendation: Governments in the pan-European region should establish the conditions for medium- and long-term sustainable mobilization of funds for biodiversity and other environmental components both by accelerating the use of available regional and global funds and mechanisms and by creating national financial instruments. Governments should also eliminate or reform harmful subsidies and incentives, and to develop effective positive incentives to mainstream biodiversity conservation across sectors and policies, promoting biodiversity conservation and sustainable use of resources. Further, Governments should ensure that trends in forest area remain positive and take additional measures to safeguard the remaining primary forests and their ecological functionality, for example, by promoting management standards aimed at preserving high-conservation value forest and by enhancing forest connectivity.

	Pan-European region
Primary forests (2015–2020) (change)	↘ (-3.1%)
Naturally regenerating forest (2015–2020) (change)	→ (-0.1%)

Note: trend is → stable or ↘ worsening.

4. Protected areas

At the same time, **the protected area estate in the pan-European region has almost tripled, and the overall forest area in the ECE region has increased by 33.5 million ha over the past 30 years.** The coverage of marine protected areas increased over the period 2000-2019 but is 6.7 per cent for the overall pan-European area (below the 10 percent of Aichi target 11). Despite progress in terrestrial and marine protected areas, overall biodiversity loss continues to occur.

Recommendation: Governments in the pan-European region should consolidate and improve the extended protected area network in the region through investment in management effectiveness, ecological representativeness and connectivity. Further efforts are needed, in particular in Eastern and South-Eastern Europe, to achieve the target of conservation of 10 per cent of coastal and marine areas in the pan-European area.

	EEA member and cooperating countries, plus United Kingdom	Eastern Europe (without Russian Federation)
Trend in protected area coverage and status (latest proportion)	↗ ☺ (30%)	↗ 😐 (8%)

Note: trend is ↗ improving, while status is ☺ (above Aichi target of 10 per cent) or 😐 (below but close to target).

[3] This trend mostly occurs in Russian Federation, which is also one of the top three countries in the world in terms of area of primary forest.

5. Land use

Land use and land-use change dynamics in the pan-European region continues to be mainly driven by agriculture. Erosion can be further reduced in most affected areas by implementing conservation agriculture. Conservation agriculture practices in the pan-European region may also play an important role in carbon sequestration and raising soil productivity by increasing soil organic carbon content. In Eastern Europe the average rate of soil erosion decreased over the last 30 years following massive cropland abandonment and climate change. In the Russian Federation, the total amount of washed soil and the rate of erosion have been reduced by 56.1 and 15 per cent respectively in the last 30 years due to the widespread abandonment of cropland and lower spring runoff. In Central Asia, wind erosion is a dominant type of land degradation. Land continues to be taken for infrastructure development in the pan-European region, but land take has decreased in most member countries of the European Environment Agency.

Recommendation: Governments in the pan-European region should provide better guidance to farmers on using soil conservation methods in areas of degraded (eroded) soils. Policies should also maintain a judicious balance between soil organic carbon accumulation for higher crop productivity and soil organic carbon storage for climate change mitigation, as this is critical for mainstreaming global sustainable initiatives such as "4 per 1000". Measures should also address the conversion of natural to agricultural ecosystems and the degradation of habitat quality due to biodiversity-unfriendly agricultural practices, for example, by using more targeted use of subsidies and other incentives. Further, Governments should take measures to reduce land take further and consistently.

	European Union	Western Europe	Central Asia	Eastern Europe	South-Eastern Europe	**Pan-European region**
Land take rate (in 2012–2018)	↗ ☹ (0.05%)	↘ ☹ (0.06%)	↗ ☹ (0.15%)	↗ ☺ (-0.23%)	↘ ☹ (0.15%)	↗ ☹ (0.08%)
Proportion of land that is degraded (2005–2019) (net land with improvement)	↗ (39%)	↗ (31%)	↗ (18%)	↗ (26%)	↗ (51%)	↗ (28%)
Soil organic carbon content (2005–2019) (net land with improvement)	↘ (-0.2%)	→ (0%)	↗ (+0.7%)	↗ (+0.7%)	↗ (+0.4%)	↗ (+0.5%)
Stunting among children under 5 years old	→ ☺	no data	↗ ☹	↗ ☹	↗ ☹	↗ ☹

Notes: trend is ↗ improving (for land take, rate is improving if 2012–2018 rate was lower than 2006–2012 rate), → stable or ↘ worsening; status of land take rate in 2012–2018 is ☺ (negative) or ☹ (positive); status of stunting is ☺ (below 3% – UNICEF target) or ☹ (not on track to reach target).

Net proportion of land improved is to be checked. .

6. Marine pollution

Marine pollution, both from land-based (for example. nutrients, plastic and chemicals) and sea-based (for example, plastic and oil) sources, continues to be an urgent problem in most sea regions. Beach and marine litter, dominated by plastic, is recognized as a major global threat to coastal and marine ecosystems in most areas, including remote and less populated areas, for example, the Barents Sea. At the same time, climate-induced changes in coastal and marine ecosystems are occurring with as yet unknown impact, such as increasing sea surface temperatures by about 0.2 °C per decade in the North Atlantic and 0.5 °C per decade in the Black Sea (since 1981) and observed acidification of surface water, at a rate of

approximately 0.02 pH units per decade, in the sea regions surrounding the European Union (and across the global ocean), except for variations near coasts.

Recommendation: Governments in the pan-European region should take urgent action to reduce key pressures to halt the degradation of coastal waters, marine ecosystems and seas.

	Baltic Sea	Black Sea	Mediterranean Sea	North-East Atlantic
Number of items on beach per 100 m of shoreline, median (2014 –2019)	78	652	428	105

7. Chemicals

Chemicals play a vital role in the economy today and are essential in paving the way towards a green economy, but it remains difficult to capture what is our full exposure to hazardous chemicals. Chemicals and waste management are at the heart of many solutions to the current challenges we face in our transition to a zero carbon and sustainable economy. The situation is similar with minerals, in particular those used in electric and electronic gear and batteries. An important opportunity to harness economic value for the region and to reduce the region's dependency regarding the sourcing of critical raw materials, which are bottlenecks in the shift towards resilient future economies, exists but it is not yet being tackled.

Recommendation: Governments in the pan-European region should ….

	European Union	Western Europe	Central Asia	Eastern Europe	South-Eastern Europe	**Pan-European region**
Reporting under Basel, Rotterdam and Stockholm Conventions (average for 2015–2019)	↘ (82%)	↘ (51%)	↘ (33%)	↘ (57%)	↗ (75%)	↘ (68%)

Note: trend is ↗ improving or ↘ worsening.

8. Air pollution

Some progress has been achieved in the pan-European region regarding air pollution, but increased effort is needed, also in view of potential increased hazards due to climate change. The health impact of long-time exposure to fine particulate matter with a diameter less than 2.5 µm ($PM_{2.5}$) in 41 European countries was reduced by 13 per cent in the period 2009–2018 and that of nitrogen oxides (NO_x) by 54 per cent. However, the number of premature deaths due to ground-level ozone exposure increased in that period by an estimated 24 per cent, possibly caused by higher mean temperatures.

Countries in the region are expanding policies to tackle air pollution. The evaluation and fitness check of existing European Union air quality legislation in 2019 led to proposals to strengthen provisions on monitoring, modelling and air quality plans to achieve cleaner air. The European Union air quality standards will be revised to align them more closely with the World Health Organization (WHO) Air Quality Guidelines, which were updated in 2021. The Russian Federation is implementing the "Clean Air" project, which provides for significant reduction of pollutants in 12 large industrial centres by 2024, as well as a radical modernization of the State system for monitoring air pollution in these cities.

Recommendation: Governments in the pan-European region should develop additional technical and organizational measures to achieve target 3.9 of the Sustainable Development Goals, especially for fine particulate matter and ground-level ozone. Key responses are the sharpening and application of best available techniques to prevent emissions of particulate matter, NO_x and hydrocarbons by industry and emission reduction from traffic (by implementing Euro-6 and 7 measures). Cooperation should be enhanced so that non-

European Union countries in the region could have the possibility to benefit from the experience on the European Union zero-pollution action plan.

	European Union	Western Europe	Central Asia	Eastern Europe	South-Eastern Europe	**Pan-European region**
Ambient fine particulate matter ($PM_{2.5}$) (mg/m^3 in 2016)	☹ (13)	☹ (11)	☹ (25)	☹ (12)	☹ (35)	☹ (16)
Emissions of SOx, NOx and $PM_{2.5}$ (2015–2019)	↗↗↗	↗↗↗	→↘→	↗↗↘	↘↗↘	↗↗→

Note: trend is ↗ improving (emissions falling), → stable or ↘ worsening; status of $PM_{2.5}$ concentrations is ☹ (exceeds WHO air quality guideline of 5 mg/m^3).

9. Waste management

While the waste management hierarchy assigns highest priority to waste prevention, waste generation continues to rise across the region. Even where a strong political commitment for a circular economy exists, such as in the European Union and other western European countries, the generated waste quantities are growing. Recycling rates differ significantly among the countries and are particularly low in Eastern Europe and Central Asia. Municipal waste recycling rates above 45 per cent exist only in a few European Union countries and Switzerland. Progress is being achieved in all subregions, but slowly. Average electrical and electronic equipment waste (e-waste), which contains both hazardous and precious components, is stabilizing in the region as a whole, but continues to increase rapidly in the economically less mature subregions. E-waste collection and recycling are highly deficient across all subregions; the recovery rates are low.

Recommendation: Governments in the pan-European region should support repair, refurbishment and remanufacturing, including through financial incentives such as tax reliefs, in order to reduce waste. These waste prevention efforts would improve resource efficiency. Governments should also equip public administrations with a skilled work force, ready to engage with all sectors of society, and to increase broad access to reliable and detailed information, in order to achieve sound management of chemicals and waste;

	European Union	Western Europe	Central Asia	Eastern Europe	South-Eastern Europe	**Pan-European region**
e-waste generation per capita (kg in 2019)	↗☹ (18)	↗☹ (23)	↘😐 (7.0)	↘☹ (10)	↘☹ (9.9)	→☹ (15)
Total waste per capita	↘	↘	↘	↘	↘	↘

Note: trend is ↗ improving, → stable or ↘ worsening; status of e-waste generation is 😐 (at the global average of 6.95 kg per capita in 2019) or ☹ (above the global average rate).

10. Disaster risk reduction

About 65 per cent of the population in the pan-European region is covered by local disaster risk reduction strategies. Only 15 countries in the region reported that all their local authorities are implementing such strategies under the Sustainable Development Goal target 13.1, while 23 countries, which jointly represent a quarter of the region's population, do not report on that target.

Recommendation: Governments in the pan-European region should strengthen awareness of climate hazard, especially among poorer communities, and establish conditions to report regularly on the Sustainable Development Goal target 13.1 and under the Sendai Framework.

	European Union	Western Europe	Central Asia	Eastern Europe	South-Eastern Europe	**Pan-European region**
Countries having local disaster risk reduction strategies	→ ☺	↗ 😐	↗ 😐	↗ 😐	- ☹	↗ 😐
Countries reporting under target 13.1	😐	☹	😐	😐	😐	😐

Note: trend is ↗ improving or ↘ worsening; status of countries having local disaster risk reduction strategies is ☺ (majority of countries reporting report 100 per cent of local governments implementing DRR strategies), 😐 or ☹ (majority of countries reporting report less than 5 per cent of local governments implementing DRR strategies); status of reporting is ☺ (all countries reporting), 😐 or ☹ (less than a half of countries reporting).

11. Coastal waters and marine ecosystems

A holistic and ecosystem-based approach to the management of coastal waters and marine ecosystems that addresses the combined effects of multiple pressures is progressively integrating social, economic and governance aspects. Such an approach applies equally to the use of nature-based solutions in sustainable infrastructure for enhancing coastal resilience and its climate-proof functionalities, and to the transition to "blue" sustainable tourism as part of the post-COVID-19 recovery.

Recommendation: Governments in the pan-European region should take urgent action to reduce key pressures to halt the degradation of coastal waters, marine ecosystems and seas.

	Baltic Sea	Black Sea	Mediterranean Sea	North-East Atlantic
Proportion of assessed marine fish stocks of Good Environmental Status	13%	0%	0%	44%

12. Monitoring

Access to information and knowledge to support Government decision-makers, industry and the public taking impact-oriented choices is improving but continues to be challenging in some sectors more than in others.

No set of chemicals' impact-oriented indicators is regularly monitored across the region. There is also a lack of information regarding the impact of chemicals on the efficiency and economic viability of circular economy schemes such as recycling. In the region, capacities to make well informed decisions on chemicals and waste issues are often either missing or expertise is not well integrated into decision-making processes.

In the pan-European region, there are still air monitoring gaps, especially in the measurement and analysis of fine particulate matter. Air emissions measurement and ambient air pollution monitoring have improved in the past decade with more appropriate equipment, advanced portable sensors and network strategies leading to greater efficiency and lower costs of ground-level monitoring stations and are increasingly available.

Recommendations: Governments in the pan-European region should:

(a) Promote the use of appropriate and standardized methods for monitoring air pollution emissions and the public availability of monitoring data in the pan-European region, while also strengthening cooperation and national investment to fill monitoring gaps in countries with economies in transition;

(b) Increase efforts to complement inventories of the number of items of beach and marine litter with information on composition and sources of litter to be able to design more effective measures. In particular, joint efforts should be taken where subregional measures are deemed necessary, as in the Caspian Sea where there is no reliable information on the presence or amount of litter discharged into the coastal or marine environment;

(c) Establish a region-wide chemicals and waste impact-oriented monitoring scheme, as a cooperation between science and policy, to achieve a better picture of the adverse impacts of chemicals on human health and the environment, and to address them.

Further sections are needed to cover freshwater, environmental finance and the two conference themes. .

I. Setting the scene

1. This chapter provides an overview of the regular assessment of the state of the environment in the pan-European region, together with the mandate for the present assessment. It also summarizes national reporting and progress in establishing a Shared Environmental Information System. The chapter concludes with an overview of environmental policies in the region.

A. Regular assessment of the state of the environment

2. This chapter begins by looking at the past Environment for Europe Ministerial Conferences and associated pan-European environmental assessments (see figure I below). It then presents the mandate for this assessment and its structure (see figure II below), explains the selection of the themes for the next Conference and describes the use of the Shared Environmental Information System as a basis for this assessment.

1. History of the state-of-the-environment assessments

Figure I
Timeline of state-of-the-environment assessments

3. The First Ministerial Conference within the Environment for Europe process was held in 1991 at Dobris Castle in the then Czechoslovakia. It was the first all-European conference of ministers responsible for the environment and international organizations working in Europe, building upon the Stockholm Conference of 1972 but also the accelerating political transition in 1990–1991. The Conference discussed ways of strengthening cooperation to protect and improve the environment and called on the Commission of European Communities to prepare, in cooperation with ECE, a report describing the state of the environment in Europe. The requested report was to become the first pan-European environmental assessment – *Europe's Environment: the Dobris Assessment*, of 1995 – though the geographical scope was focused on central and eastern Europe.

4. The Second Environment for Europe Ministerial Conference was held in 1993 in Lucerne, Switzerland. Though the first report on the state of the environment had yet to be produced, the environmental programme for Europe had been developed and the broad strategy contained in the Environmental Action Programme for Central and Eastern Europe was endorsed by the Conference, as was an ECE report on Elements for a Long-term Environmental Programme for Europe.

5. The Third Environment for Europe Ministerial Conference was held in Sofia in 1995. The Sofia Conference saw the publication of the *Europe's Environment: The Dobris Assessment* report, which assessed for the first time Europe's environment as a whole. The report's findings were of immediate concern to the Conference, since they demonstrated the need for far-reaching action in a number of environmental sectors.

6. The Fourth Ministerial Conference took place in Aarhus (Denmark) in 1998. This might be termed the first pan-European conference. *Europe's Environment: The Second Assessment*, identifying the main areas of achievement and concern in the state of the European environment, set the scene for the Conference. Based on its findings, the Ministers decided to strengthen support within the Environment for Europe process for the newly independent States and those countries of central and eastern Europe that were not part of the European Union's accession process. *Europe's Environment: The Second Assessment* did not

cover Central Asia, for which the report *Sub-regional integrated environment assessment: Central Asia*[4] was prepared by the countries in the subregion.

7. The Fifth Ministerial Conference took place Kyiv in 2003. It concluded with the adoption of the Ministerial Declaration, which underlined the importance of the Environment for Europe process as a tool to promote environmental protection and sustainable development in the region, thus contributing to wider peace and security. *Europe's Environment: The Third Assessment*[5] for the first time covered all countries of the Caucasus, Central Asia and Eastern Europe. Ministers noted that the three assessment reports on the state of the environment produced by EEA had helped to identify major threats and challenges for the development of regional environmental policies and laid the ground for the preparation of the Environmental Programme for Europe.

8. The Sixth Ministerial Conference took place in Belgrade in 2007. The Conference noted the fourth assessment report on the state of the environment (*Belgrade Assessment*)[6] and some improvements in the state of the environment at the pan-European level and in some subregions and countries but were particularly concerned by the report's negative findings. Two further assessments were presented to the Conference: *First assessment of transboundary rivers, lakes and groundwaters*[7] and *Policies for a Better Environment: Progress in Eastern Europe, Caucasus and Central Asia*.[8]

9. The Seventh Ministerial Conference took place in Nur-Sultan (then Astana) in 2011. It welcomed the *Europe's Environment: An Assessment of Assessments* report,[9] which was an assessment of all environmental assessments produced in the region. To keep the pan-European environment under review, Ministers decided to establish a regular process of environmental assessment and to develop the Shared Environmental Information System across the region. These would serve multiple policy processes, including multilateral environmental agreements, and include capacity-building of countries in the Caucasus, Central Asia and Eastern and South-Eastern Europe to monitor and assess their environment. They invited the European Environment Agency and its partners to develop an outline for how these actions could be performed. In addition, the *Second Assessment of Transboundary Rivers, Lakes and Groundwaters in the ECE region*[10] was presented to the Conference.

10. The latest conference, the Eighth Environment for Europe Ministerial Conference took place in Batumi, Georgia, in June 2016. Ministers welcomed the launch of the European regional assessment of the Global Environment Outlook, as the regular pan-European environmental assessment. The *GEO-6: Global Environment Outlook: Regional assessment for the Pan-European Region*[11] was built on existing national, subregional and thematic assessments, including *The European environment - state and outlook 2015* report.[12]

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[4] IFAS, ICSD & UNEP, 2007. Available at http://wedocs.unep.org/bitstream/handle/20.500.11822/9850/-Sub-regional_integrated_environment_assessment_Central_Asia-2007Sub_regional_integrated_environment_assessment_central_asia.pdf.pdf?sequence=3&isAllowed=y.

[5] Prepared by EEA with the support of countries and ECE and in cooperation with UNEP and other international organizations.

[6] Prepared by EEA with the support of countries, the European Commission and ECE, and in cooperation with other partners.

[7] ECE, 2007.

[8] OECD, 2007. Summary for policymakers, available at https://www.oecd.org/env/outreach/39271802.pdf.

[9] Coordinated and produced by EEA in cooperation with the countries, the Regional Environmental Centres (RECs), MEA secretariats, ECE and international organizations.

[10] ECE, 2011.

[11] UNEP & ECE, 2016.

[12] EEA, 2015.

2. Mandate for this assessment

11. The series of assessments of the state of the environment in the pan-European region provide up-to-date and policy-relevant information on interactions between the environment and society. The assessments were a consistent feature of the Environment for Europe process from 1995 to 2016. The 2009 reform of that process identified the pan-European assessment as one of the three substantive documents to be prepared for each ministerial conference, together with up to two theme-specific reports (ECE/CEP/S/152, annex I, para. 12 (a) and (d)).

12. Following the Seventh Environment for Europe Ministerial Conference (Nur-Sultan, 21–23 September 2011), responsibility for drafting the assessment shifted from the European Environment Agency to the United Nations Environment Programme (UNEP) and the United Nations Economic Commission for Europe (ECE).

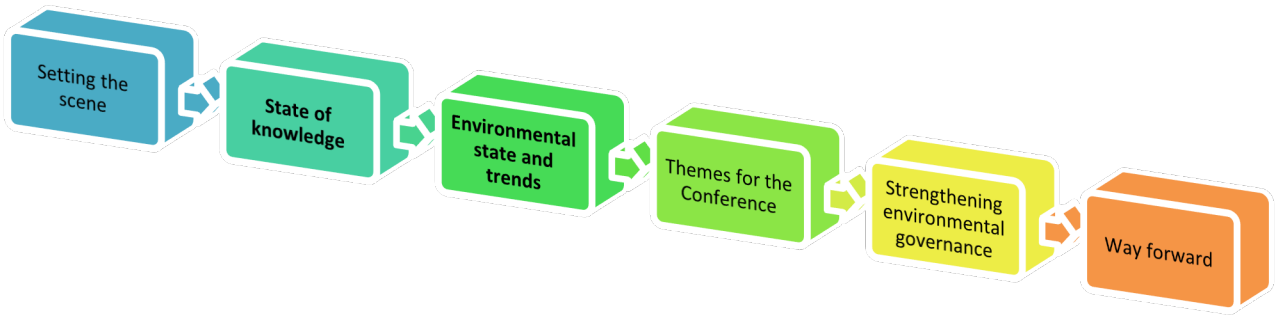
13. During the Eighth Environment for Europe Ministerial Conference (Batumi, Georgia, 8–10 June 2016), the launch of the European regional assessment of the Global Environment Outlook as the regular pan-European environmental assessment was welcomed (ECE/BATUMI.CONF/2016/2/Add.1, para. 10).

14. Following the Eighth Environment for Europe Ministerial Conference, the ECE Committee on Environmental Policy adopted the revised mandate and terms of reference of the Working Group on Environmental Monitoring and Assessment for the period 2017–2021 (ECE/CEP/2017/2, para. 32 and annex II). The Working Group was tasked by the Committee with leading a process of consultation on the regular pan-European environmental assessment (ECE/CEP/2017/2, annex II, para. 2 (b)) for consideration by the Committee and leading up to the next Environment for Europe Ministerial Conference.

15. At its twenty-fifth session (Geneva, 13–15 November 2019), the Committee on Environmental Policy: welcomed the information provided by the secretariat and UNEP on the next pan-European environmental assessment; selected option 3 from among the options for the next pan-European environmental assessment set out in document ECE/CEP/AC.10/2019/6, subject to availability of resources; requested the secretariat and UNEP, working in close cooperation with the European Environment Agency, to prepare a limited indicator-based and thematic assessment and to regularly inform the Bureau of progress made; and encouraged all member States to provide the necessary funding to enable the preparation of the assessment (ECE/CEP/2019/15, para. 37 (k)).

16. The Committee selected the two following specific themes for the ministerial conference and, consequently, the assessment: (a) greening the economy in the pan-European region: working towards sustainable infrastructure; and (b) applying principles of circular economy to sustainable tourism (ECE/CEP/2019/15, para. 21 (b)). At its twenty-sixth session (Geneva and online, 9 and 10 November 2020), the Committee rescheduled the next Ministerial Conference, to be held in Nicosia, for 5–7 October 2022.

Figure II
Structure of the assessment



B. State of knowledge and the Shared Environmental Information System

17. This section reviews regular national reporting on the state of the environment and provides an overview of progress achieved in establishing a Shared Environmental Information System in Europe and Central Asia.

1. Reporting on the state of the environment

18. Regular reporting on the state of the environment in the countries of the pan-European region provides comprehensive and targeted information about environmental conditions, trends and pressures in each of the countries. This section will review such reporting. A table will provide an overview of whether national state-of-the-environment reports or indicator-based state-of-the-environment reports are produced on a regular basis.

19. The resulting reports provide a strategic view to shape policy and action. National state-of-the-environment reports, based on a sound evidence base, aim to inform and provide knowledge for decision-makers and the public and to engage readers to influence their behaviour.

20. Most of the countries in the pan-European region review the state of the environment on a regular basis and prepare integrated reports covering several thematic areas and/or indicator-based national state-of-the-environment reports.

21. Within the framework of the final review of the establishment of a Shared Environmental Information System in Europe and Central Asia, ECE member States in the pan-European region were asked to provide information on the regularity and type of reports they produce. The reports vary in regularity, content and form but all of them support the transition to a more sustainable use of resources and the protection of the environment for the wellbeing of human life.

Table 2
Overview on national state-of-the-Environment reporting

Country	Regular production of an integrated state-of-the-environment report	Year of latest state-of-the-environment report	Regular production of an indicator-based state-of-the-environment report	Year of latest indicator-based state-of-the-environment report
Albania	Yes	2019	No	2018
Andorra	to be confirmed	to be confirmed	Yes	2019
Armenia	No	2011	Yes	2020
Austria	Yes	2019	Yes	2019
Azerbaijan	No	2019	No	to be confirmed
Belarus	Yes	2019	Yes	2019
Belgium (regions)	Yes	2019	No	2012
Bosnia and Herzegovina	Yes	2012	No	to be confirmed
Bulgaria	Yes	2020	No	2020
Croatia	No	to be confirmed	Yes	2019
Cyprus	No	2015	No	to be confirmed
Czechia	Yes	2018	Yes	2020
Denmark	Yes	2014	Yes	to be confirmed
Estonia	Yes	2013	Yes	2019
Finland	Yes	2018	Yes	2020
France	Yes	2019	Yes	2020
Georgia	Yes	2017	Yes	2017

Country	Regular production of an integrated state-of-the-environment report	Year of latest state-of-the-environment report	Regular production of an indicator-based state-of-the-environment report	Year of latest indicator-based state-of-the-environment report
Germany	Yes	2019	Yes	2020
Greece	Yes	2019	Yes	to be confirmed
Hungary	Yes	2017	Yes	2020
Iceland	Yes	2019	Yes	2019
Ireland	Yes	2020	Yes	2020
Israel	Yes	2019	to be confirmed	2010
Italy	Yes	2019	Yes	2019
Kazakhstan	Yes	2019	Yes	2018
Kyrgyzstan	No	2012	to be confirmed	to be confirmed
Latvia	Yes	2016	Yes	2019
Liechtenstein	No	2021	Yes	2015
Lithuania	Yes	2020	Yes	2020
Luxembourg	No	2003	to be confirmed	2018
Malta	Yes	2018	Yes	2011
Monaco	Yes	2018	Yes	2018
Montenegro	Yes	2019	Yes	2017
Netherlands	Yes	2020	Yes	2019
North Macedonia	Yes	2020	Yes	2018
Norway	Yes	2020	Yes	2020
Poland	Yes	2018	No	2001
Portugal	Yes	2019	Yes	2019
Republic of Moldova	Yes	2011	No	2014
Romania	Yes	2019	Yes	2018
Russian Federation	Yes	2019	Yes	2019
San Marino	to be confirmed	to be confirmed	Yes	2020
Serbia	Yes	2019	No	2016
Slovakia	Yes	2018	Yes	2020
Slovenia	No	2010	Yes	2020
Spain	Yes	2019	Yes	2019
Sweden	Yes	2020	Yes	2020
Switzerland	Yes	2018	Yes	2018
Tajikistan	No	to be confirmed	to be confirmed	to be confirmed
Turkey	Yes	2016	Yes	2017
Turkmenistan	No	to be confirmed	No	to be confirmed
Ukraine	Yes	2015	No	to be confirmed
United Kingdom of Great Britain and Northern Ireland	Yes	2020	Yes	to be confirmed
Uzbekistan	No	to be confirmed	No	to be confirmed

Key: 2019–2021 2016–2018 2013–2015

Countries are invited to verify these data. For example, Albania has indicated that it has no such report, while the value for Portugal was previously indicated as 2011. .

2. Progress achieved in establishing a Shared Environmental Information System in Europe and Central Asia

22. At the Seventh Environment for Europe Ministerial Conference (Nur-Sultan, 21–23 September 2011), ministers requested that a Shared Environmental Information System be developed to underpin a regular environment assessment process across the pan-European region (ECE/ASTANA.CONF/2011/2/Add.1, para. 14). This was reiterated by ministers at the Eighth Environment for Europe Ministerial Conference (Batumi, Georgia, 8–10 June 2016) (ECE/BATUMI.CONF/2016/2/Add.1, para. 10).

23. Since then, overall, a Shared Environmental Information System has been successfully established in Europe and Central Asia. All member States have, to varying degrees, made progress regarding the establishment of a national system during the past years and in making environmental information available and accessible including for the use in regular assessments such as the seventh pan-European environmental assessment.

24. According to the final review report on the establishment of the Shared Environmental Information System (ECE/CEP/AC.10/2021/6), national Shared Environmental Information Systems vary in form and regularity regarding their updates and content, and gaps remain that need to be addressed including regarding the full establishment of the system in line with all Shared Environmental Information System principles and pillars. The gaps identified indicate that countries still need assistance to fully implement the Shared Environmental Information System's pillars and principles and for the full production and sharing of all data flows associated with the ECE environmental indicators also beyond 2021.

25. Further reviews of the implementation of the Shared Environmental Information System according to its principles would help to address gaps and, by doing so, ensure that it supports regular assessments and reporting in the region beyond 2021.

26. The final review report also recommends that the establishment of the System and the production of relevant data flows that underpin the ECE environmental indicators be harmonized and aligned with the revised ECE environmental indicators and aligned with the United Nations Framework for the Development of Environmental Statistics and monitoring and assessment processes at the regional and global levels, including in the context of the 2030 Agenda for Sustainable Development and a green and circular economy, to enhance their policy relevance.

27. Based on the countries' replies during the final review of the establishment of the Shared Environmental Information System, for each data flow, limitations in comparing the data flow across countries and the region were assessed. The results from the submissions show limitations in 44 per cent of cases due also to the fact that several countries did not provide links to the data flows or information on the time series.

28. Furthermore, the final review report recommends continuation of digitalization of environmental monitoring systems and use of new technologies for enhanced high-quality data production in support of regular assessments and policymaking.

To check whether section authors expressed any views on the usefulness of SEIS.

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Figure I

Use of data flows for more than one purpose, per cent of data flows by reply "yes" or "no"

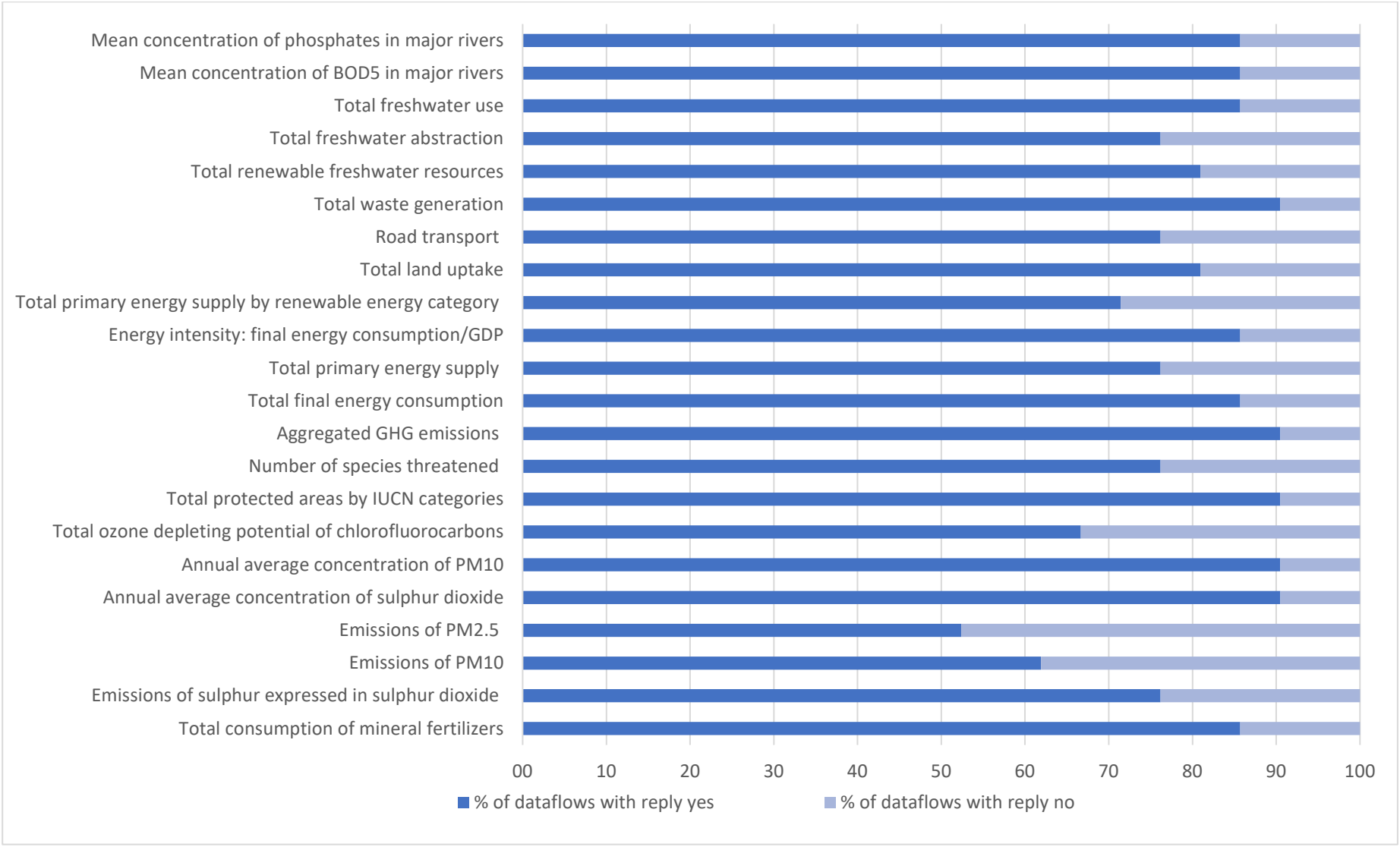


Figure II

Ready online availability and accessibility of data flows on a national platform, per cent of data flows with reply "yes"

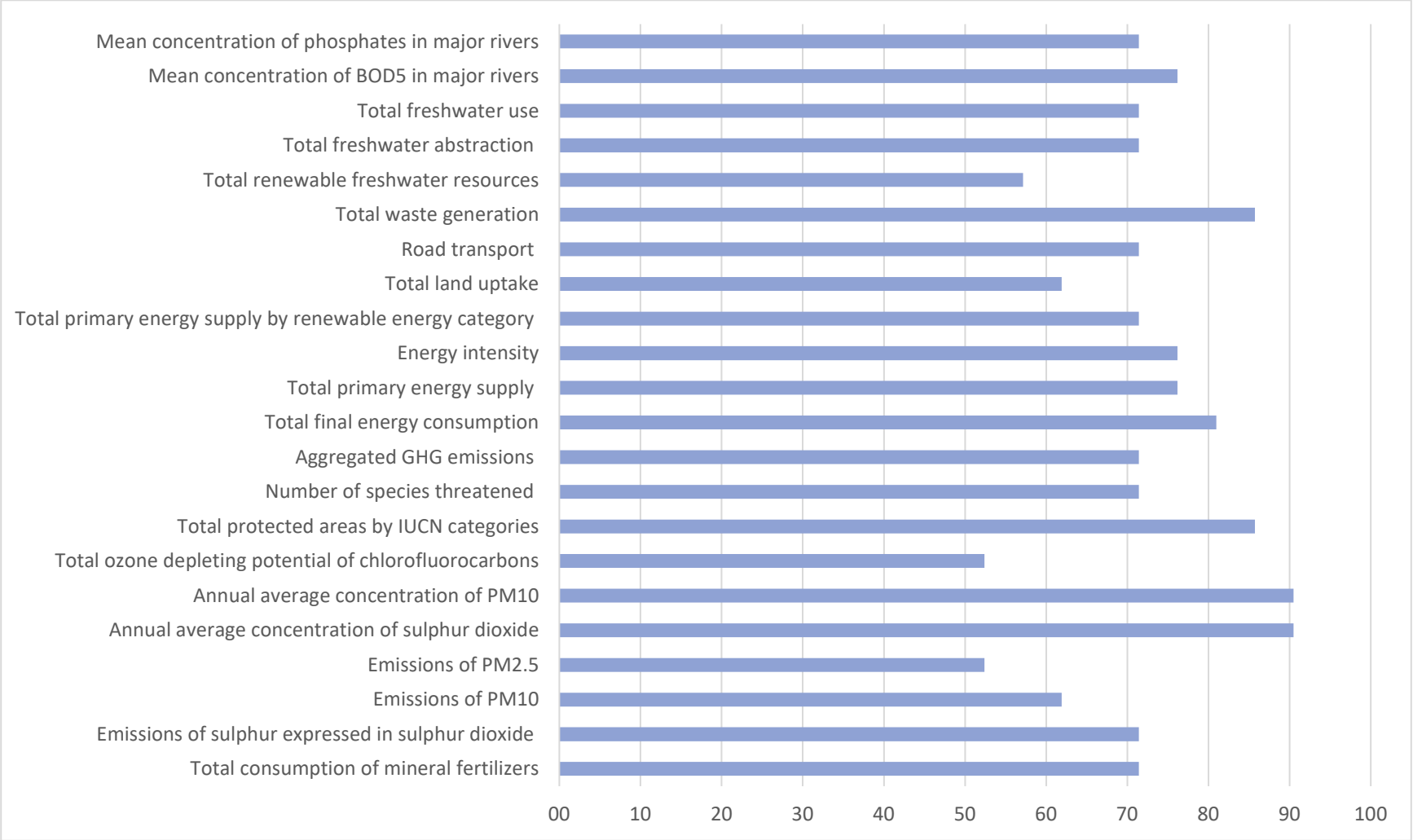


Table A.1
Performance scores per country

		Performance score by theme (not weighted/aggregated)								*Performance score by pillar (not weighted/aggregated)*			
	Performance score	*Agriculture*	*Air pollution and ozone depletion*	*Biodiversity*	*Climate change*	*Energy*	*Land and soil*	*Transport*	*Waste*	*Water*	*Content*	*Cooperation*	*Infrastructure*
Albania	53.6	7.7	3.2	8.0	7.6	8.2	2.8	5.9	6.7	6.2	17.3	21.3	17.2
Austria	85.9	10.9	10.4	8.9	11.1	10.9	9.8	8.6	10.7	9.0	28.4	29.6	31.6
Azerbaijan	78.5	9.0	10.0	5.8	10.3	9.7	9.5	9.5	10.3	10.0	27.0	33.3	28.9
Belarus	89.0	10.3	7.8	10.1	10.2	9.7	10.2	10.3	10.5	9.3	28.7	31.5	26.4
Bosnia and Herzegovina	67.9	5.9	9.5	6.5	8.3	9.9	10.5	10.6	9.8	9.0	25.4	19.4	28.8
Bulgaria	58.0	5.4	5.8	7.8	7.6	8.0	5.9	6.2	2.0	5.7	18.4	13.0	21.1
Croatia	62.0	5.5	8.3	9.4	5.8	9.3	4.4	7.8	8.6	9.5	25.1	15.7	25.4
France	79.5	9.5	10.5	8.8	10.2	9.3	8.2	9.0	9.0	7.8	27.9	29.6	27.1
Georgia	80.6	9.4	9.5	9.1	10.2	8.5	8.2	6.3	7.3	10.1	27.1	27.8	27.3
Germany	30.7	5.5	2.2	0.0	1.6	9.5	0.0	0.0	7.5	4.0	11.6	13.0	11.8
Kazakhstan	91.9	9.5	8.3	9.3	10.3	10.2	10.3	10.3	10.3	9.6	29.1	33.3	27.2
Montenegro	50.2	4.0	6.3	5.2	8.8	5.6	2.9	5.7	7.5	3.3	18.2	13.0	14.6
North Macedonia	89.1	9.9	10.4	10.3	9.9	5.9	10.8	10.7	9.9	8.3	26.7	31.5	27.6
Rep. of Moldova	65.4	7.9	4.5	7.3	8.5	7.6	8.6	10.3	10.3	8.2	21.5	21.3	22.0
Romania	70.8	2.0	9.0	8.1	9.7	6.5	9.4	6.4	9.0	5.9	21.0	26.9	22.9
Serbia	16.2	2.5	5.3	1.5	2.4	2.1	1.6	1.7	3.3	3.5	14.5	0.0	5.6
Slovakia	71.5	8.5	7.3	7.7	8.9	9.4	8.5	8.5	9.7	8.2	28.4	5.6	24.3
Spain	47.9	0.0	3.4	8.0	9.8	0.0	0.0	0.0	7.8	4.4	11.4	11.1	10.6
Sweden	58.9	9.9	3.9	5.6	8.1	2.2	9.9	9.1	9.1	2.5	13.2	26.9	14.4
Switzerland	97.3	11.0	10.8	10.7	11.1	10.7	10.3	11.0	11.1	9.8	30.0	33.3	33.3
Uzbekistan	23.3	3.6	1.6	2.7	3.5	3.1	3.8	3.5	4.7	3.9	13.8	0.0	4.9

Source: UNEP.

C. Environmental policies in the region

This section should not exceed 3 pages. .

29. This section explores global, regional and subregional policy frameworks that are at play at the level of the pan-European region. The policies, but also their objectives, goals, targets and indicators, all play a role in driving action by countries. Among the most relevant global level instruments are the multilateral environmental agreements (MEAs), the United Nations Environment Assembly and the 2030 Agenda for Sustainable Development. Notable regional level frameworks are the Environment for Europe Ministerial process, the European Environment and Health Process and regional MEAs. Major elements at the subregional level include the European Union's environmental policy and legislation, the European Union accession process and environmental and sustainable development policies emanating from the Commonwealth of Independent States.

Global policy frameworks

30. The 2030 Agenda for Sustainable Development provides the overarching policy framework for sustainable development and integrated environmental policy. The 2030 Agenda's 17 universal Sustainable Development Goals and 169 targets[13] provide policy objectives at all levels, though Governments have also adopted national targets and indicators.

31. The Sendai Framework for Disaster Risk Reduction 2015–2030 aims for the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of people, businesses, communities and countries. It includes a set of seven global targets, which are indirectly related to the environment, and sets four priority actions, each of which has an environmental dimension. Besides, it includes activities at local, national, regional and global levels.

32. The Strategic Plan for Biodiversity 2011–2020, including Aichi Biodiversity Targets, has set the global framework for action to preserve biodiversity for the past decade. The Plan identifies five strategic goals, with each having between three and six targets. The post-2020 global biodiversity framework is being negotiated in 2021 *[to update in late 2021]*. The Sustainable Development Goals also include targets and indicators related to biodiversity.

33. The global MEAs, such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, the Convention on Biological Diversity, the Convention to Combat Desertification, and those on specific pollutants (such as persistent organic pollutants (POPs), mercury and ozone-depleting substances (ODSs)) and waste, also drive environmental policy within the ECE region, including through the setting of legally binding limits. The rapid take up of the global agreements, evident in Figure X, emphasizes their political importance at the international level; the selection of MEAs shown in the figure is purely illustrative. A more complete list of MEAs is provided in the table below.

Table
Key multilateral environmental agreements

Treaty	*Categories*	*Number of Parties*
Vienna Convention for the Protection of the Ozone Layer		198
Montreal Protocol on Substances that Deplete the Ozone Layer	Climate and Atmosphere	198
London, Copenhagen, Montreal, Beijing and Kigali Amendments		

[13] UNEP has determined that over 86 of the 169 targets directly concern the environment.

Treaty	*Categories*	*Number of Parties*
United Nations Framework Convention on Climate Change	Climate and Atmosphere	197
Kyoto Protocol	Climate and Atmosphere	193
Paris Agreement	Climate and Atmosphere	191
United Nations Convention to Combat Desertification	Biological Diversity, Land and Agriculture, Drylands	197
Convention on Biological Diversity	Biological Diversity	196
Cartagena Protocol on Biosafety to the Convention on Biological Diversity	Biological Diversity, Land and Agriculture	173
Nagoya – Kuala Lumpur Supplementary Protocol	Biological Diversity, Land and Agriculture	49
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization	Biological Diversity, Land and Agriculture	132
Convention concerning the Protection of the World Cultural and Natural Heritage	Biological Diversity, Marine and Freshwater, Land and Agriculture	194
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Chemicals and Waste	188
Basel Protocol on Liability and Compensation	Environmental Governance, Chemicals and Waste	12
Stockholm Convention on Persistent Organic Pollutants	Chemicals and Waste	184
International Plant Protection Convention	Biological Diversity, Land and Agriculture	184
Convention on International Trade in Endangered Species of Wild Fauna and Flora	Biological Diversity	183
Convention on Wetlands of International Importance (Ramsar Convention)	Biological Diversity, Land and Agriculture, Marine and Freshwater	170
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	Chemicals and Waste	164
International Convention for the Prevention of Pollution from Ships	Marine and Freshwater	160
International Treaty on Plant Genetic Resources for Food and Agriculture	Biological Diversity, Land and Agriculture	148
Minamata Convention on Mercury	Chemicals and Waste	132
Convention on the Conservation of Migratory Species of Wild Animals	Biological Diversity	132
Agreement on the Conservation of African-Eurasian Migratory Waterbirds	Biological Diversity	82

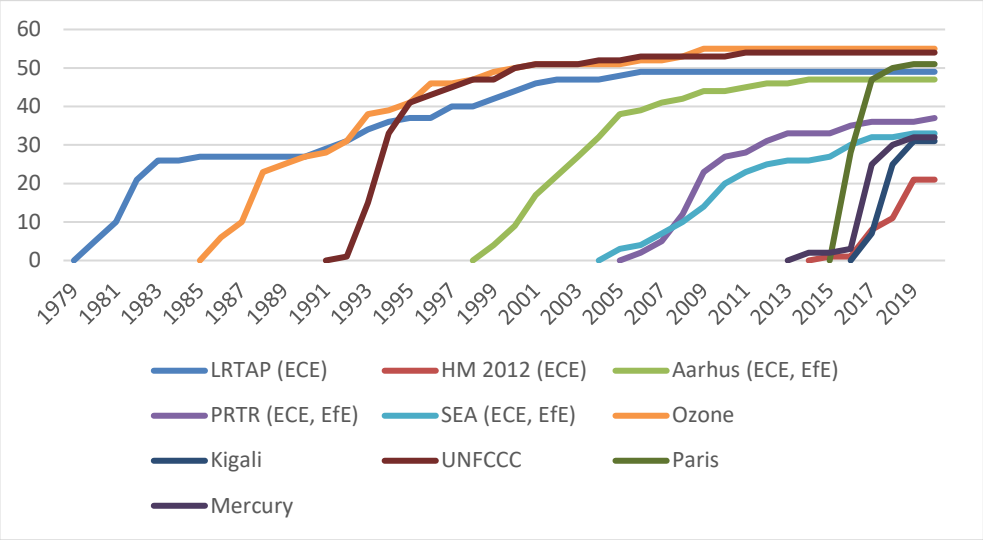
Treaty	*Categories*	*Number of Parties*
Convention on Long-range Transboundary Air Pollution, and its Protocols	Chemicals and Waste, Climate and Atmosphere	51
Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)	Environmental Governance	47
Protocol on Pollutant Release and Transfer Registers	Environmental Governance, Chemicals and Waste	38
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)	Environmental Governance	45
Protocol on Strategic Environmental Assessment	Environmental Governance	33
Convention on the Protection and Use of Transboundary Watercourses and International Lakes	Biological Diversity, Marine and Freshwater	45
Protocol on Water and Health	Chemicals and Waste, Biological Diversity, Marine and Freshwater	27
Convention on the Transboundary Effects of Industrial Accidents	Chemicals and Waste, Climate and Atmosphere, Biological Diversity, Marine and Freshwater, Land and Agriculture	41
Barcelona Convention, and its Protocols	Chemicals and Waste, Biological Diversity, Marine and Freshwater	22
Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas	Biological Diversity	10
Framework Convention on the Protection and Sustainable Development of the Carpathians, and its Protocols	Biological Diversity, Land and Agriculture	7

Note: Categories are according to www.InforMEA.org (accessed on 8 September 2021). The specified number of Parties (globally) is to the parent treaty if protocols are referred to but not listed separately.

The long table above is perhaps of limited usefulness. It would be good to have the number of Parties in the pan-European region. .

34. The United Nations Environment Assembly provides an overarching, global structure for environmental governance, bringing emerging issues to the attention of the global community. It sets priorities for global environmental policies and develops international environmental law. Through its ministerial declaration and resolutions, the Assembly also provides leadership, catalyses intergovernmental action on the environment, and contributes to the implementation of the 2030 Agenda.

Figure X. Regional membership of multilateral environmental agreements (illustrative examples selected)



Note: LRTAP = Convention on Long-range Transboundary Air Pollution; HM = Protocol on Heavy Metals to the LRTAP Convention; Aarhus = Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters; PRTR = Protocol on Pollutant Release and Transfer Registers; SEA = Protocol on Strategic Environmental Assessment; Ozone = Montreal Protocol on Substances that Deplete the Ozone Layer; Kigali = Kigali Amendment to the Montreal Protocol; Paris = Paris Agreement on climate change; Mercury = Minamata Convention on Mercury. The Aarhus Convention and the Protocols on SEA and PRTRs were adopted at Environment for Europe (EfE) Ministerial Conferences. *[To update in 2022.]*

Regional policy frameworks

Environment for Europe ministerial process

35. At the regional level, the Environment for Europe process and its Ministerial Conferences, which aim at harmonizing environmental quality and policies in the pan-European region, and securing its peace, stability and sustainable development, have provided the primary policy framework over the past three decades. The Lucerne Declaration adopted by Ministers of Environment in 1993 sets out the political dimension of the Environment for Europe process. The 1995 Sofia Declaration underlined the urgent need for further integration of environmental considerations into all sectorial policies, so that economic growth takes place in accordance with principles of sustainable development.

36. The Environment for Europe process gave birth to a series of regional multilateral environmental agreements, complementing already existing ones. Specifically, the following were adopted: the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) and later its Protocol on Pollutant Release and Transfer Registers (PRTRs); two new Protocols to the Convention on Long-range Transboundary Air Pollution (LRTAP), on Heavy Metals and on Persistent Organic Pollutants; the Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention); the Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters; and the Convention on the Protection and Sustainable Development of the Carpathians. Despite the encouragement of ministers to all countries in the region to join these agreements, Figure X shows how the take up of global agreements has been more rapid and complete.

37. At the 2011 Ministerial Conference in Nur-Sultan, a series of policy commitments were decided, such as to: improve environmental protection and to promote sustainable development in the ECE region; reiterate the importance of the involvement of civil society, including business, women, non-governmental organizations and other groups, in decision-

making to improve the environment; pursue implementation of the principles of integrated water resources management, an ecosystem approach and the integration of ecosystem values in economic accounting; improve water management and strengthening transboundary cooperation; and pursue completion and implementation of a 10-Year Framework of Programmes on Sustainable Consumption and Production.[14]

38. Outcomes of the Conference in Nur-Sultan were reviewed in Batumi, Georgia in 2016, including through the consideration of a final report on the implementation of the Astana Water Action, a report on progress in establishing the Shared Environmental Information System and a report on 20 years of Environmental Performance Reviews.[15] The Batumi Conference also:

- Endorsed the voluntary Pan-European Strategic Framework for Greening the Economy and invited ECE member States and other stakeholders to implement it;
- Welcomed the Batumi Initiative on Green Economy (BIG-E), which consists of voluntary commitments to operationalize the Strategic Framework;
- Endorsed the voluntary Batumi Action for Cleaner Air (BACA) and welcomed the initiatives launched by interested countries and other stakeholders aimed at improving air quality and protecting public health and ecosystems.

39. The Conference also committed to: improve environmental protection, advancing sustainable development, implementing the Sustainable Development Goals and providing access to essential services; enhance ecosystems and ecosystem services as part of ecological infrastructure and improving the sustainable use of natural resources; lead the transition to a green economy, direct investments and trade to support a green and inclusive economy and work towards the full internalization of externalities that cause the loss of or damage to natural capital; fostering a circular economy, transparent and responsible business practice and eco-innovation, and further work towards cleaner and more resource-efficient production processes; develop the human capital for green and decent jobs and increase the availability of such jobs; improve air quality for a better environment and human health, strengthen the role of civil society in addressing air pollution and its impacts and ensure adequate monitoring of and public access to relevant information on air pollution; strengthen and scale-up education for sustainable development; promote effective public participation; civil society participation in decision-making to improve the environment and promote sustainable development; and develop partnerships with civil society organizations in the region and create favourable conditions for their operation.[16]

40. The fulfilment of commitments made under BIG-E and BACA, both at the Conference and subsequently, have been monitored, notably through a mid-term review carried out by the Committee on Environmental Policy in January 2019. The evaluation was based upon reports on the implementation of each of the three Batumi instruments and MEAs in support of the 2030 Agenda, and on activities to support countries in their efforts to green their economies, establishment of the Shared Environmental Information System and the third cycle of environmental performance reviews.[17] The evaluation demonstrated harmonization and improvement of relevant data flows and the quality of selected environmental indicators and use of data flows for multiple purposes. The evaluation has also highlighted the progress achieved in implementing voluntary commitments by the member States and organizations participating in BIG-E and BACA. It noted that since 2017, the Sustainable Development Goals and targets are being included in environmental performance reviews. The Committee welcomed the commencement of activities to assist reviewed countries in the implementation of recommendations emerging from their reviews.

[14] Declaration: "Save water, grow green!" (ECE/ASTANA.CONF/2011/2/Add.1).

[15] ECE/BATUMI.CONF/2016/10, ECE/BATUMI.CONF/2016/8 and ECE/BATUMI.CONF/2016/INF/5, respectively.

[16] Declaration: "Greener, cleaner, smarter!" (ECE/BATUMI.CONF/2016/2/Add.1).

[17] For details, see the report of the Committee on Environmental Policy on its twenty-fourth session (ECE/CEP/2019/2).

41. The Committee noted that countries still need assistance in fully implementing the pillars and principles of the Shared Environmental Information System and in the regular production and sharing of relevant data flows associated with the ECE environmental indicators by 2021. The Committee also recognized the need to allocate sufficient resources for multilateral environmental agreements to assist Governments to achieve Sustainable Development Goals.

European Environment and Health Process

42. The European Environment and Health Process started in Frankfurt, Germany in 1989. The Second Conference, in Helsinki in 1994, was followed in 1995 by the publication *Concern for Europe's tomorrow. Health and the environment in the WHO European Region*,[18] a comprehensive survey on environmental health in Europe. In 1999, the Third Conference adopted the Protocol on Water and Health to the ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes. At the Fifth Conference, held in Parma, Italy in 2010, Governments of the 53 member States of the WHO European Region set clear targets to reduce the adverse health impact of environmental threats in the next decade. At the most recent, Sixth Conference in Ostrava, Czechia in 2017, member States committed to develop national portfolios for action that should address the need to accelerate progress on health and environment and, in particular, the environment-related health goals and targets of the 2030 Agenda.

Other regional processes

43. Other important processes and instruments include the ECE Steering Committee on Education for Sustainable Development, the Transport, Health and Environment Pan-European Programme and the ECE Environmental Performance Review programme.

Subregional policy frameworks

44. Among the frameworks below the regional level, the policies of the European Union, including its accession process, have been among the strongest drivers of policy change. Subregional environmental agreements also play a significant role because of their binding provisions for their parties; these include the Alpine Convention, the Framework Convention on the Protection and Sustainable Development of the Carpathians, the Framework Convention on Environmental Protection for Sustainable Development in Central Asia and a whole series of regional seas agreements, such as the Barcelona Convention for the Mediterranean.

45. At the European Union level, the European Green Deal promotes a holistic approach and sets out a roadmap for climate neutrality by 2050 and setting sustainability as the new standard for all policies. It includes a Biodiversity Strategy 2030, Zero Pollution Action Plan, "Farm-to-Fork" and Transition to a circular economy as ambitious directions for the European Union and beyond, acknowledging the ecological continuity and inclusion of its immediate neighbourhood. The Biodiversity Strategy provides a plan to protect nature and reverse the degradation of ecosystems and is instrumental for measuring ecosystem health and halting biodiversity loss across ecosystems including marine ecosystems. It runs concurrently with the global process under the Convention on Biodiversity Diversity for the elaboration of the post-2020 Global Biodiversity Framework.

[18] Available at https://www.euro.who.int/en/publications/abstracts/concern-for-europes-tomorrow.-health-and-the-environment-in-the-who-european-region.

II. Regional context and developments as drivers of environmental change

This section should not exceed 4–6 pages. The current text is DRAFT. .

1. The period since 1990 has seen dramatic socioeconomic and political changes in the pan-European region that have increased pressure on the natural environment and are driving environmental change. It is anticipated that this section will look at five clusters of drivers:[19]

- An urbanizing and more coastal population
- A more prosperous society with increased use of resources
- Shifting energy production and use
- An increasingly mobile society

2. This section will be revised according to the drivers and pressures identified by the authors of the thematic sections of chapters III and IV. Drivers and pressures will be examined also through the lens of the two conference themes.

1. An urbanizing and more coastal population

47. The region's population has grown slowly by about 6.5 per cent between 1990 and 2015 (compared with about 38 per cent globally) and is expected to rise by only 2.7 per cent (relative to 2015, or 1.5 per cent relative to 2020) before declining after 2040.[20] The region is also becoming more urban. Though rates of urbanization are slower than in the period 1950–1990, there is no stabilization of the proportion expected by 2050. There is considerable variation in that proportion across the region, from below 50 per cent to over 80 per cent (figure III).

3. Growing urbanization and consumption levels are main drivers of the need for a more sustainable infrastructure to prevent growing GHG emissions, air, water and soil pollution and nuisance by noise and congestion. Currently, the high concentration of human activities in urban territory causes 70% of the global GHG emissions and air pollution standards for PM10, PM2,5 and NO2 are often exceeded in these areas.

4. The main driver for increased sustainability of infrastructure lies in the new technologies and innovative approaches to spatial planning, mobility and energy consumption (e.g., smart cities, smart grids/networks). New Urban Agenda[21] promotes

[19] Other clusters of drivers are presented in the European Environment Agency (EEA) publication *Drivers of change of relevance for Europe's environment and sustainability,* Report No. 25/2019 (Luxembourg, Publications Office of the European Union, 2020); and Paul Ekins, Joyeeta Gupta and Pierre Boileau, eds., *Global Environment Outlook: Geo-6 – healthy planet, healthy people* (Cambridge, Cambridge University Press, 2019), chap. 2. The publication *Drivers of change of relevance for Europe's environment and sustainability*, by the European Environment Agency (Luxembourg: Publications Office of the European Union, 2020), available at https://www.eea.europa.eu/publications/drivers-of-change, is structured around six clusters of drivers: a growing, urbanizing and migrating global population; climate change and environmental degradation worldwide; increasing scarcity of and global competition for resources; accelerating technological change and convergence; power shifts in the global economy and geopolitical landscape; and diversifying values, lifestyles and governance approaches. See also chapter 2 on drivers in the *Sixth Global Environment Outlook* by UNEP, available at https://wedocs.unep.org/bitstream/handle/20.500.11822/27654/GEO6_CH2.pdf?sequence=1&isAllowed=y; the chapter is structured around: population, urbanization, economic development, technology and climate change.

[20] United Nations, Department of Economic and Social Affairs, Population Division (2018). *World Urbanization Prospects: The 2018 Revision*, Online Edition, available at https://population.un.org/wup/Download/.

[21] New Urban Agenda, Habitat III, United Nations, 2017

https://habitat3.org/wp-content/uploads/NUA-English.pdf

smart-city approach that makes use of opportunities from digitalization, clean energy and technologies, as well as innovative transport technologies, thus providing options for inhabitants to make more environmentally friendly choices. Sustainable infrastructure is strongly promoted by climate policies in order to enable greater resilience to extreme weather events.

5. The impacts of rapid and unplanned urbanization could affect the likelihood of conflict over limited resources.

6. The population living within 10 km of the coast in the coastal Member States of the pan-European region[22] has increased by 10 % between 2000 to 2015, from 133.6 to 147.7 Million (OECD, 2020), as compared to a 6 % increase in the total population over the same period, from 784.8 to 829.9 Million (UN DESA, 2021). Projections by Merkens et al. (2016) indicate that the global population living in coastal zones will increase from 638 million in 2000 (58 % of the global population) to more than one billion in 2050 (71% of the global population).

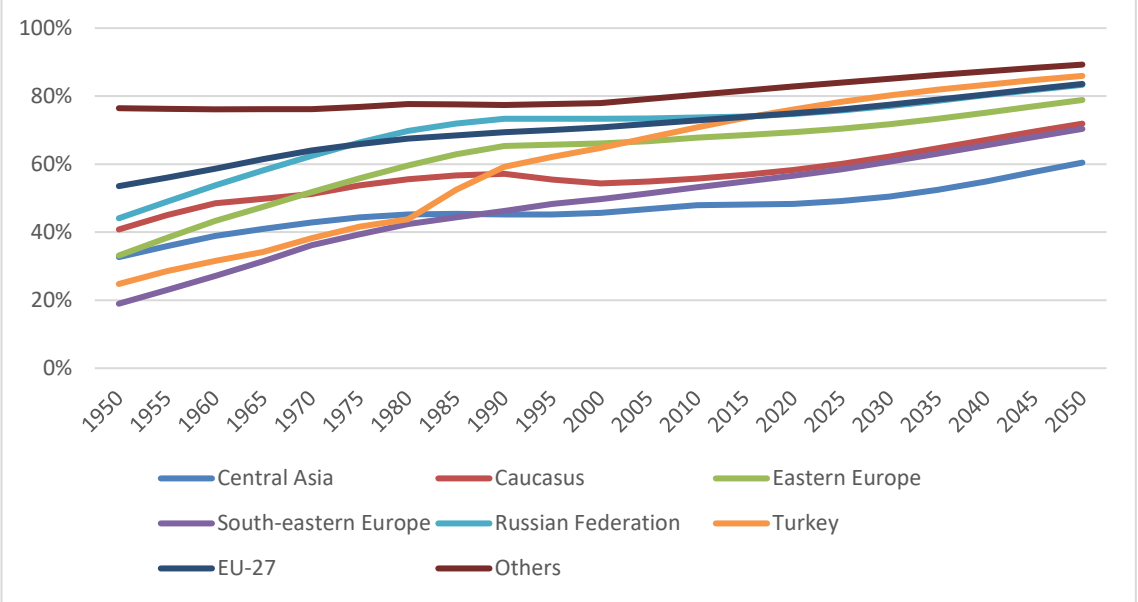
7. The growth of coastal (peri) urban hubs generates multiple environmental pressures from the generation of air and water pollution, wastewater discharges or sewage overflows and waste generation, calling for appropriate methods for addressing changes in consumption patterns and for processing waste and sewage generated by coastal populations and in catchment areas. Coastal urbanization results in land consumption, degradation of habitats, landscapes and coastlines, putting increasing pressure on coastal ecosystems. These pressures are further amplified by the development of tourism, often concentrated in coastal areas and in the summer months, as is the case of the Mediterranean region (UNEP/MAP and Plan Bleu, 2020). High-density coastal areas are characterized by elevated urban footprints, associated with an increased strain on infrastructure, and specific challenges for coastal countries in achieving sustainable development and the conservation of coastal and marine areas. These challenges can be exacerbated by climate change and rapid growth in regions and cities that currently lack the capacity to face these mounting pressures (UNEP, 2019).

8. The coastal population in the assessment area depends on seas and coasts to provide food, building materials, trade, transport, energy, and recreational benefits. These resources support the livelihoods of all inhabitants, sustaining life, providing jobs, and contributing to the economy.

A graph on coastal population growth might be added. .

[22] Out of 54 ECE Member States, the following 37 Member States are considered to be coastal (in alphabetical order): Albania (AL), Azerbaijan (AZ), Belgium (BE), Bosnia and Herzegovina (BA), Bulgaria (BG), Croatia (HR), Cyprus (CY), Denmark (DK), Estonia (EE) , Finland (FI), France (FR), Georgia (GE) , Germany (DE), Greece (EL), Iceland (IS), Ireland (IE), Israel (IL), Italy (IT), Kazakhstan (KZ), Latvia (LV), Lithuania (LT), Malta (MT), Monaco (MC), Montenegro (ME), Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Romania (RO) , Russian Federation (RU), Slovenia (SI), Spain (ES), Sweden (SE), Turkey (TR), Turkmenistan (TM), Ukraine (UA) and United Kingdom (UK).

Figure III
Percentage of population living in urban areas, forecast from 2020.



Source: United Nations, Department of Economic and Social Affairs, Population Division (2018). *World Urbanization Prospects: The 2018 Revision*, Online Edition.

Abbreviations: EU-27 – 27 member States of the European Union as of 1 January 2021.

2. A more prosperous society with increased use of resources

9. Prosperity has brought changes in lifestyles and behaviours. As noted in the Organisation for Economic Co-operation and Development (OECD) *Global Material Resources Outlook to 2060*,[23] growing populations with higher incomes in the coming decades will drive a strong increase in global demand for goods and services. The growing share of services in the economy will reduce the growth in materials use as the sector is less material intensive than agriculture and industry, though wealthier countries in the pan-European region already have a high share of services. The Outlook also saw that technological developments will help decouple growth in production levels from material inputs, though again the greatest opportunities may lie in countries with less-developed technology at present. However, the decrease in resource intensity may be slower than growth in GDP, thus driving up resource use. OECD predicts for Eurasia[24] an increase to 1.5 times current materials use and 2.5 times GDP in the period 2011–2060; over the same period, material intensity is expected to drop from 0.9 tons/$ to 0.5 tons/$. For OECD Europe,[25] materials use is to grow 1.8 times and GDP 2.5 times, while material intensity drops from 0.4 tons/$ to 0.3 tons/$.

10. One indicator of a more prosperous society, and particularly one where population growth rates have slowed or even reversed, is the expansion of single-occupancy housing, with a resultant increase in material and energy use per capita. Single-occupancy housing has risen steeply in the period 2000–2017 in many countries, though there has been a decline in a few countries in the region, especially since 2010 (see table 1).

[23] Reference to be added.

[24] Central Asia, the Caucasus, Eastern Europe, South-eastern Europe and Andorra, Bulgaria, Croatia, Cyprus, Latvia, Lithuania (though it became an OECD member in 2018), Malta, Romania, the Russian Federation and San Marino.

[25] Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel (though not in the pan-European region), Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Table 1

One-person households (number), selected countries, ordered by decreasing percentage change (2000–2017).

Country	2000	2005	2010	2015	2017	Percentage increase from 2000 to 2017
Italy	5,037,000	5,937,000	6,997,000	7,910,000	8,158,000	62%
Austria	976,600	1,198,500	1,300,200	1,418,400	1,438,325	47%
Finland	856,745	964,739	1,040,378	1,112,342	1,162,308	36%
Netherlands	2,272,219	2,449,378	2,669,516	2,867,797	2,961,228	30%
Germany	13,750,000	14,695,000	16,195,000	16,875,000	17,263,000	26%
Norway	739,563	784,231	874,931	894,126	928,483	26%
Azerbaijan	116,667	122,976	130,998	139,547	142,314	22%
Estonia	195,119	180,055	201,450	210,875	236,988	21%
Switzerland	1,120,878	no data	1,274,641	1,275,667	1,320,230	18%
Denmark	904,766	950,489	993,345	1,011,089	1,015,296	12%
Georgia	144,362	138,558	143,863	138,901	146,965	2%
Sweden	2,029,016	2,056,648	2,264,385	1,752,604	1,800,832	-11%
Ukraine	3,698,300	3,896,300	4,005,900	3,021,742	2,927,716	-21%
Uzbekistan	184,000	226,000	155,000	136,000	129,000	-30%

Source: ECE Statistical Database.

11. Prosperity in the region has led to vastly developed infrastructure, continuing extraction of natural resources and the expansion and intensification of agriculture (including in countries outside the region but feeding the pan-European region), which have increased pressure on land. Across the region, national footprints far exceed global biocapacity (about 1.7 tons per person) in all countries except Tajikistan. Figure XI shows national average footprint (2016) against Human Development Index (HDI) (2018) and how no country falls within a zone where global biocapacity is respected and a high HDI is achieved. For now, increasing HDI depends on rising GDP which results in turn in a larger footprint.

12. Usage of chemicals and the occurrence of waste are tightly interwoven with our standards of living and economic prosperity. An estimated 40,000 to 60,000 industrial chemicals are commercially traded worldwide (UNEP 2019) and used for example in agriculture, healthcare and the manufacturing of items such as electronics, textiles, furniture and toys. In 2017, the global chemical industry's production capacity amounted to 2.3 billion tonnes, making the chemical industry the second largest manufacturing industry in the world in terms of economic relevance (UNEP 2019). The volume of traded chemicals is expected to significantly grow in the future (UNEP 2019); the number of new chemicals is also rising (Escher et al. 2020). Of the 345 million tonnes of chemicals consumed in the European Union in 2016, 62 per cent belonged to categories classified as hazardous to human health and 35 per cent were hazardous to the environment (EEA 2018a).

13. Occurrence of large amounts of waste is linked to inefficient use of resources as part of unsustainable consumption and production practices in current societies. Some waste is hazardous and its sound handling is an essential element in reducing chemical pollution. Other waste streams cause losses of materials and energy and aggravate pressures on the environment, for example, introduction of micro-plastics into the food chains, affecting biodiversity and human health. At the same time, sound and value-oriented management of solid waste can substantially contribute to the mitigation of climate change by potentially displacing around 15 to 20 per cent of greenhouse gas emissions worldwide (UNEP and ISWA 2015).

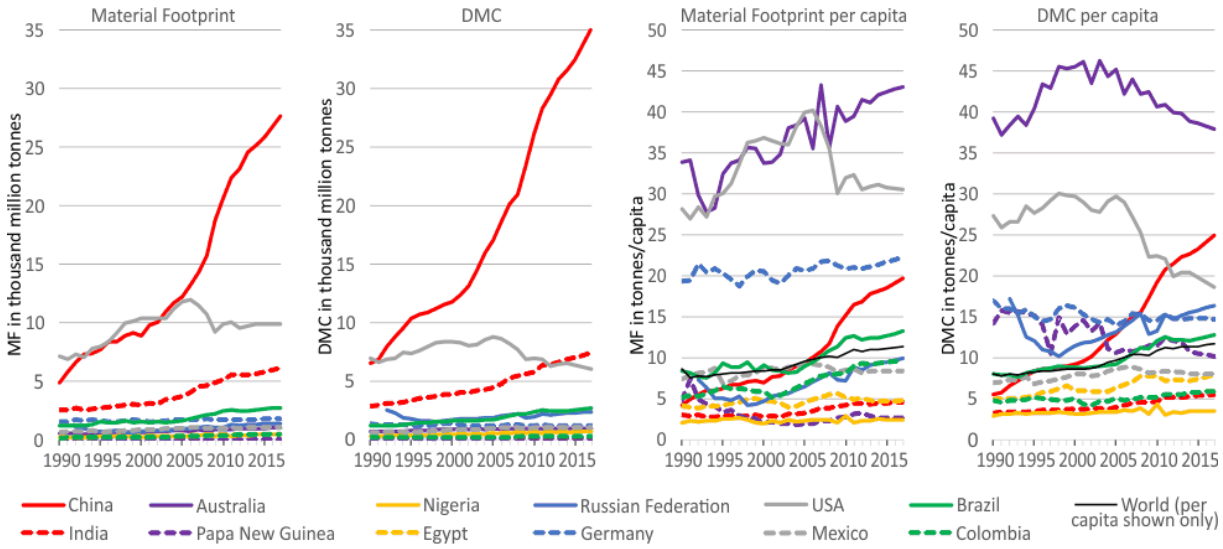
14. The Material Footprint (MF) which describes the total of raw materials (materials extracted from the environment) used to serve final demand of an economy, regardless of

whether raw material use occurs inside or outside the domestic territory. As some countries use resources to be used in other countries, the Domestic Material Consumption (DMC) provides a measure of what is produced or processed in a country, that is, the sum of domestic resource extraction and trade balance (physical flows of imports minus physical flows of export). The figures below[26] show that has expected countries with highest population use more resources, but if inspecting on a per capita basis, Australia and the USA stand up as the largest relative consumers. It is to be noted that China's resource use per capita is rapidly growing, and domestically due own use or processing of resources to be used in China.

Graphs showing material footprint and domestic material consumption, likely per capita, might be included, similar to below. .

Figure

MF and DMC (in thousand million tonnes), and MF and DMC per capita, 1990 to 2017, according to UNEP IRP data; shown for the two countries with highest population number on each continent (Asia, Australasia/Oceania, Africa [Egypt instead of Ethiopia shown due to data availability], Europe with Eurasia, North America with Central America, South America) [27]



Own elaboration, using UNEP data (retrieved 12 August 2018) available on the UNEP Environment Live Platform (data and statistics section): https://environmentlive.unep.org/downloader (there based on UN Environment International Resource Panel Global Material Flows Database)

15. The Ecological Footprint (EF), which compares demand for nature to available biocapacity, is depicted in map of figure 3. Larger countries with less intensive industry tend to still have a positive balance, but many countries of the work are in deficit, either by consumption or due to production.

16. A general increase in personal wealth is also a main driver for the development of coastal tourism, including the construction of luxury resorts and hotels, other facilities and infrastructure. It is a vital economic sector for certain Mediterranean countries, the region that hosted around 27% of world tourism in 2017 (UNWTO, 2019), as well as other coastal tourism hotspots (Figure …).

[26] Source: Kusch-Brandt S. (2019) Material Footprint: Understanding Resource Efficiency by Considering Actual Raw Material Consumption. In: Leal Filho W., Azul A., Brandli L., Özuyar P., Wall T. (eds) Responsible Consumption and Production. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham. https://doi.org/10.1007/978-3-319-71062-4_85-1

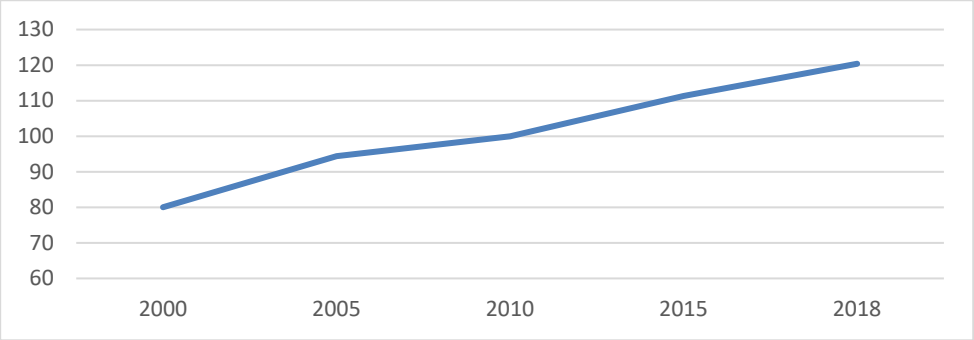
[27] Source: Kusch-Brandt S. (2019) Material Footprint: Understanding Resource Efficiency by Considering Actual Raw Material Consumption. In: Leal Filho W., Azul A., Brandli L., Özuyar P., Wall T. (eds) Responsible Consumption and Production. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham. https://doi.org/10.1007/978-3-319-71062-4_85-1

3. Shifting energy production and use

17. Despite industrial production increasing by 25 per cent from 2000 to 2010 and by 20 per cent from 2010 to 2018 (figure VI), total energy sources have hardly shifted since 1990 (a 3 per cent drop to 2017), whereas the energy mix has changed: 44 per cent less coal, 9 per cent less crude oil, 21 per cent more gas, 5 per cent more nuclear, 17 per cent more hydropower, 11 times wind and solar and almost double biofuels and waste (figure VII). However, coal, oil and natural gas still represent 74 per cent of net energy production (down from 84 per cent in 1990), while hydro, wind, solar, biofuels and waste represent just 14 per cent (up from 5 per cent) (see also figure VIII). The period 2015–2017 even saw a 2.4 per cent uptick in fossil fuels (figure IX).

Figure VI

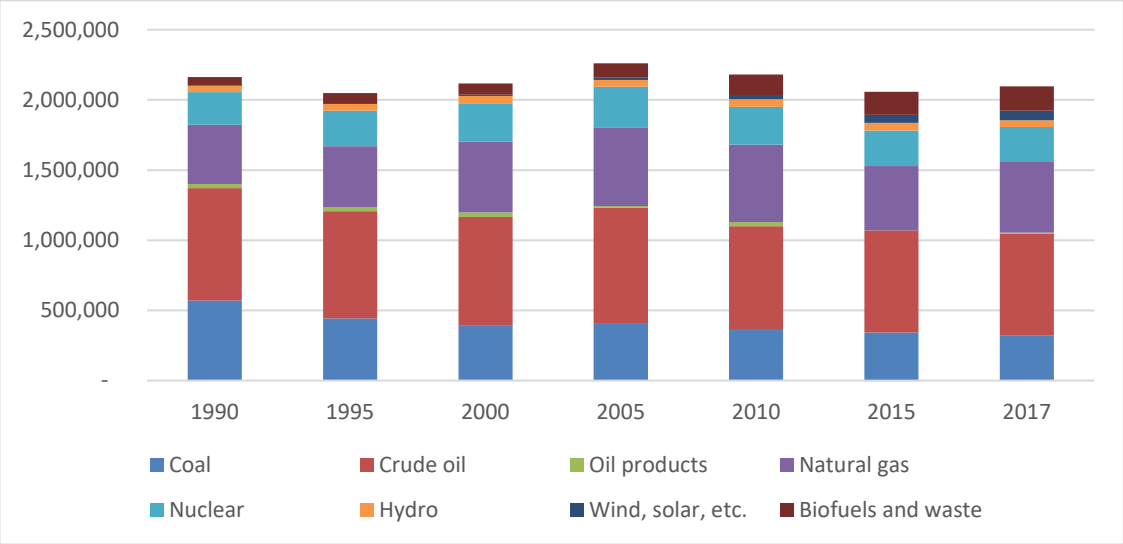
Industrial production (2010=100) (2000–2018)



Source: ECE Statistical Database. No data for Andorra, Iceland, Liechtenstein, Monaco, San Marino and Turkmenistan. Interpolation used to fill gaps in data for Bosnia and Herzegovina, Montenegro and the Russian Federation.

Figure VII

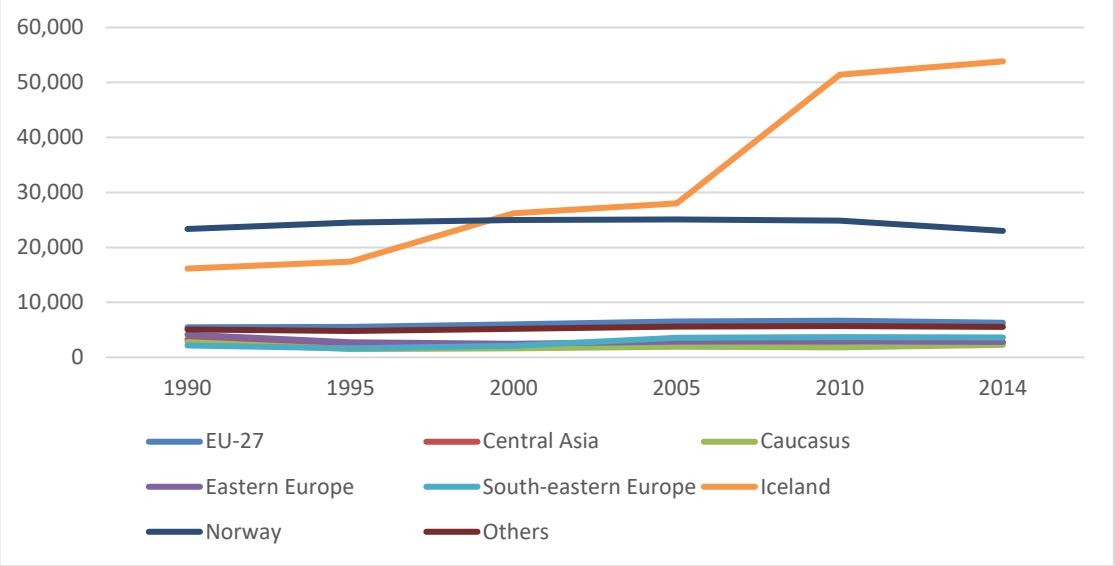
Energy sources, net of imports and exports (ktoe), Europe (1990–2017)



Source: International Energy Agency (IEA). *Note*: Excludes the Caucasus and Central Asia. Additional data are being sought.

Figure XI

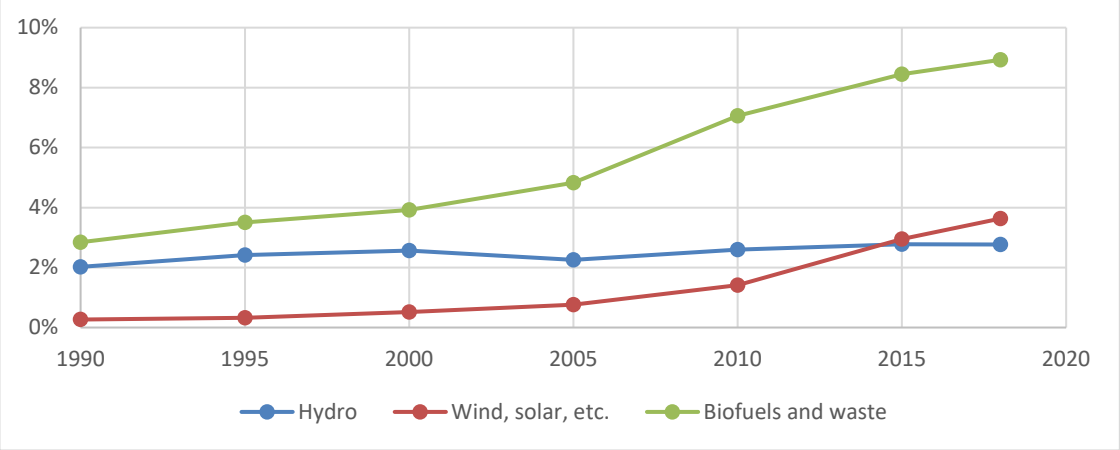
Electric power consumption (kWh per capita)



Source: World Development Indicators, The World Bank.

Figure VIII

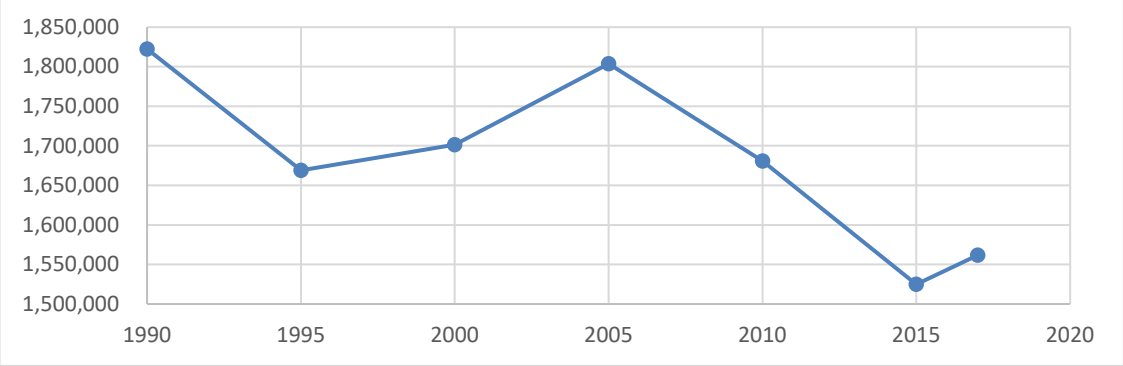
Selected renewables (per cent of total energy supply), Europe (1990–2018)



Source: IEA. *Note*: Excludes the Caucasus and Central Asia. Additional data are being sought.

Figure IX

Fossil fuels produced, net of imports and exports (ktoe), Europe (1990–2017)



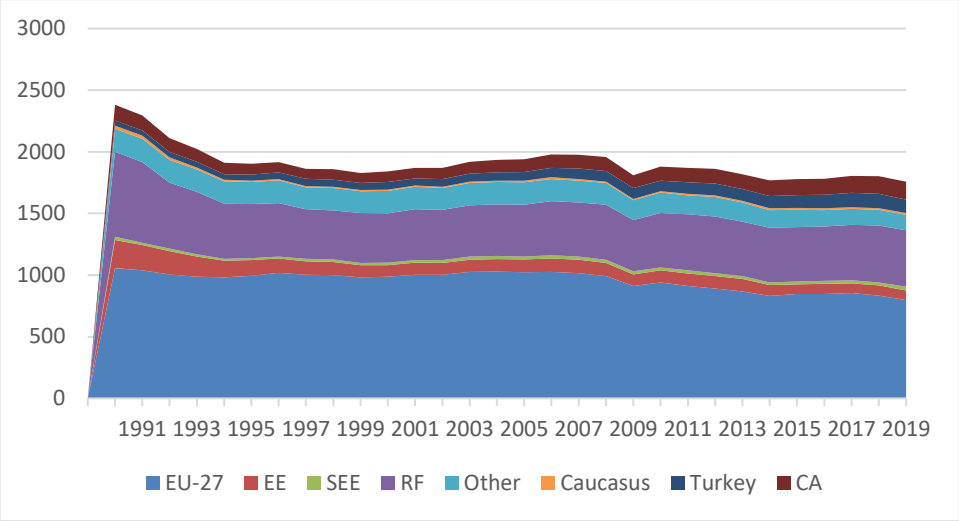
Source: IEA. *Note*: Excludes the Caucasus and Central Asia. Additional data are being sought.

17. The change in energy mix has also led to a stabilisation in CO_2 emissions from the region, though with significant geographical variations (see figure X). The reductions in

greenhouse gas emissions necessary to limit global temperature rise to 2 C, let alone 1.5 C, have yet to be seen.

Figure X

Territorial fossil CO_2 emissions by country (million tons of CO_2) (1990–2019)



Source: Global Carbon Budget, 2020[28]

Abbreviations: EU-27 – 27 member States of the European Union as of 1 January 2021; EE – Eastern Europe; SEE – South-eastern Europe; CA – Central Asia.

18. New trends are expected in electricity consumption. On one hand cryptocurrency is using increasing quantities of energy, such as shown in Figure XI for Iceland[29]. On the other hand, the European Union aims to have at least 3 million electric vehicle chargers by 2030 a three-fold in comparison with today. This trend will however promote material pressure such as lithium for batteries.

4. An increasingly mobile society

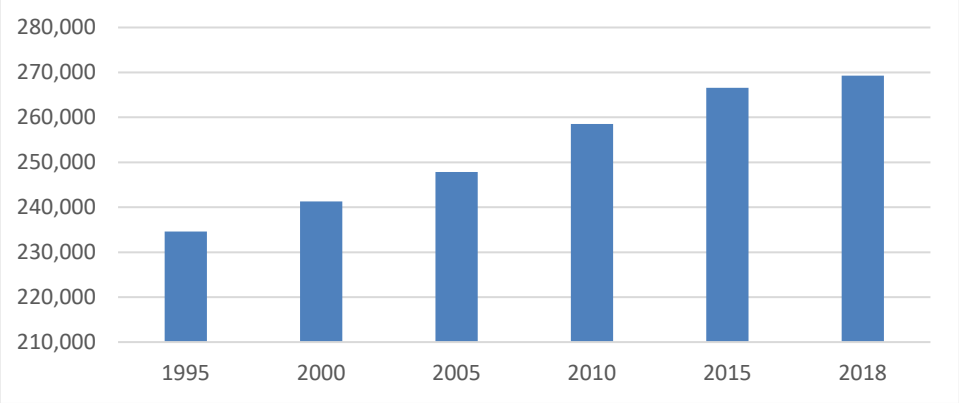
19. Infrastructure including for transport has seen continued growth. For example, the length of motorways has continued to grow, though at a slower rate (figure IV). At the same time, motor transport has continued to see growth, which has accelerated in some countries; Finland at least has turned the corner and seen a decrease in motor vehicle movements between 2010 and 2017 (see table 2). In addition, railway passenger traffic has grown (figure V). This trend – among others – has likely been reversed, however, by the effects of the COVID-19 pandemic.

[28] Pierre Friedlingstein, Michael O'Sullivan, Matthew W. Jones, Robbie M. Andrew, Judith Hauck, Are Olsen, Glen P. Peters, Wouter Peters, Julia Pongratz, Stephen Sitch, Corinne Le Quéré, Josep G. Canadell, Philippe Ciais, Rob Jackson,Simone Alin, Luiz E.O.C. Aragão, Almut Arneth, Vivek Arora, Nicholas R. Bates, Meike Becker, Alice Benoit-Cattin, Henry C. Bittig, Laurent Bopp, Selma Bultan, Naveen Chandra, Frédéric Chevallier, Louise P. Chini, Wiley Evans, Liesbeth Florentie, Piers M Forster, Thomas Gasser, Marion Gehlen, Dennis Gilfillan, Thanos Gkritzalis, Luke Gregor, Nicolas Gruber, Ian Harris, Kerstin Hartung, Vanessa Haverd, Richard A. Houghton, Tatiana Ilyina, Atul Jain, Emilie Joetzjer, Koji Kadono, Etsushi Kato, Vassilis Kitidis, Jan Ivar Korsbakken, Peter Landschützer, Nathalie Lefèvre, Andrew Lenton, Sebastian Lienert, Zhu Liu, Danica Lombardozzi, Gregg Marland, Nicolas Metzl, David R. Munro, Julia E.M.S Nabel, Shin-Ichiro Nakaoka, Yosuke Niwa, Kevin O´Brien, Tsuneo Ono, Paul I. Palmer, Denis Pierrot, Benjamin Poulter, Laure Resplandy, Eddy Robertson, Christian Rödenbeck, Jörg Schwinger, Roland Séférian, Ingunn Skjelvan, Adam JP Smith, Adrienne J. Sutton, Toste Tanhua, Pieter P. Tans, Hanqin Tian, Bronte Tilbrook, Guido van der Werf, Nicolas Vuichard, Anthony P. Walker, Rik Wanninkhof,Andrew J. Watson, David Willis, Andrew J. Wiltshire, Wenping Yuan, Xu Yue, Sönke Zaehle. Global Carbon Budget 2020, Earth Syst. Sci. Data, 2020.

[29] Iceland attracts data miners from around the world given the cheap geothermal-produced electricity.

Figure IV

Motorway length, pan-European region (km).



Source: ECE Transport Division Database. No data for Albania, Belarus, Greece, Montenegro, Tajikistan and Turkmenistan. Interpolation used to fill gaps in data for Azerbaijan, Georgia, Kazakhstan and Uzbekistan.

Table 2

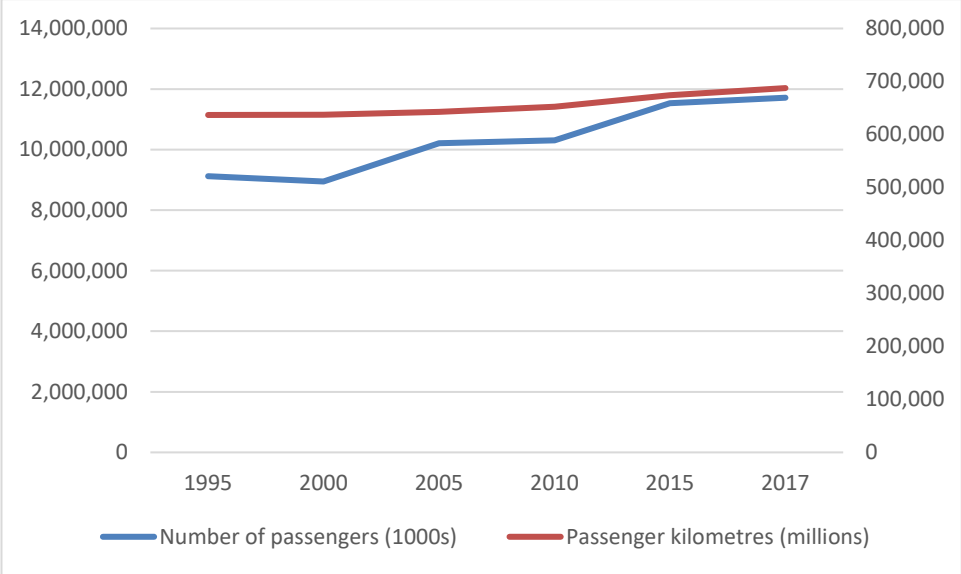
Motor vehicle movements on national territory by vehicle-kilometres (millions), selected countries, ordered by decreasing percentage change (2000–2017)

	2000	2010	2017	Percentage increase from 2000 to 2017
Turkey	56,151	80,124	127,997	128%
Estonia	6,441	8,355	10,811	68%
Slovenia	13,346	17,826	21,437	61%
Norway	32,669	43,847	46,791	43%
Austria	65,143	75,957	86,854	33%
Czechia	40,490	46,381	54,558	35%
Hungary	32,974	no data	43,016	30%
Switzerland	52,873	60,036	67,822	28%
Sweden	69,667	76,836	83,896	20%
Spain	208,508	241,131	244,661	17%
France	525,787	560,429	606,042	15%
Finland	46,710	54,715	51,386	10%
United Kingdom	478,376	495,917	526,423	10%

Source: ECE Transport Division.

Figure V

Railway passenger traffic, thousands of passengers (left axis) and millions of passenger kilometres (right axis) (1995–2017)



Source: ECE Transport Division Database. Interpolation used to fill gaps in data for one or both series for all countries except Austria, Bulgaria, Czechia, Estonia, Finland, Latvia, Lithuania, North Macedonia, Poland, Romania, Slovakia, Slovenia, Sweden, Switzerland and Turkey.

20. According to IEA30 (2020), aviation $CO_{2\text{-eq}}$ emissions rose rapidly, at an average annual rate of 2 per cent. during 2000-19, with commercial passenger flight activity since 2000 rising 5 per cent yearly. The energy intensity of commercial passenger aviation has decreased 2.8% per year on average, but improvements have slackened over time. This is due to operational and technical efficiency measures adopted by commercial airlines, including new aircraft purchases. But most (>99.5%) aviation relies on jet kerosene, and most jet kerosene (>85%) is used by commercial passenger aviation and alternatives are yet not found[31].

21. Lenzen et al. (2018) estimated the contribution of tourism to climate change to be 8 per cent, and transport is responsible for the majority of emissions. Travel distance and modal choice are the key determining factors in tourism transport emissions. The combination of strong increases of transport speed and low fares through the development of air transport were the main drivers of overconsumption of travelled distances (P. M. Peeters, 2017).

22. Maritime transport remains the main gateway to the global marketplace, with around 90 % of all goods moved across the world by ships (OECD website[32]). Figure 4 shows the vast scale of the shipping sector globally, with a focus on the pan-European region, highlighting the most important and busiest ports and the most commonly-used shipping routes. Transport of oil and chemicals predominates in the North Sea, the southern parts of the Caspian Sea and inland transport from Azov Sea. The Mediterranean Sea also hosts major oil transportation lanes, notably with oil shipments through two of the six major oil chokepoints worldwide, the Suez Canal / SUMED Pipeline and the Turkish straits which together accounted for 13.24 % of the world's seaborne oil trade in 2015 (UNEP/MAP and Plan Bleu, 2020). The increasing container volumes and ship sizes have exacerbated the need

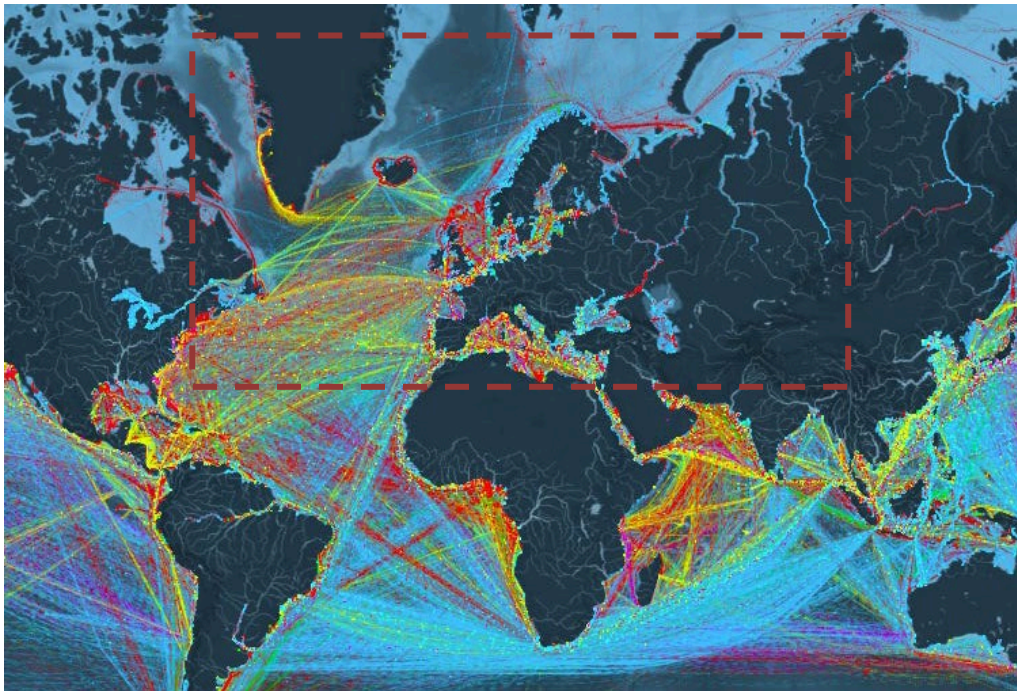
30 https://www.iea.org/reports/tracking-transport-2020/aviation

31 According to the same report near to mid-term priorities include implementing fiscal and regulatory measures that promote exploitation of operational and technical efficiency and managing the investment risks derived from developing and deploying clean sheet airframes, new engines and propulsion systems, and for production low-lifecycle GHG-emissions Sustainable Aviation Fuels.

32 https://www.oecd.org/ocean/topics/ocean-shipping/

to improve port infrastructure and move towards deep-water terminals able to better process larger and more efficient ships.

Figure
Map showing the movements of all ships in the global merchant fleet during 2012, the most recent year with complete data



Source: Will (2017)

Notes: Colour code: Yellow: Container (e.g., manufactured goods); Blue: Dry bulk (e.g., coal, aggregates); Red: Tanker (e.g., oil, chemicals); Green: Gas bulk (e.g., liquefied natural gas); Purple: Vehicles (e.g., cars). The dashed box highlights the pan-European region.

III. Environmental state and trends

Introduction

1. This chapter discusses the environmental state, trends and policy responses, using the ECE set of environmental indicators,[33] Sustainable Development Goal indicators and other indicator frameworks as appropriate. The indicators used have been selected based on the following criteria: policy relevance; soundness of the methodology, preferably based on national sources; data availability; and coverage of pressures, state and impacts. The chapter addresses eight environmental themes:

- Atmospheric air
- Climate change
- Fresh water
- Coastal waters, marine ecosystems and seas
- Biodiversity and ecosystems
- Land and soil
- Chemicals and waste
- Environmental financing

2. For each theme, key messages and policy recommendations are presented based on an assessment of the state, trends and outlook towards meeting policy objectives. Key messages and recommendations are derived from text and not repeated in text. Links are provided to circular and green economy, sustainable development and the two conference themes.

3. Throughout the assessment, where feasible and relevant, the following subregions are referred to:

(a) European Union, comprising 27 member States, i.e. without the United Kingdom of Great Britain and Northern Ireland;

(b) Western Europe, comprising non-European Union high-income countries and including Israel;

(c) Central Asia, comprising Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan;

(d) Eastern Europe, including the Caucasus and the Russian Federation;

(e) South-Eastern Europe, comprising Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia and Turkey.

4. National values for some indicators are provided online.[34]

[33] For a list and guidance on application of United Nations Economic Commission for Europe (ECE) environmental indicators, see https://unece.org/guidelines-application-environmental-indicators.

[34] To be added at https://unece.org/pan-european-assessment.

A. Atmospheric air

1. Key messages and recommendations

Key messages

3. The health impact of long-term exposure to fine particulate matter with a diameter less than 2.5 µm ($PM_{2.5}$) in 41 European countries was reduced by 13 per cent in the period 2009–2018 and that of nitrogen oxides (NO_x) by 54 per cent. However, the number of premature deaths due to ground-level ozone exposure increased in that period by an estimated 24 per cent, possibly caused by higher mean temperatures.[35]

4. The Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) has had positive effects on human health and the environment. The phasing out of hydrochlorofluorocarbons present as coolant in refrigerators and air conditioning systems remains incomplete, especially in countries with economies in transition.

5. Emissions measurement and ambient air pollution monitoring have improved in the past decade, with more appropriate equipment, advanced portable sensors and network strategies leading to greater efficiency and lower costs of ground-level monitoring stations, and are increasingly available.[36] In the pan-European region, there are still monitoring gaps, especially in the measurement and analysis of fine PM.

6. Countries in the region are expanding policies to tackle air pollution. The evaluation and fitness check of existing European Union air quality legislation in 2019[37] led to proposals to strengthen provisions on monitoring, modelling and air quality plans to achieve cleaner air. The European Union air quality standards will be revised to align them more closely with the World Health Organization (WHO) Air Quality Guidelines, which are to be updated in 2021.[38] The Russian Federation is implementing the "Clean Air" project,[39] which provides for significant reduction of pollutants in 12 large industrial centres by 2024, as well as a radical modernization of the State system for monitoring air pollution in these cities.

Recommendations

7. Cooperation should be enhanced so that non-European Union countries in the region could have the possibility to benefit from the experience on the European Union zero-pollution action plan.[40]

8. Governments should develop additional technical and organizational measures to achieve target 3.9 of the Sustainable Development Goals, especially for fine particulate matter and ground-level ozone. Key responses are the sharpening and application of best available techniques to prevent emissions of particulate matter, nitrogen oxides (NO_x) and

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[35] European Environment Agency (EEA), *Air Quality in Europe – 2020 report*, EEA Report No. 9/2020 (Luxembourg, Publications Office of the European Union, 2020), available at www.eea.europa.eu/publications/air-quality-in-europe-2020-report/at_download/file.

[36] Real-time air polluting concentrations and air pollution indices are available and are published on maps by different providers (for example, http://iqair.com). Since 2015, the European Copernicus Atmosphere Monitoring Service (http://atmosphere.copernicus.eu) has provided continuous satellite data and information on atmospheric composition. The Service tracks air pollution, solar energy, greenhouse gases and climate forcing globally.

[37] European Commission, *Fitness Check of the Ambient Air Quality Directives*, Commission Staff Working Document (Brussels, 2019), available at https://ec.europa.eu/info/publications/fitness-check-eu-ambient-air-quality-directives_en.

[38] Sentence to be reviewed in 2022.

[39] Full information on the project is available (in Russian) at https://rpn.gov.ru/activity/fresh-air/info/.

[40] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Pathway to a Healthy Planet for All EU Action Plan: "Towards Zero Pollution for Air, Water and Soil", COM(2021) 400 final.

hydrocarbons by industry and emission reduction from traffic (by implementing Euro-6 and 7 measures).

9. Governments should contribute or urge donors to contribute to the adequate replenishment of the Multilateral Fund for the implementation of the Montreal Protocol in order to accelerate the phasing out of hydrochlorofluorocarbons globally.

10. Governments should promote the use of appropriate and standardized methods for monitoring air pollution emissions[41] and the public availability of monitoring data in the pan-European region, while also strengthening cooperation and national investment to fill monitoring gaps in countries with economies in transition.

2. Context

11. Emissions of substances such as sulfur dioxide (SO_2), carbon monoxide (CO) and lead (Pb), which were problematic in the second half of the twentieth century, have been reduced worldwide. Others, such as PM, NO_x and ammonia (NH_3), have increased in many areas. In the past 40–50 years, policy measures to reduce air pollution have been developed at the national level and through successful international cooperation, such as European Union directives and guidelines and the multilateral environmental agreements of the United Nations Economic Commission for Europe (ECE).[42] Since 2016, 27 countries and various organizations have submitted commitments to the Batumi Action for Cleaner Air.[43]

12. For the pan-European region, the Convention on Long-range Transboundary Air Pollution (Air Convention), with its 51 Parties and its various protocols, has initiated actions, founded on scientific arguments, to deal with the long-term challenges of air pollution. The Convention's 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, as amended in 2012, is the leading instrument for setting national emission ceilings for SO_2, NO_x, NH_3, volatile organic compounds (VOCs) and $PM_{2.5}$ to be achieved by 2020 and beyond. As black carbon (soot, a short-lived climate pollutant) is included in the PM fraction, climate co-benefits are also achieved. Other key protocols of the Convention are the Protocol on Heavy Metals and the Protocol on Persistent Organic Pollutants.

13. Air quality in the pan-European region remains moderate and unhealthy for sensitive groups in many regions, particularly in urban and industrial areas, despite some sizable reductions in ambient concentrations, and air pollution is still considered as the most important environmental risk to human health. At present, PM, nitrogen dioxide (NO_2) and ground-level ozone (O_3) are the substances that most seriously influence human health, even when concentrations do not exceed current established limit values.

3. Status, main trends and recent developments

14. Air pollution in Europe has in general decreased in European Union and European Free Trade Association countries in recent decades and, mainly through economic growth, increased in the countries of the Caucasus, Central Asia and Eastern Europe. Joint efforts of national and regional authorities have not yet led to all desired results as some air quality standards are still exceeded, especially in urban areas.

15. The health impact of long-time exposure to $PM_{2.5}$ in 41 European countries was reduced by 13 per cent in the period 2009–2018 to 417,000 premature deaths (4.8 million years of life lost). For NO_x, the health impact was reduced by 54 per cent to 55,000 premature deaths (624,000 years of life lost) in the same period. However, the number of premature deaths due to ground-level ozone exposure increased in this period by an estimated 24 per cent to 20,600 (247,000 years of life lost), possibly caused by higher mean temperatures.[44]

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[41] For example, as described in European Union Best Available Techniques reference documents and their equivalents in the Russian Federation.

[42] To be described in Chapter I of the published pan-European environmental assessment.

[43] Available at https://unece.org/baca.

[44] European Environment Agency, *Air Quality in Europe – 2020 report*.

16. In the Russian Federation, the number of cities with high and very high air pollution decreased by 70 per cent in the period 2010–2019 (based on air pollution indices). The Government of the Russian Federation has instructed the authorities in big cities like Moscow and St. Petersburg to develop a road map to set up restrictions for heavily polluting traffic (under Euro-3).[45] In other countries of the Caucasus, Central Asia and Eastern Europe, there have been similar developments in the field of fuel quality. In Uzbekistan, over 50 per cent of private cars and trucks use cleaner natural gas as fuel.[46]

17. The global BreatheLife campaign,[47] led by WHO, UNEP and the Climate and Clean Air Coalition, calls on Governments to commit to achieving the WHO Air Quality Guidelines targets in 2030. The aim is to halve the number of air pollution-related deaths by 2030, while helping to slow the pace of climate change. Within the Coalition, over 70 States have founded a voluntary partnership together with intergovernmental organizations, non-governmental organizations, cities and financial and business institutions, aimed at reducing emissions of short-lived climate pollutants (black carbon, methane, hydrofluorocarbons and tropospheric ozone).

18. The Second European Union Clean Air Forum (2019) discussed differences between the European Union air quality guidelines and their mostly more stringent WHO equivalents and ways to close this gap. The European Union clean air policy framework to abate air pollution includes three pillars: air quality standards, national emission ceilings for key pollutants and emission limit values for key sources of pollution. The 2019 fitness check of the European Union Ambient Air Quality Directive[48] showed that not all the Directive's targets have been met and that the gap to achieve air quality standards is wide in some cases, thus requiring improvement of existing legislation. In specific cases, stricter emission ceilings in the National Emission Ceilings Directive[49] or more stringent emission limit values in the Industrial Emissions Directive[50] and for mobile sources could be necessary to meet the policy challenge to achieve all European Union air quality standards as a first step to achieving their WHO equivalents in 2030. In 2021, the European Commission adopted a Zero Pollution Action Plan.

19. The European Environmental Agency and the European Commission launched the European Air Quality Index in 2017, which provides on-line information on the air quality situation, based on measurements from more than 2,000 air quality monitoring stations across Europe. An interactive map shows the local air quality situation at station level, based on five key pollutants: $PM_{2.5}$, PM_{10}, ground-level ozone, NO_2, and SO_2.

20. At the global level, the General Assembly adopted resolution A/RES/74/212 on the International Day of Clean Air for blue skies (first held on 7 September 2020). UNEP, in collaboration with the Climate and Clean Air Coalition and WHO, coordinated activities for the International Day, to raise public awareness, demonstrate the connection with the Sustainable Development Goals and promote and facilitate solutions for air protection.

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[45] Konstantin Fomin, "How Russian cities are cleaning up their air", Greenpeace, 30 April 2019.

[46] *Environmental Performance Reviews: Uzbekistan – Third Review* (United Nations publication, Sales No. E.20.II.E.26).

[47] See https://breathelife2030.org.

[48] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, *Official Journal of the European Union*, L 152 (2008), pp. 1–44.

[49] European Union Directive 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC, *Official Journal of the European Union*, L 344 (2016), pp. 1–31.

[50] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), *Official Journal of the European Union*, L 334 (2010), pp. 17–119.

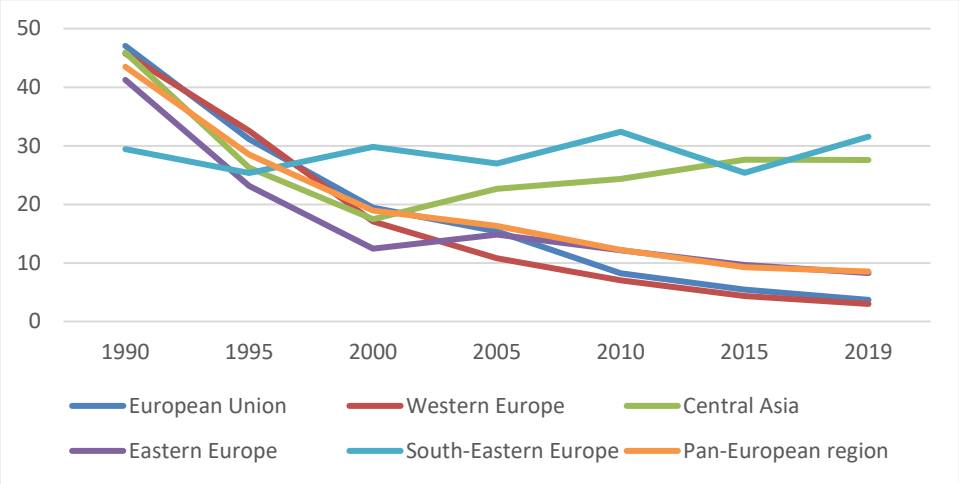
4. Indicators

Emission of pollutants into the atmospheric air (ECE, pressure indicator)

21. Within the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), 43 out of 51 Parties to the Air Convention submitted their emission inventories in 2020. Nevertheless, the quality of data varies widely, generating uncertainty. Experts and modellers are working on a solution towards a harmonized emission methodology.

22. In the period 2000–2018, emissions of the main pollutants (SO_2, NO_x, NH_3, non-methane VOCs, PM_{10}, $PM_{2.5}$, PM_{coarse} and black carbon) have shown a major decoupling from economic growth and an absolute decrease in the western part of the region. In the countries of the Caucasus, Central Asia and Eastern Europe and Turkey, emissions have increased since 2000, but these emissions are often based on expert estimates extrapolated from gross domestic product growth trends, due to the lack of plausible reporting. Figures I (below) and II and III (overleaf) show strong decreases in emissions of SO_2 and NO_x, while decreases for $PM_{2.5}$ are much smaller.

Figure I
Emission trends for SO_2, kg per annum per capita (1990–2018)

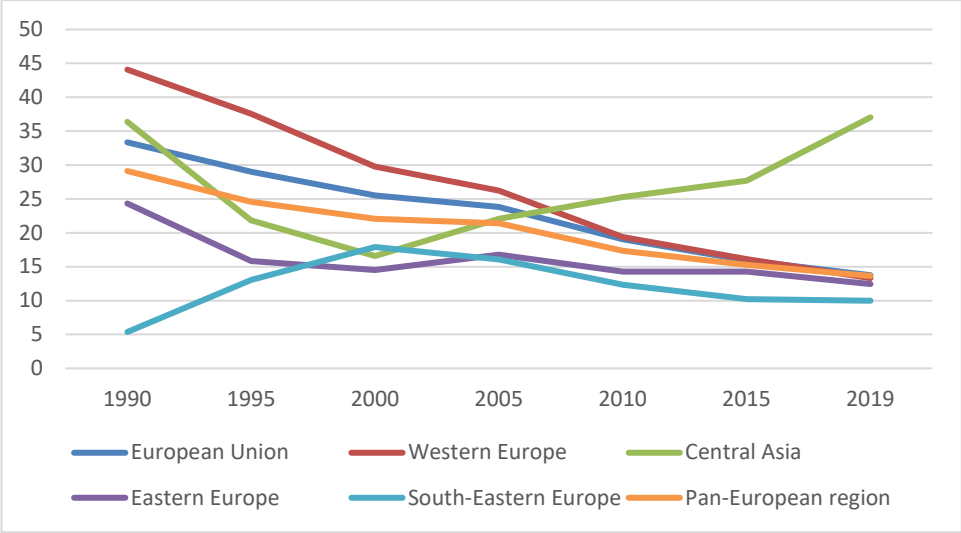


Source: EMEP Centre on Emission Inventories and Projections, 2021, Officially reported emission data, available at www.ceip.at/webdab-emissions-database/reported-emissiondata. Population data from ECE Statistics Database, 2019 or latest.

Notes: No data for Andorra, Bosnia and Herzegovina (except 1992), Israel or San Marino; data only for Kazakhstan and Kyrgyzstan in Central Asia; gaps for Armenia, Azerbaijan, Belarus and Ukraine; 2017 instead of 2019 data for Azerbaijan and Kyrgyzstan.

23. The largest decoupling between economic growth and production and air polluting emissions in recent decades has occurred in the energy-producing sector and manufacturing industry. Emissions from the road and non-road transport sector also decreased considerably by stringent emission standards set at the European Union level and, with some delay, also in the pan-European region. The agriculture and waste sectors had significantly less reductions in emissions. The residential, commercial and institutional sector did not reduce its emissions very much except for SO_2 emissions.

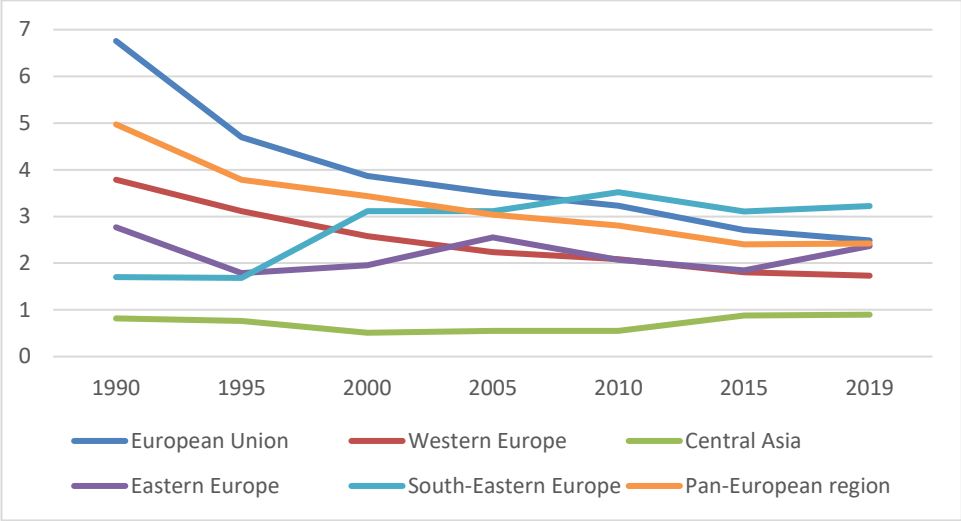
Figure II
Emission trends for NO_x, kg per annum per capita (1990–2018)



Source: EMEP Centre on Emission Inventories and Projections, 2021, Officially reported emission data, available at www.ceip.at/webdab-emissions-database/reported-emissiondata.

Notes: No data for Andorra, Bosnia and Herzegovina, Israel or San Marino; data only for Kazakhstan and Kyrgyzstan in Central Asia; gaps for Armenia; 2017 instead of 2019 data for Azerbaijan and Kyrgyzstan.

Figure III
Emission trends for $PM_{2.}$, kg per annum per capita (1990–2018)



Source: EMEP Centre on Emission Inventories and Projections, 2021, Officially reported emission data, available at www.ceip.at/webdab-emissions-database/reported-emissiondata.

Notes: No data for Andorra, Bosnia and Herzegovina, Israel or San Marino; no data for 1992 and 1995 for Estonia, Hungary, Slovenia and Spain; data only for Kazakhstan and Kyrgyzstan in Central Asia; gaps for Armenia, Belarus, the Russian Federation and Ukraine; 2017 instead of 2019 data for Azerbaijan and Kyrgyzstan.

Ambient air quality in urban areas (ECE, state indicator)

24. Improvements in air quality monitoring and reporting in the past 15–20 years make it possible to assess and report air quality trends in a qualitative, good statistical way. Long-term records of concentrations of the limited number of air polluting substances regulated in the European Union Ambient Air Quality Directive are available for European Union Member States, Iceland, Norway, Switzerland and the United Kingdom of Great Britain and

Northern Ireland.[51] Countries in the Caucasus and Central Asia and some Eastern European countries perform reporting of air quality by a different method in the form of air pollution indices, in which three different indicators are used to assess air quality. These indicators make it possible to characterize both short-term air pollution and the chronic impact of air pollution on public health and the environment. The assessment of the air quality in the countries of the Caucasus, Central Asia and Eastern Europe also includes specific pollutants for which hygienic standards have been established (more than 700 substances, for 160 of which State regulation measures are applied). The air quality category established by a set of indicators considers the main pollutants for each city, as assessed relative to standards. Assessments for specific pollutants that make the greatest contribution to air pollution levels in cities are regularly published online.[52]

25. SO_2 concentrations show the largest decrease of the main pollutants in the pan-European region over the past 20 years, with mean European Union values showing a 70 per cent reduction at traffic monitoring stations and 85 per cent at monitoring stations in urban background and industrial areas. In the past few years, the decrease of SO_2 concentrations has slowed. For ambient NO_x concentrations in the European Union, the mean reduction of 25–35 per cent over the past 20 years is similar for all station types, with rural stations having the largest decrease. The phasing out of combustion engines in automobiles is expected to accelerate the decrease of NO_x concentrations in urban and suburban stations in the next 10 years. Annual mean ground-level ozone trends in Europe over the past 20 years did not show significant trends or increased around 20 per cent for traffic stations, with 25 per cent of these sites showing increases of 40 per cent or more, while high ozone peaks have decreased by about 10 per cent except at traffic stations. The increase of mean ozone concentrations is coupled with the reduction of NO_x and VOC emissions. From 2000, annual mean PM_{10} concentrations in Europe have decreased by 40–50 per cent for all stations, with the largest reduction at industrial monitoring stations, while the reduction of $PM_{2.5}$ was around 30 per cent (measured relative to 2008). Regional differences occur with seasonal peaks of PM concentrations in areas where mostly wood is used for domestic heating, such as South-Eastern Europe, Eastern Europe and Central Asia. Figure IV overleaf illustrates the changes in the period 2010–2016.

Consumption of ozone-depleting substances (ECE, response indicator)

26. Ozone-depleting substances (ODS) are being phased out, although certain limited essential uses are still allowed, such as laboratory use and firefighting in special cases. Consumption of ozone-depleting substances in the 27 Member States of the European Union (production, plus imports, minus exports and destruction) has been negative since 2012, falling from 343,000 ozone-depleting potential (ODP) tons in 1986.[53] In the countries of the Caucasus, Central Asia and Eastern Europe, the consumption of ozone-depleting substances fell from 243 to 34 tons and in the Russian Federation from 684 to 287 tons in the period 2014–2019. [54] Figure V overleaf provides an overview hydrochlorofluorocarbon consumption per capita in the period 2010–2019.

27. The emission of ODS today has been reduced by 98 per cent compared to 1990 levels. Obligations for parties to the Montreal Protocol are the gradual phase-out of production and consumption of the controlled substances according to specific timelines, reporting of data

[51] Augustin Colette and Laurence Rouïl, *Air Quality Trends in Europe: 2000–2017: Assessment for surface SO_2, NO_2, Ozone, PM_{10} and $PM_{2.5}$*, European Environment Information and Observation Network Report ETC/ATNI 2019/16 (Kjeller, Norway, European Topic Centre on Air pollution, Transport, Noise and Industrial Pollution, 2020)

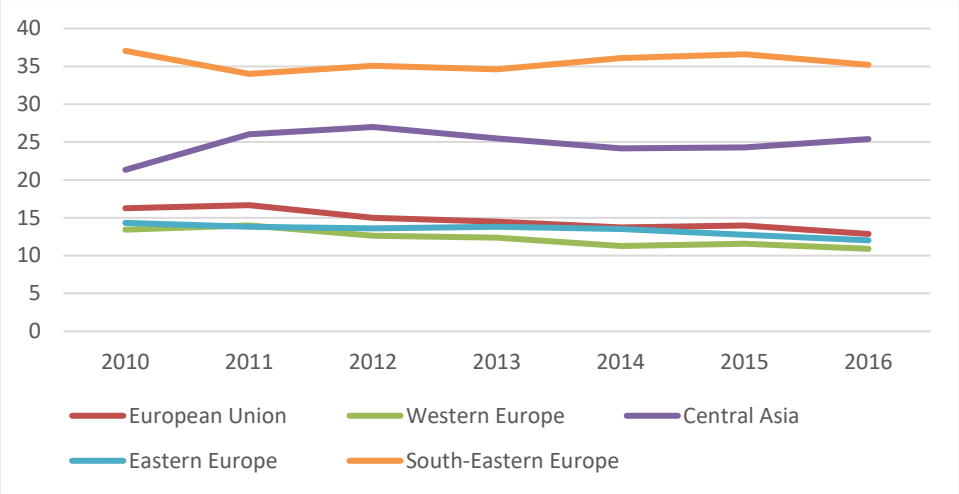
[52] Russian Federation, Sanitary Rules and Norms, State standards for air pollution.

[53] European Commission, *Evaluation of Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer*, Commission Staff Working Document (Brussels, 2020), available at https://ec.europa.eu/clima/sites/default/files/ozone/docs/swd_2019_406_en.pdf.

[54] See http://ozone.unep.org.

on the production, use, import and export to the Ozone Secretariat and establishing an import- and export licensing system.

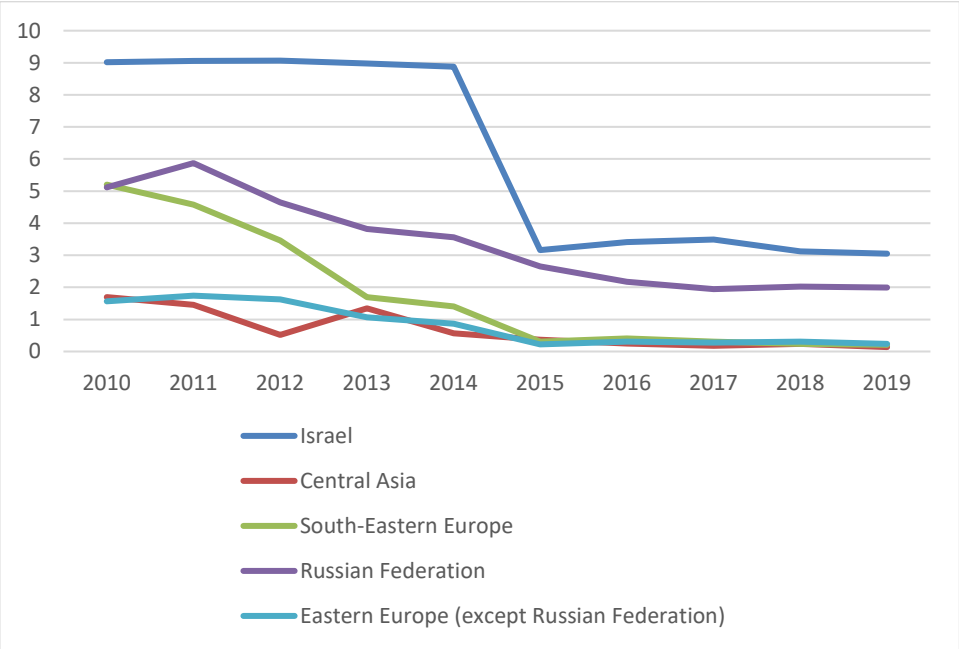
Figure IV
Concentrations of fine particulate matter ($PM_{2.5}$), all areas, mg/m3 (2010–2016)



Source: WHO Global Health Observatory, www.who.int/data/gho/data/indicators/indicator-details/GHO/concentrations-of-fine-particulate-matter-(pm2-5), last update 7 May 2021.

Notes: Regional values are population weighted. No data for Liechtenstein. Corresponds to Sustainable Development Goal indicator 11.6.2.

Figure V
Consumption of hydrochlorofluorocarbons, ODP g per capita (2010–2019)



Source: UNEP Ozone Secretariat, http://ozone.unep.org.

Notes: European Union net consumption below zero since 2010; Western Europe except Israel, zero consumption since 2015, Azerbaijan and Belarus achieved zero consumption in 2019, Kyrgyzstan in 2020.

28. In the countries of the Caucasus, Central Asia and South-Eastern and Eastern Europe, and Turkey, the consumption of chlorofluorocarbons has been phased out completely in the period 2005–2010. Consumption of hydrochlorofluorocarbons has been reduced in the period 2014–2019 from 90 to 27.5 tons ODP (the Caucasus, Central Asia and Eastern Europe), from

14.5 to 12 tons ODP (South-Eastern Europe) and from 124 to 8.5 tons ODP (Turkey). For the implementation of the Kigali amendment to the Protocol, Belarus, Kazakhstan, Tajikistan and Uzbekistan follow the same rules as the Russian Federation.

5. Case studies

29. Three possible sources for case studies are suggested. The first is the recently published "Measures to Green the Post-Pandemic recovery", by the Issue-based Coalition on Environment and Climate Change, which includes interesting examples under the categories "Transport and Mobility, Climate Action" measure 10 (Chisinau), "Transport, Air Quality, Climate Action" measure 11 (Milan (Italy), Amsterdam, Ukraine and Belarus) and "Transport and Mobility, Air Quality, Biodiversity action" measure 13 (Barcelona (Spain)).[55] The second and third sources are the City of London's Air Quality Strategy 2019–2024[56] and a case study from South-East Europe under the UNEP regional air quality policy update report for the pan-European region (forthcoming).

[55] Available at https://unece.org/sites/default/files/2021-02/IBC%20Env%20Green%20post-pandemic%20measures%2031.1.21.pdf.

[56] Available at https://www.cityoflondon.gov.uk/services/environmental-health/air-quality/air-quality-strategy.

B. Climate change

1. Key messages and recommendations

Key messages

30. In spite of the commitments related to the reduction of greenhouse gas emissions, expressed by all countries in the pan-European region, net greenhouse gas emissions in the region are still rising.

31. Efforts and achievements are unevenly distributed throughout the region. Reductions, which are mostly achieved in the western part of Europe (2014–2018), are three times less than the increase in emissions in the rest of the region.

32. National commitments under the Paris Agreement were renewed by 35 countries in the region with more ambitious targets. However, some countries still do not have firm, quantifiable commitments or mechanisms to follow the progress towards them, which results in significant data gaps.

33. While decarbonization becomes a new narrative for Europe, there is a widening gap between rhetoric and action. The use of renewables was increased in 29 countries in the pan-European region in the period 2013–2017, but the region still largely relies on fossil fuels – some 78 per cent of the total final energy consumption on average comes from fossil fuels. The penetration of renewables in the energy mix rises more slowly than the increase in the total final energy consumption in the region.

34. The estimated population covered by local disaster risk reduction (DRR) strategies in the pan-European region is about 65 per cent. Only 15 countries in the region reported that all their local authorities are implementing DRR strategies under the Sustainable Development Goal target 13.1, while 23 countries, which jointly represent a quarter of the region's population, do not report on that target.

Recommendations

35. The principle of "common but differentiated responsibilities" should be followed, but not necessarily when it comes to reporting obligations.

36. Governments should establish the conditions for medium- and long-term sustainable mobilization of funds for climate action, both by accelerating the use of available regional and global funds and mechanisms and by creating national financial instruments.

37. Governments should deepen decarbonization by phasing out fossil fuel subsidies and shifting promotion of investments towards renewable energy.

38. Governments should strengthen awareness of climate hazards, especially among poorer communities, and establish conditions to report regularly on the Sustainable Development Goal target 13.1 and under the Sendai Framework for Disaster Risk Reduction 2015–2030.

2. Context

39. Within the scope of global climate action, all countries of the pan-European region have committed to cut their greenhouse gas emissions to limit the increase in global temperature to 1.5 °C, as stated in the Paris Agreement.

40. According to the International Energy Agency (IEA),[57] despite a slowing trend, global energy demand may still expand by 30 per cent between 2017 and 2040. Energy use is expected to continue to be the main cause of anthropogenic greenhouse gas emissions. The European Union has defined its pathway to decarbonization, with the long-term vision to reduce its greenhouse gas emissions by 80–95 per cent by 2050 compared to 1990. In that context, several European Union Member States have already stated their intention to phase

[57] International Energy Agency (OECD/IEA), *The World Energy Outlook 2018* (OECD/IEA, 2018), available at https://www.iea.org/reports/world-energy-outlook-2018.

out coal and lignite completely between 2025 and 2035. Such an objective may be too ambitious and difficult for countries that rely heavily on coal. The countries in the region are in very different situations in terms of their fossil fuel reserves and renewable energy potentials, technological capacities, energy demand patterns, infrastructure and labour and capital markets. While the decarbonization process brings an impetus for development of new low- and zero-carbon technologies, it is necessary to address energy poverty and a just transition.

41. Urgent adaptation approaches that are systemic, multidimensional and transformative are required to address the impacts of climate change, especially on the most vulnerable communities. The development of local adaptation strategies is increasing throughout Europe. As of April 2019, over 1,900 local authorities in the European Environment Agency member and collaborating countries have made commitments related to adaptation within the Covenant of Mayors for Climate and Energy.[58] A further challenge is to implement those strategies.

3. State, main trends and recent developments

42. Emissions of greenhouse gases in the pan-European region increased by 1 per cent in the period 2014–2018, while the average carbon footprint per person rose by 0.2 per cent. The Climate Action Progress Report of the European Union "Kick-Starting the Journey Towards A Climate Neutral Europe" states that in 2019 greenhouse gas emissions were down by 24 per cent from 1990 levels[59] and that the European Union remains on track to achieve its target of reducing greenhouse gas emissions by 20 per cent by 2020.

43. According to IEA most recent data[60] the coronavirus pandemic (COVID-19) situation generated a 6 per cent overall decline in global energy-related greenhouse gas emissions in 2020, hitting a low in April that year. However, in December 2020, global emissions were 2 per cent, or 60 million tons, higher than they were in the same month a year earlier. Globally, financing for climate action has increased substantially, but it continues to be surpassed by investments in fossil fuels.

44. While renewables are increasing, so is energy demand. The share of modern renewable energy in global final energy consumption has stayed around 10 per cent since 2010. Adding traditional uses of bioenergy, the share of all renewable energy in total final energy is 18 per cent.[61] The IEA *Net Zero by 2050: a Roadmap for the Global Energy Sector* sets out more than 400 milestones which include, from today, no investment in new fossil fuel supply projects and no further final investment decisions for new unabated coal plants. The pathway calls for annual additions of solar photovoltaic to reach 630 GW by 2030, and those of wind power to reach 390 GW. Together, this is four times the record level set in 2020. The Roadmap also sets as targets that, by 2035, there will be no sales of new internal combustion engine passenger cars and, by 2040, the global electricity sector has already reached net-zero emissions. Included in the Roadmap is a major worldwide push to increase

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[58] European Environment Agency, *The European environment — state and outlook 2020: knowledge for transition to a sustainable Europe* (Luxembourg, Publications Office of the European Union, 2019), available at https://www.eea.europa.eu/soer/2020

[59] According to the approximated greenhouse gas inventory of the European Environment Agency. See European Environment Agency, "EU on track to meet greenhouse gas emissions and renewable energy 2020 targets, progress in 2019 shows more ambitious long-term objectives are reachable", press release, 30 November 2020, available at https://www.eea.europa.eu/highlights/eu-on-track-to-meet.

[60] International Energy Agency, "After steep drop in early 2020, global carbon dioxide emissions have rebounded strongly", press release, 2 March 2021, available at https://www.iea.org/news/after-steep-drop-in-early-2020-global-carbon-dioxide-emissions-have-rebounded-strongly#:~:text=Global%20emissions%20plunged%20by%20almost,for%20road%20transport%20and%20aviation.

[61] International Renewable Energy Agency, *Global Renewables Outlook – Energy transformation 2050* (Abu Dhabi, 2020), available at https://www.irena.org/publications/2020/Apr/Global-Renewables-Outlook-2020.

energy efficiency, resulting in improvements of the global rate of energy efficiency averaging 4 per cent a year through 2030 – this is about three times the average over the last two decades.

45. The European Union set a new target for increasing renewable energy in final energy consumption to at least 32 per cent by 2030, while non-European Union parties of the Energy Community (Albania, Bosnia and Herzegovina, Georgia, Montenegro, North Macedonia, the Republic of Moldova, Serbia and Ukraine) could not agree on new targets for decarbonization, renewables and energy efficiency for 2030.

46. The share of energy from renewable sources used in transport activities in the European Union reached 8.9 per cent in 2019,[62] although it is still uncertain if the 10 per cent target for renewable energy use in transport by 2020 will be met. Technological development can enable a switch from fossil-fuelled vehicles to clean vehicles. Electric vehicles combined with renewable electricity generation are seen as a promising approach to decarbonize a substantial fraction of road transportation. However, electric vehicles represent only 0.2 per cent of the European Union's total vehicle fleet and, if they continue to penetrate the market at the current growth rate, it will take around 60 years for them to reach 50 per cent of the current passenger car fleet.[63] At global level, the share of renewables in the transport sector was at 3.3 percent in 2017, the majority of which was consumed in the form of liquid biofuels, predominantly crop-based ethanol and biodiesel.

47. The pan-European region is attractive to tourists from all over the world and the carbon footprint of tourism is significant. The application of the principles of circular economy in the tourism sector in-country or in-resort could reduce the footprint a little, but the major burden remains from travelling itself.

4. Indicators

Greenhouse gas emissions (ECE indicator)

48. The indicator shows the extent to which countries have achieved their specified goals for emissions and the response to country policies for achieving the emissions target.

49. Table 1 overleaf shows available greenhouse gas emission data for pan-European subregions, for the period 2014–2018. The overall changes in the pan-European region, both positive and negative, are highly dependent on "big players", i.e. highly industrialized, populous countries.

[62] Eurostat, Renewable energy statistics, Highlights, available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics#:~:text=In%202019%2C%20renewable%20energy%20represented,of%20gross%20final%20energy%20consumption).

[63] S. Tagliapietra, G. Zachmann, *Addressing Europe's failure to clean up the transport sector* (Bruegel, 2018), available at https://www.jstor.org/stable/resrep28617?seq=1#metadata_info_tab_contents.

Table 1

Total greenhouse gas emissions in the pan-European region (without land use, land-use change and forestry) by subregion, million tons of CO_2 equivalent (2014–2018)

Subregion	*2014*	*2015*	*2016*	*2017*	*2018*	*Trend*
European Union	3,783	3,835	3,834	3,860	3,771	→
Western Europe	714	699	673	659	648	↘
Central Asia	351	360	361	382	397	↗
Eastern Europe	2,550	2,501	2,526	2,569	2,651	↗
South-Eastern Europe	534	552	577	602	600	↗
Pan-European Region	7,856	7,868	7,891	7,994	7,989	↗

Legend: ↗ – increase in greenhouse gas emissions; → – no change; ↘ – reduction in greenhouse gas emissions.

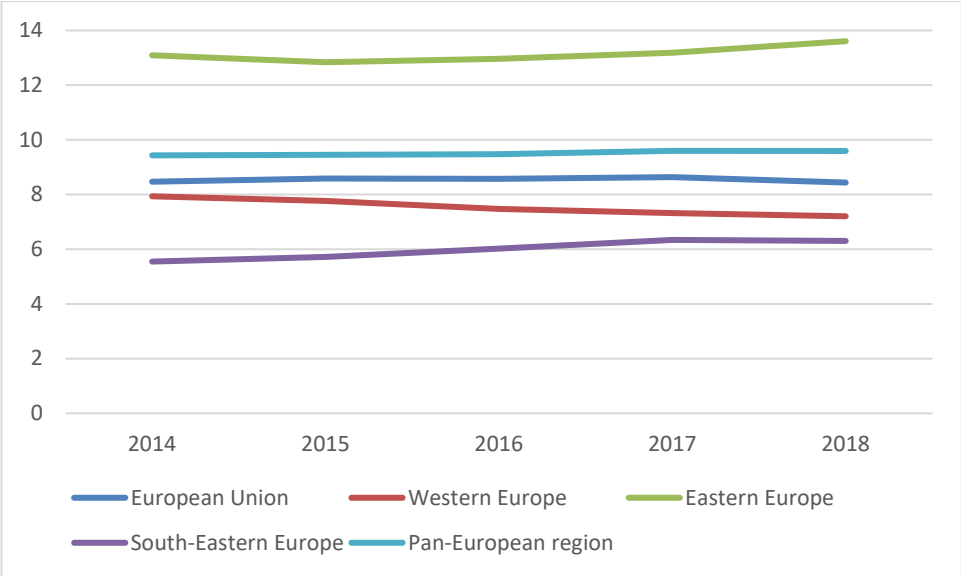
Source: Global Sustainable Development Goal Indicators Database and national submissions to the United Nations Framework Convention on Climate Change.

Note: Only countries with available data for the whole period 2014–2018 were counted in sub-regional totals

50. During the observed period (2014–2018) greenhouse gas emissions were reduced in the European Union by 11.24 Mt of CO_2 equivalent, mostly in Germany but with an increase of emissions in 15 other European Union Member States (see figure VI overleaf for an overview). Non-European Union high-income countries including Israel ("Western Europe") also achieved emissions reduction, with the United Kingdom of Great Britain and Northern Ireland accounting for 98.5 per cent of reductions. In Eastern Europe, the increase of greenhouse gas emissions is dominated by an increase in the Russian Federation, while Ukraine reduced emissions by 23.26 Mt of CO_2 equivalent. The trend in South-Eastern Europe and Central Asia is dominated by increase in greenhouse gas emissions in Turkey and Kazakhstan, while data is inexistent for several countries.

Figure VI

Greenhouse gas emissions (without land use, land-use change and forestry) per capita, tons of CO_2 equivalent (2014–2018)



Source: Global Sustainable Development Goal Indicators Database and national submissions to the United Nations Framework Convention on Climate Change.

Note: Central Asia not shown as only Kazakhstan reported (21.4 tons CO_2 eq. per capita in 2018, with 25 per cent of the subregion's population); Eastern Europe includes here only Belarus, the Russian Federation and Ukraine (91 per cent of the population); and South-Eastern Europe has only Turkey (alone 84 per cent of the population), which has lower emissions per capita than other countries in the subregion. The pan-European emissions per capita are based on these countries, together with the European Union and Western Europe countries.

Renewable energy share in the total energy consumption (Sustainable Development Goal indicator 7.2.1)

51. The renewable energy share in total final consumption is the percentage of final consumption of energy that is derived from renewable resources. Table 2 overleaf shows this indicator by subregion for the period 2014–2018.

52. Although the consumption of energy from renewable sources in the pan-European region raised between 2014 and 2018 for 1.3 petajoules, the share of renewables stayed the same due to a parallel rise of consumption of energy from non-renewable sources.

53. The renewable energy share in the total energy consumption varies from 4 per cent in Eastern Europe and Central Asia, to 18 per cent in the European Union and Western Europe. The average share for the whole pan-European region is 13 per cent. Only Western Europe saw a stable rising trend in the five-year period (2014–2018).

54. To remain on the 1.5°C pathway requires the share of renewable energy in primary supply to increase globally at an annual growth rate, from 0.25 per cent to 2 per cent.[64]

Proportion of local governments that adopt and implement local DRR strategies in line with national DRR strategies (Sustainable Development Goal indicator 13.1.3)

55. Target E of the Sendai Framework aims at increasing the proportion of local governments that adopt and implement local DRR strategies. Data on Sustainable Development Goal indicator 13.1.3, in the period 2015–2019, indicates that 31 countries from pan-European region reported such strategies, covering 41,850 local communities (see

[64] International Renewable Energy Agency, *World Energy Transitions Outlook: 1.5°C Pathway* (Abu Dhabi, International Renewable Energy Agency, 2021), available at https://www.irena.org/publications/2021/March/World-Energy-Transitions-Outlook-

table 3 below). More than 600 cities in the pan-European region (out of 4,360 cities globally) participate in the "Making Cities Resilient" initiative coordinated by United Nations Office for Disaster Risk Reduction.[65] Moreover, 9,919 local communities from 33 countries of the pan-European region participate in the Global Covenant of Mayors for Climate and Energy initiative. In 2018, about 41 per cent of the European Union population was living in municipalities that are signatories of the Covenant of Mayors for Climate and Energy.

Table 2
Renewable energy share in the total energy consumption, per cent (2014–2018)

Subregion	*2014*	*2015*	*2016*	*2017*	*2018*	*Trend*
European Union	18%	18%	18%	18%	18%	→
Western Europe	15%	16%	16%	17%	18%	↗
Central Asia	3%	4%	4%	4%	4%	↗
Eastern Europe	4%	4%	4%	4%	4%	→
South-Eastern Europe	14%	15%	15%	13%	14%	→
Pan-European Region	**13%**	**13%**	**13%**	**13%**	**13%**	→

Legend: ↗ – increased share of renewables; → – no change in the share of renewables in the total final energy consumption

Source: United Nations Statistics Division – Energy balances, https://unstats.un.org/unsd/energystats/pubs/balance/

Table 3
Number of countries and behaviour regarding local disaster risk reduction strategies, as number of countries per category (2019)

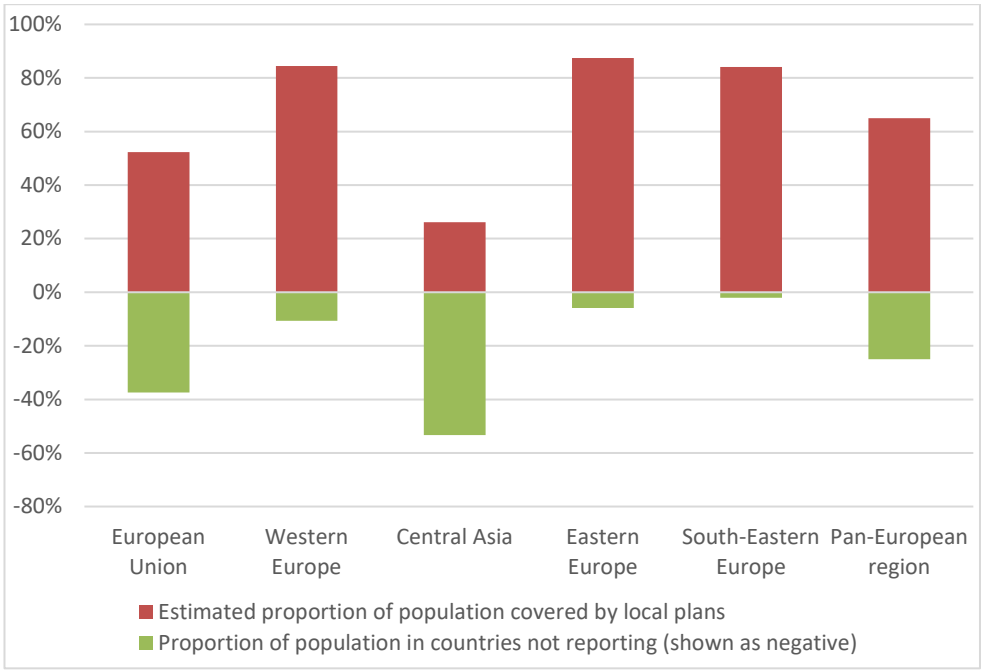
Subregion	*In the subregion*	*Not reporting*	*Having less than 5% of local governments implementing DRR strategies*	*With a stable trend*	*With a rising trend*	*Having 100% of local governments implementing DRR strategies*
European Union	27	13	4	1	0	9
Western Europe	9	5	0	1	1	2
Central Asia	5	2	0	0	2	1
Eastern Europe	7	2	1	0	2	2
South-Eastern Europe	6	1	4	0	0	1
Pan-European Region	**54**	**23**	**9**	**2**	**5**	**15**

Source: Global Sustainable Development Goal Indicators Database, https://unstats.un.org/sdgs/indicators/database/

[65] See https://www.unisdr.org/campaign/resilientcities/cities.

56. The estimated population covered by local DRR strategies in the pan-European region is 65 per cent, due to the large population of countries that do have strategies (for example, France, Germany, the Russian Federation, Turkey, Ukraine and the United Kingdom of Great Britain and Northern Ireland). Coverage greater than 80 per cent is achieved in Eastern and South Eastern Europe, as well as in Western Europe (85 per cent), while Central Asia coverage is below 26 per cent (see figure VII below).

Figure VII
Estimated proportion of population covered by local disaster risk reduction strategies, or for which no data is available, per cent (2019)



Sources: Global Sustainable Development Goal Indicators Database, https://unstats.un.org/sdgs/indicators/database/. Population data from ECE Statistics Database, 2019 or latest.

Note: The estimated proportion of the population covered by local plans is the estimated population covered by plans divided by the subregion's total population.

5. Case studies

Fossil-fuel free Stockholm 2040

57. Stockholm, the capital of Sweden aims to be fossil-fuel free by 2040. As the city's strategy document explains, "Stockholm's ambition is to be totally fossil-fuel free by 2040 at the latest, precluding the use of fossil fuels within the city's geographical boundaries. However, the municipal authorities recognize that it may prove difficult to eliminate fossil fuels in the aviation and international shipping industries, and that some fossil-based plastics will still be incinerated in heating plants in 2040. Nevertheless, climate neutrality or zero net emissions can be achieved by compensating for these residual effects, for example by investing in carbon sinks. Climate neutrality permits the use of fossil fuels provided that CO_2 emissions are offset by measures that in some way bind the carbon or carbon dioxide."[66]

58. The plan is that, by 2040, natural gas will be entirely phased out of the city's energy grid and heating system, replaced primarily by biogas. The district heating company has decided to phase out fossil fuels by 2030. To increase the use of renewable energy in transportation from the current 16 per cent to 100 per cent by 2040, the city plans to double

[66] City of Stockholm, *Strategy for a fossil-fuel free Stockholm by 2040*, (Stockholm, City Executive Office, 2016), available at https://international.stockholm.se/globalassets/rapporter/strategy-for-a-fossil-fuel-free-stockholm-by-2040.pdf

the capacity of the public transport system, while improving walking and bicycling infrastructure.

Covenant of Mayors

59. The Covenant of Mayors is the initiative launched by the European Commission in 2008 with the ambition to gather local governments voluntarily committed to achieving the European Union's climate and energy targets. With about 2,000 cities gathered in 2010, the European Commission launched the Covenant of Mayors East initiative that now operates in Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova and Ukraine. Nowadays the Global Covenant of Mayors for Climate and Energy is the largest movement of local governments committed to going beyond their own national climate and energy objectives. There are 9,919 members from 33 countries of the pan-European region participating in this initiative. During the Climate Summit in Paris, the European Commission announced the geographical extension of the Covenant of Mayors for Climate and Energy, with new regional offices in Sub-Saharan Africa, North and South America, Japan, India, China and South-East Asia.

C. Fresh water

This section is still being developed. .

D. Coastal waters, marine ecosystems and seas

1. Key messages and recommendations

Key messages

3. Marine pollution, both from land-based (for example, nutrients, plastic, chemicals) and sea-based (for example, plastic, oil) sources, continues to be an urgent problem in most sea regions. Beach and marine litter, dominated by plastic, is recognized as a major global threat to coastal and marine ecosystems in most areas, including remote and less populated areas, for example, the Barents Sea.

4. Amongst the climate-induced changes in coastal and marine ecosystems are increasing sea surface temperatures by about 0.2 °C per decade in the North Atlantic and 0.5 °C per decade in the Black Sea (since 1981) and observed reductions in surface water pH (i.e., acidification), at a rate of approximately 0.02 pH units per decade, in the sea regions surrounding the European Union (and across the global ocean), except for variations near coasts, with as yet unknown impact.

5. Marine Key Biodiversity Areas (KBAs) coverage by protected areas in most littoral ECE countries increased during the period 2000–2019. However, the coverage of marine protected areas (MPAs) in 20 out of 37 littoral countries in the region of the United Nations Economic Commission for Europe (ECE) lags the Convention on Biodiversity Diversity Aichi target 11 (conserving at least 10 per cent of coastal and marine areas) and is 6.7 per cent for the overall pan-European area.

6. Geographically, there are significant variations in the proportion of sustainable fish stocks. The Mediterranean Sea and Black Sea remain highly overfished, whereas signs of recovery of fish stocks can be observed in the North-East Atlantic Ocean and the Baltic Sea as a result of improved management decisions.

7. A holistic and ecosystem-based approach to the management of coastal waters and marine ecosystems that addresses the combined effects of multiple pressures is progressively integrating social, economic and governance aspects. Such an approach applies equally to the use of nature-based solutions in sustainable infrastructure for enhancing coastal resilience and its climate-proof functionalities, and to the transition to “blue” sustainable tourism as part of the post-COVID-19 recovery.

Recommendations

8. Governments at all levels (local, national and regional) should take urgent action to reduce key pressures to halt the degradation of coastal waters, marine ecosystems and seas. Climate change, biodiversity loss and pollution threats are intricately connected and constitute the triple planetary crisis.

9. Further efforts are needed, in particular in Eastern and South-Eastern Europe, to achieve the target of conservation of 10 per cent of coastal and marine areas in the pan-European area. The target has already been achieved in most of the European Union.

10. The theme “Coastal waters, marine ecosystems and seas”, associated indicators and dataflows should be included as a theme within the United Nations Economic Commission for Europe (ECE) set of environmental indicators. Promising new developments related to data (for example, earth observation, artificial intelligence, citizen monitoring, models and novel in-situ measurements) should be considered to improve the spatial and temporal coverage, including the need for long-term time-series data to understand climate-change impacts.

11. Policymakers should increase efforts to complement inventories of the number of items of beach and marine litter with information on composition and sources of litter to be able to design more effective measures. In particular, joint efforts should be taken where subregional measures are deemed necessary, as in the Caspian Sea where there is no reliable information on the presence or amount of litter discharged into the coastal or marine environment

2. Context

12. Oceans play a critical role as a climate regulator and buffer to climate change effects, which comes at the expense of their productivity and the health of marine ecosystems. The ubiquitous degradation of coastal waters, marine ecosystems and oceans is a clear manifest of the triple planetary crisis and the intricately connected threats of climate change, biodiversity loss and pollution.[67] At the global level, two-thirds of the oceans are significantly impacted by human activities that generate multiple pressures ranging from excessive inputs of nutrients and hazardous substances, including plastics, microplastics and nano-plastics; unsustainable fishing, including illegal, unreported and unregulated (IUU) fishing; and habitat destruction due to coastal development – including for tourism – and extraction of natural resources. Other detrimental environmental changes associated with climate change include ocean warming, acidification and deoxygenation impacting the diversity and abundance of marine species.

13. "Blue economy", which is steadily growing and poses sustainability challenges, involves income generating activities in the ocean such as harvesting of food, shipping, seabed mining, offshore hydrocarbon exploration and exploitation, tourism and recreation. Interest in seabed mining is on the rise, in part fuelled by the increased demand for minerals and rare earths, such as cobalt needed in batteries for electric vehicles as a climate change mitigation measure.

14. The systematic nature of these challenges calls for the use of integrated and ecosystem-based management approaches, supported by spatially-based assessments and the analysis of multiple pressures and cumulative impacts.[68]

15. Despite having specific ecological, socioeconomic characteristics and governance structures, a number of similarities related to the key trends and challenges exist among the pan-European sea regions. The assessment follows a combined approach, by integrating existing knowledge available at the sea region level and national data reported under the Sustainable Development Goal 14 "Conserve and sustainably use the oceans, seas and marine resources for sustainable development".

16. The pan-European area includes 37 littoral ECE countries[69] and the following sea regions: Baltic Sea, Black Sea, Caspian Sea, Mediterranean Sea and North-east Atlantic Ocean.[70] For the latter four, extensive knowledge and information are available in publications and indicators maintained by the European Environment Agency and the Regional Seas Conventions.[71] Other sea (sub)regions included in the assessment area, such as the Aral Sea, Barents Sea, East Siberian Sea, North Sea and Norwegian Sea are not systematically discussed.

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[67] UNEP, *Making Peace with Nature: A Scientific Blueprint to Tackle the Climate, Biodiversity and Pollution Emergencies* (Nairobi, UNEP, 2021), available at www.unep.org/resources/making-peace-nature.

[68] European Environment Agency European Topic Centre on Inland, Coastal and Marine Waters (2019), briefing on "Multiple Pressures and Their Combined Effects in Europe's Seas", available at www.eea.europa.eu/themes/water/europes-seas-and-coasts/multiple-pressures-and-their-combined.

[69] The 37 littoral ECE countries are (in alphabetic order, with the 22 European Union Member States marked in **bold**): Albania, Azerbaijan, **Belgium**, Bosnia & Herzegovina, **Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France**, Georgia, **Germany, Greece**, Iceland, **Ireland**, Israel, **Italy**, Kazakhstan, **Latvia, Lithuania, Malta**, Monaco, Montenegro, **the Netherlands,** Norway, **Poland, Portugal, Romania**, the Russian Federation, **Slovenia, Spain, Sweden**, Turkey, Turkmenistan, Ukraine and the United Kingdom of Great Britain and Northern Ireland.

[70] The sea (sub)regions covered by the North-east Atlantic Ocean are the Barents Sea, Bay of Biscay, Celtic Sea, Greenland Sea, Iceland Sea, North Sea and Norwegian Sea

[71] Convention on the Protection of the Marine Environment of the Baltic Sea Area (HELCOM Convention); Bucharest Convention for the Black Sea; Barcelona Convention for the Mediterranean Sea; and Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).

17. Information on the Caspian Sea is mainly available in the Caspian Sea State of the Environment (2019) report by the Tehran Convention.[72] Twenty-two of the thirty-seven littoral ECE countries are member States of the European Union. The new European Union Biodiversity Strategy 2030 is instrumental for measuring ecosystem health and halting biodiversity loss across ecosystems including marine ecosystems. In parallel, the Marine Strategy Framework Directive (Directive 2008/56/EC; Commission Decision 2017/848) aims at achieving or maintaining Good Environmental Status in the four European Union regional seas by protecting and restoring the marine environment and phasing out pollution. The Maritime Spatial Planning Directive (Directive 2014/89/EU) makes a key contribution to the Marine Strategy Framework Directive on aspects related to use and management of ocean space.

Links to conference themes

18. A direct link between the theme of coastal waters, marine ecosystems and seas and the two conference themes exists. For example, the use of nature-based solutions in sustainable infrastructure enhances coastal resilience and its climate-proof functionalities. At the same time, this approach addresses multiple issues, such as rising sea levels, flood protection, coastal erosion that causes loss of land, assets and livelihoods, while harmonizing coastal development with habitat and ecological protection.

19. With more than half of the European Union's tourist accommodation establishments located in coastal areas, maritime and coastal tourism is a pillar of the blue economy, in particular in the Mediterranean region, which hosts about one third of world tourism.[73] The prospects of maritime and coastal tourism have been severely impacted by the coronavirus (COVID-19) pandemic, together with many other closely connected sectors. The post-COVID recovery is expected to boost ambitions and trends towards more sustainable tourism.

3. State, main trends and recent developments

20. Marine pollution originating from land-based sources includes discharges from municipal waste, mainly in the form of plastic litter, wastewater and industrial activities. Huge investments on large-scale projects, constructing new or modernizing wastewater treatment plants has led to a general decrease in the discharge of untreated wastewater into the sea, in particular in certain areas of the Black Sea,[74] Caspian Sea[75] and the Mediterranean Sea.[76] The semi-enclosed Baltic and Black Seas are historically known for their high sensitivity to eutrophication, the enrichment of water by nutrients nitrogen and phosphorus, as a result of limited exchange of water with outside seas.

21. Marine litter pollution includes beach, floating and seafloor litter, litter in biota and micro-litter – pieces of plastic less than 5 mm in diameter known as microplastics. Microplastics are of growing concern because they accumulate in the food web, posing a risk to marine biota and human health. Marine litter has been observed throughout the pan-

[72] Interim Secretariat of the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Tehran Convention), *Caspian Sea: State of the Environment* (Geneva and Arendal, Tehran Convention Secretariat and GRID-Arendal, 2019), available at www.grida.no/publications/476.

[73] UNEP Mediterranean Action Plan and Plan Bleu, *State of Environment and Development in Mediterranean* (Nairobi, UNEP, 2020), available at https://planbleu.org/en/soed-2020-state-of-environment-and-development-in-mediterranean/.

[74] J. Slobodnik and others (2021), "Summary of EMBLAS Project Finding, Gaps and Recommendations." EU/UNDP Project: Improving Environmental Monitoring in the Black Sea–Selected Measures (EMBLAS-Plus) – Agreement ENI/2017/389-859.

[75] Tehran Convention, *Caspian Sea: State of the Environment*.

[76] European Environment Agency and UNEP Mediterranean Action Plan, *Technical Assessment of Progress towards a Cleaner Mediterranean — Monitoring and Reporting Results for Horizon 2020 Regional Initiative* (Luxembourg, Publications Office of the European Union, 2021), available at www.eea.europa.eu/publications/technical-assessment-of-progress-towards.

European area, including the less populated Barents Sea area.[77] Most of the litter comes from land-based sources, except in the North-East Atlantic where sea-based litter is equally important.[78] No reliable information on the volumes of litter discharged into the coastal or marine environment of the Caspian Sea is available, although this is considered a pressing issue.[79]

22. Fishing is one of the main pressures affecting the sustainability, health, productivity and resilience of marine ecosystems. Overexploitation of commercial fish and shellfish stocks continues across the sea regions in the pan-European area. The state of fisheries has improved significantly in the North-East Atlantic Ocean and the Baltic Sea, with clear signs of recovery of commercial fish and shellfish stocks since the early 2000s. On the other hand, the situation remains critical in the Mediterranean Sea and the Black Sea with no signs of improvement. This is due to elevated fishing pressures, significant knowledge gaps on the status of fish and shellfish stocks and the difficulties in the Mediterranean Sea in adopting management measures for a single stock.[80] The Caspian Sea has also seen declining fish stocks,[81] as a result of overfishing and unregulated fishing. IUU fishing is one of the factors that negatively impacts the local economies and coastal livelihoods, as well as being a threat to marine ecosystems.

23. A drastic decline in marine biodiversity is observed, at a faster rate than for land species. The Red List assessments for the European Union sea regions show that of the 1,196 marine species assessed, 9 per cent are threatened, while 3 per cent are near-threatened. Birds, mammals and turtles are particularly at risk, with over 20 per cent of species being threatened.[82] Eighteen species of sturgeon from all over Europe and Asia assessed in the Red List were all found to be threatened. The Beluga sturgeon in the Caspian Sea is listed as critically endangered along with all of the other commercially important Caspian Sea species, which are the main producers of wild caviar[83].

24. The resilience of marine ecosystems is further reduced due to changes in ocean temperature and oxygen content, and ocean acidification as a result of anthropogenic climate change. Such changes in environmental conditions indicate that significant systemic changes are taking place in the European Union sea regions.[84] Increases in sea surface temperature lead to changes in species' distribution ranges (see European Environment Agency indicator on Changes in fish distribution in European seas[85]), abundance and seasonality, affecting marine food webs.

25. Political awareness of the role of oceans in achieving climate targets is on the rise, with more governments committing to more ambitious ocean agendas. The European Union Biodiversity Strategy for 2030 highlights the need for expanding protection of the European Union's sea regions to 30 per cent, creating ecological corridors to help reverse biodiversity

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[77] For example, Bjørn E. Grøsvik and others, "Assessment of Marine Litter in the Barents Sea, a Part of the Joint Norwegian–Russian Ecosystem Survey." *Frontiers in Marine Science* 5 (2018). https://doi.org/10.3389/fmars.2018.00072.

[78] European Environment Agency, *State of Europe's Seas* (Luxembourg, Publications Office of the European Union, 2017), available at www.eea.europa.eu/publications/state-of-europes-seas.

[79] Tehran Convention, *Caspian Sea: State of the Environment*.

[80] WISE-Marine – Marine Information System for Europe, available at https://water.europa.eu/marine, and European Environment Agency, *Marine Messages II – Navigating the Course towards Clean, Healthy and Productive Seas through Implementation of an Ecosystem-based Approach* (Luxembourg, Publications Office of the European Union, 2019, available at www.eea.europa.eu/publications/marine-messages-2/.

[81] Tehran Convention, *Caspian Sea: State of the Environment*.

[82] European Environment Agency, *Marine Messages II*.

[83] International Union for the Conservation of Nature, "Sturgeon more critically endangered than any other group of species", news article, 18 March 2010, available at www.iucn.org/content/sturgeon-more-critically-endangered-any-other-group-species.

[84] WISE-Marine – Marine Information System for Europe, available at https://water.europa.eu/marine.

[85] See www.eea.europa.eu/data-and-maps/indicators/fish-distribution-shifts/assessment-1.

loss, contribute to climate change mitigation and resilience.[86] A proposal for legally binding instruments on restoration is also included as part of the European Union Restoration Plan. At the global level, 51 countries have pledged to protect at least 30 per cent of marine areas by 2030, known as the Global Ocean Alliance 30by30,[87] of which 17 are ECE countries.[88] Following an extensive participatory process (3rd International Ocean Governance Forum, April 2021), the European Union is revising its International Ocean Governance Agenda – an integral part of the European Green Deal and the European Union's response to Sustainable Development Goal 14 (life below water). Other initiatives at the regional or global level address awareness of marine litter pollution, sustainable blue economy and conservation efforts. The understanding of the seas continues to improve through the deployment of innovative sensors and autonomous observation platforms, enabling the expansion of observation programmes through better coordination and integration.

4. Indicators

26. Sustainable Development Goal 14 provides an appropriate indicator framework for the purpose of the pan-European assessment of coastal waters, marine ecosystems and ocean.[89]

Marine Pollution: Beach litter density

27. This indicator provides the number of litter items on a 100 m beach stretch of European Union sea regions (table 1 and figure I overleaf). No data is available for the Caspian Sea.

28. The data is derived from the citizen-science-based European Environment Agency Marine Litter Watch database (2014–2019). The values are consistent with beach litter densities provided in regional assessments, in particular for the Baltic and Black Seas. Plastic is the most abundant type, comprising around 70-83 per cent of marine litter, exceeding 90 per cent in some areas.

29. Most assessments are not able to draw conclusions on time trends in marine litter. This is due to the survey limitations and methodological challenges with interpreting marine litter data. The abundance of beach litter is highly influenced by water currents, prevailing winds and the exposure of the beach.[90]

[86] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, On a New Approach for a Sustainable Blue Economy in the EU Transforming the EU's Blue Economy for a Sustainable Future, COM(2021) 240 final.

[87] See www.gov.uk/government/topical-events/global-ocean-alliance-30by30-initiative/about.

[88] As at 21 July 2021, these are: Armenia, Belgium, Croatia, Cyprus, Denmark, Finland, France, Germany, Italy, Luxembourg, Monaco, Montenegro, Norway, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland.

[89] The context for the selection of the following indicators is provided above and supplemented with more information in an appendix to be made available online.

[90] European Commission, *Guidance on Monitoring of Marine Litter in European Seas. A guidance document within the Common Implementation Strategy for the Marine Strategy Framework Directive* (Brussels, 2013), MSFD Technical Subgroup on Marine Litter.

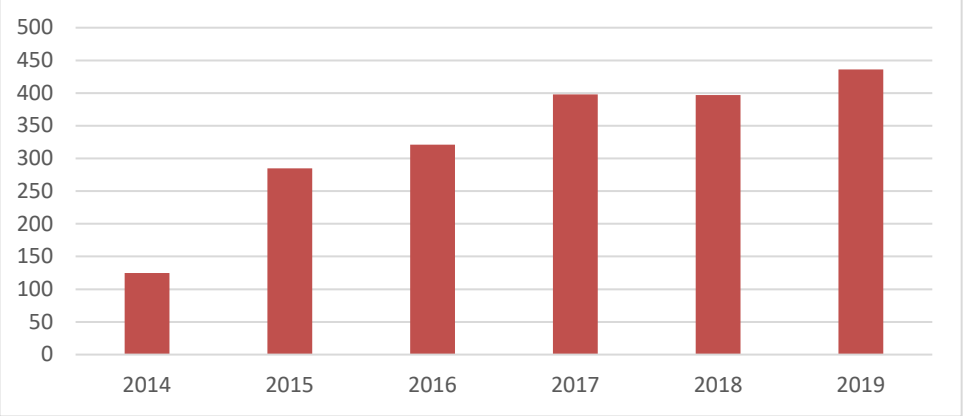
Table 1
Overview of the number of beach litter items and plastic composition

Sea region	*Number of items on beach per 100 m of shoreline, median for the period 2014 –2019* [a]	*Plastic composition*
Baltic Sea	78	70 per cent of beach litter
Black Sea	652	83 per cent of beach litter
Mediterranean Sea	428	95–100 per cent of the total floating marine litter; 50 per cent of the seabed marine litter
North-East Atlantic	105	Over 90 per cent of beach litter in some areas

Source: Kideys and Aydın, 2020.[91]

Note: [a] Only European Environment Agency monitoring data from sea beaches under Marine Litter Watch.

Figure I
Evolution in median beach litter numbers for the four sea regions surrounding the European Union combined, number per 100 m of beach (2014–2019)



Source: Kideys and Aydın, 2020.

Note: Monitoring data only. No data for the Caspian Sea.

Fisheries: Proportion of fish stocks within biologically sustainable levels

30. This indicator is based on data held by the Food and Agriculture Organization of the United Nations (FAO) for Sustainable Development Goal indicator 14.4.1 (Proportion of fish stocks within biologically sustainable levels), which measures the sustainability of the marine capture fisheries by their abundance.[92] Table Table 2 below shows the proportion of marine fish stocks within biologically sustainable levels, supplemented with data for the four European Union sea regions on the proportion of assessed stocks meeting the Marine Strategy Framework Directive's Good Environmental Status primary criteria.

[91] Kideys, A.E. and M. Aydın, *Marine Litter Watch (MLW) European Beach Litter Assessment 2013–2019* (European Topic Centre on Inland, Coastal and Marine waters, 2020), available at www.eionet.europa.eu/etcs/etc-icm/products/marine-litter-watch-mlw-european-beach-litter-assessment-2013-2019.

[92] A fish stock whose abundance is at or greater than the level that can produce the maximum sustainable yield is classified as biologically sustainable. In contrast, when abundance falls below the maximum sustainable yield level, the stock is considered biologically unsustainable.

Table 2
Proportion of marine fish stocks within biologically sustainable levels

FAO Major Fishing Area [a]	*Proportion of stocks within biologically sustainable levels, 2017 (per cent)*	*Sea region* [b]	*Proportion of assessed stocks meeting specified criteria (per cent)*			
			both GES criteria	*either of the two GES criteria*	*at least one of the two GES criteria*	*neither of the two GES criteria*
Mediterranean and Black Seas	37.50	Mediterranean Sea	0	6.1	6.1	93.9
		Black Sea	0	14.3	14.3	85.7
North-East Atlantic, including Baltic Sea	79.31	Baltic Sea	12.5	50.0	62.5	37.5
		North-East Atlantic	44.1	38.2	82.3	17.7

Sources: [a] FAO, *The State of World Fisheries and Aquaculture 2018 – Meeting the Sustainable Development Goals* (Rome, FAO, 2018), available at www.fao.org/3/I9540EN/i9540en.pdf.; and [b] European Environment Agency, *Marine Messages II*.

Notes: GES = Good Environmental Status. GES primary criteria: achieving (a) a fishing mortality and (b) a reproductive capacity compatible with having population biomass levels above those capable of producing the maximum sustainable yield.

31. Both sources confirm that there are significant differences between regions. The Mediterranean Sea and Black Sea remain highly overfished, whereas signs of recovery of fish stocks can be observed in the North-East Atlantic and the Baltic Sea as a result of improved management decisions.

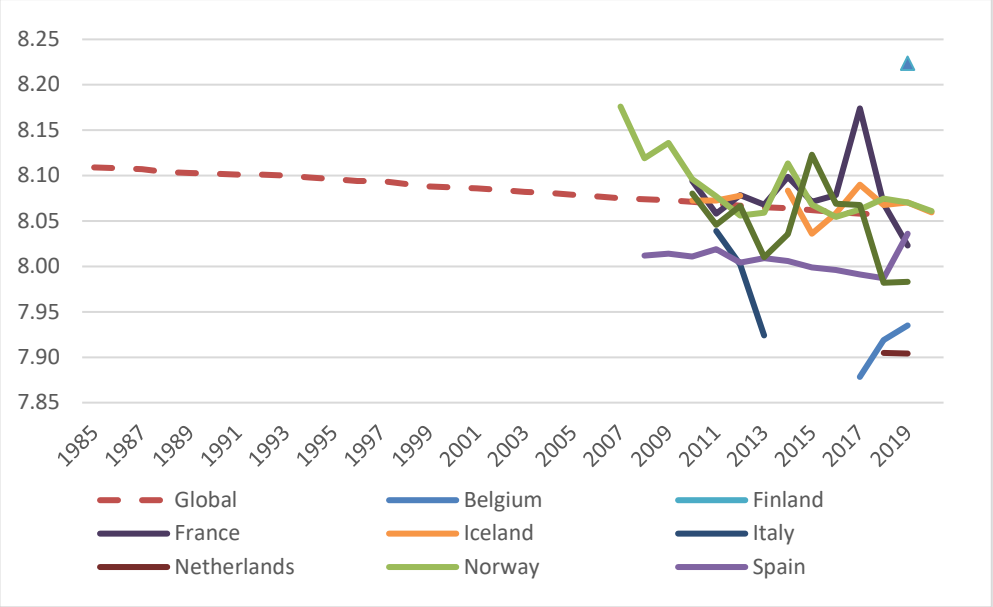
Climate change impacts: Average marine acidity (pH) measured at agreed suite of sampling stations

32. This indicator combines data reported by ECE littoral countries under Sustainable Development Goal target 14.3.1 (Average marine acidity (pH) measured at agreed suite of representative sampling), superimposed on the global annual average of surface ocean pH for the period 1985–2018. The purpose of this indicator is to monitor the carbon system by measuring four parameters: pH, total dissolved inorganic carbon, carbon dioxide partial pressure and total alkalinity. Each country's government decides which sites to select, as long as the same sites are measured regularly to capture the changes in the parameters' values. When at least half of coastal nations report values, regional values can be aggregated.

33. Observations of ocean acidification over the past 35 years have shown an increase in acidity by 0.052 pH units (figure II overleaf). At the national scale, the trend is more complex with significant variations near the coast. Long-term observational records, especially in the coastal zones, are required to identify the ocean acidification signals.

Figure II

Global annual average of surface ocean pH taken from the Copernicus Marine Service and based on a reconstruction method using in situ data and remote sensing data, as well as empirical relationships, pH units (1985–2019)



Sources: European Environment Agency, "Yearly mean surface seawater pH reported on a global scale" (2020), available at www.eea.europa.eu/data-and-maps/daviz/yearly-mean-surface-sea-water-1#tab-chart_3); and Sustainable Development Goal target 14.3 national data (United Nations Global Sustainable Development Goal Indicators Database, available at https://unstats.un.org/sdgs/indicators/database/, retrieved on 29 April 2021), with the exception of data from Belgium: Research Institute Nature and Forest, Flanders Region (2020), available at https://www.vlaanderen.be/inbo/backgroundindicatoren/noordzee-oceaanverzuring).

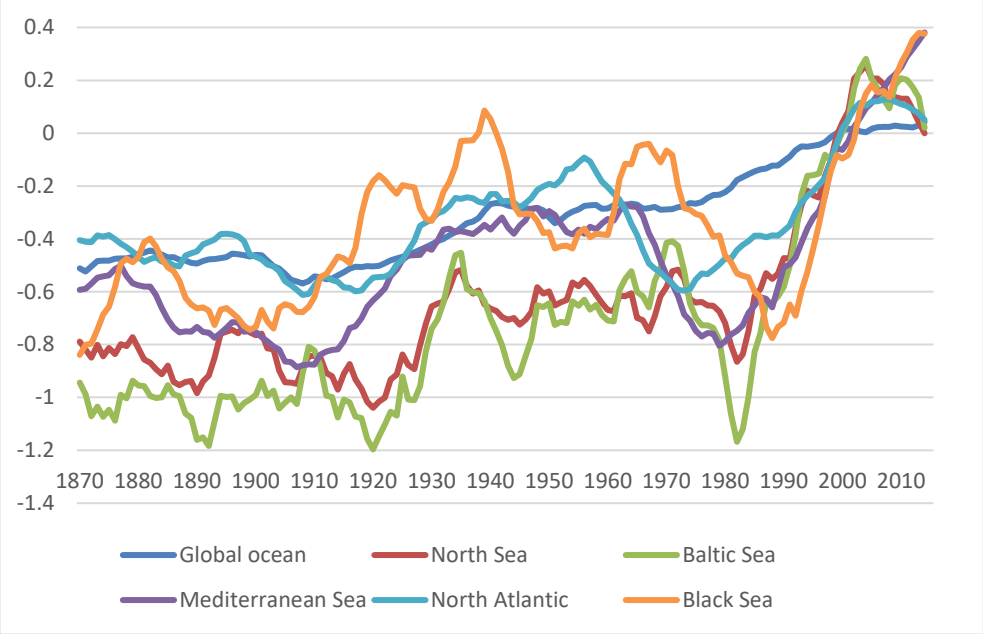
Climate change impacts: Average sea surface temperature anomaly

34. This indicator shows the annual average sea surface temperature (in °C), referenced to the average temperature between 1993 and 2012 in the global ocean and four pan-European seas.

35. All sea regions have warmed considerably since 1870 (see figure III overleaf). The warming has been evident since the late 1970s and particularly rapid since 1998. Since 1981, marking the satellite era for which more comprehensive data is available, the trend in sea surface temperature rise has been between around 0.2 °C per decade in the North Atlantic and 0.5 °C per decade in the Black Sea. According to the Intergovernmental Panel on Climate Change,[93] the average sea surface temperature has increased by 0.6 °C since 1850. Depending on the emissions scenario, sea surface temperature is projected to continue to increase, albeit more slowly than air temperature over land.

[93] Intergovernmental Panel on Climate Change, *Special Report on the Ocean and Cryosphere in a Changing Climate* (2019), available at www.ipcc.ch/srocc/.

Figure III
Time series of annual average sea surface temperature (°C), referenced to the average temperature between 1993 and 2012



Source: WISE-Marine[94]

Responses: Coverage of protected areas in relation to marine areas

36. This indicator shows the coverage of marine protected areas (MPAs) in relation to the area of the Exclusive Economic Zone (see table 3).

Table 3
Percentage MPA coverage per subregion in 2018

Subregion	*Littoral ECE countries*	*MPA coverage, per cent*
European Union	Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden	10.8
Western Europe	Iceland, Israel, Monaco, Norway, United Kingdom of Great Britain and Northern Ireland	8.5
Central Asia	Kazakhstan, Turkmenistan	29.7
Eastern Europe	Azerbaijan, Georgia, Russian Federation, Ukraine	3.1
South-Eastern Europe	Albania, Bosnia and Herzegovina, Montenegro, Turkey	0.2
Total for pan-European Region		**6.7**

Source: United Nations Global Sustainable Development Goal Indicators Database, available at https://unstats.un.org/sdgs/indicators/database/, retrieved on 29 April 2021.

Note: No data for Bosnia and Herzegovina.

[94] WISE-Marine – Marine Information System for Europe, available at https://water.europa.eu/marine.

37. A total of 10.8 per cent of the surface of European Union seas was designated as MPA by the end of 2016, implying that the bloc has reached the global Aichi Biodiversity Target 11.[95] However, that MPA coverage is more than six times higher in coastal waters than in offshore waters, meaning that not all biodiversity features are adequately represented in the MPA network.[96] The greatest growth in protected areas and other effective area-based conservation measures over the last 10-year period has been in marine and coastal areas as compared to terrestrial areas. [97] However, , the current MPA coverage stands at 7.74 per cent at the global level, and only 6.7 per cent in 2018 in the pan-European level, falling short of the 10 per cent coverage target.

5. Case studies

"The Black Sea is recovering but chemical and marine litter pollution are still a major issue" [98]

38. For decades, the Black Sea has been the European Union's most polluted sea region. In the 1990s, the Black Sea experienced unprecedented degradation when widespread nutrient loading caused a large dead zone. The main sources of nutrients were runoff from the agricultural sector (fertilizers and livestock waste), domestic and industrial wastes. Three rivers – Dniester, Dnipro and Danube – are the main source of nutrient, chemical and litter pollution into the Black Sea. The contaminants monitoring programme conducted under the EMBLAS series of projects revealed extremely high concentrations of chemicals in offshore waters, biota, fish and mussels. Water samples showed traces of caffeine, medicine and illicit drugs, with pharmaceuticals, especially antibiotics, posing the biggest threat. The number of floating items per km^2 (90.5 items/km^2) is the highest among European Union seas and almost twice that in the Mediterranean Sea. Sediment samples taken from the seafloor were found to contain microplastics.

39. Over the past 20 years, the Danube has been the subject of a massive clean-up operation financed by the European Union. The construction of wastewater treatment plants along the river has prevented the discharge of raw wastewater in the river, leading to an improvement in water quality over the last 15 years. Other improvements included reductions in industrial and agricultural discharges. The ecosystem in the North-western shelf of the Black Sea is recovering, as witnessed by the return of once-abundant red seaweed *Phyllaphora.* This is a clear example of a "source-to-sea" approach to coastal and marine management.

"A green and blue recovery for coastal and maritime tourism in the Mediterranean"[99]

40. In 2019, the Mediterranean basin welcomed more than 400 million international tourists, and the tourism sector accounted for up to 15 per cent of regional GDP. Tourists are

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[95] By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

[96] See https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/marine-protected-areas.

[97] *Protected Planet Report* (UNEP and International Union for the Conservation of Nature), available at https://livereport.protectedplanet.net/.

[98] Sources: EMBLAS-Plus project (http://emblasproject.org/) and BBC News, "The Black Sea: Can Europe's most polluted sea be saved?", 2 December 2019, available at www.bbc.com/reel/video/p07w83tq/can-europe-s-most-polluted-sea-be-saved-.

[99] Sources: Fosse, J., I. Kosmas, and A. Gonzalez, *The Future of Mediterranean Tourism in a (Post) Covid World* (Eco-union, 2021), available at https://www.ecounion.eu/wp-content/uploads/2021/04/Nota_Thefuture_mediterranean_tourism_03.pdf; European Environment Agency and UNEP Mediterranean Action Plan, *Technical Assessment of Progress towards a Cleaner Mediterranean*; UNEP Mediterranean Action Plan, *Mediterranean Strategy for Sustainable Development 2016-2025* (2016), Valbonne. Plan Bleu, Regional Activity Centre; and Plan Bleu, *MED Sustainable Tourism*, available at https://planbleu.org/en/projects/med-sustainable-tourism-community/.

attracted by landscapes and rich biodiversity, cultural heritage and traditional lifestyles, coupled with favourable environmental conditions, such as a mild climate, beaches and clear seawater.

41. While being one of the global biodiversity hotspots,[100] the region is also subject to critical levels of habitat loss from unsustainable exploitation of resources, pollution, climate change and invasive marine species. The negative environmental impacts of tourism on the coastal and maritime areas originate mainly from the construction and operations of built infrastructures (resorts, residencies, ports and marinas, facilities, etc.) and from maritime or coastal recreational activities (nautical tourism, golf courses, water sports, etc.). The high spatial and temporal variations of tourism, which is predominantly concentrated along the coastal strip and peaks during the summer season, boosts the amount of potentially mismanaged waste, as well as in discharges of inadequately treated urban wastewater. More than 75 per cent of the annual waste production is generated during the summer.

42. A key challenge is to promote "blue" sustainable tourism practices in coastal and marine areas, promoting positive externalities for the environment, workers and local communities. The Mediterranean tourism sector has been hard hit in 2020 by travel restrictions due to the COVID-19 pandemic. It is now at a crossroads: back to previous overgrowing trends and mass tourism or leapfrog towards more sustainable tourism patterns? The massive investments provided by the ambitious, green and inclusive recovery plans offer a unique opportunity to recover better, by transforming the tourism sector and contributing to a more prosperous region. These measures should be multi-fold, involving various actors and benefitting the environmental, social and economic dimensions.

[100] A biodiversity hotspot is an area characterized as of exceptional biodiversity value and a large number of endemic species

E. Biodiversity and ecosystems

1. Key messages and recommendations

Key messages

43. Overall forest area in the ECE region has increased by 33.5 million ha[101] over the past 30 years. The relative share of the particularly biodiversity-rich primary forests has declined significantly over the same period.[102] Forest fragmentation remains an important pressure.

44. Beyond forests, the status of ecosystems remains a cause for concern, with no evidence of a clear positive trend. Only a minority of the habitats assessed at the European Union level have a good conservation status, and the overall picture is likely to be similar beyond the European Union.

45. The protected area (PA) estate in the pan-European region has almost tripled over the past 30 years, and key policy targets related to PAs have been met in the region.

46. Land continues to be taken for infrastructure development in the pan-European region, but land take has decreased in most European Environment Agency member countries.

Recommendations

47. Governments should ensure that trends in forest area remain positive. They should take additional measures to safeguard the remaining primary forests and their ecological functionality, for example, by promoting management standards aimed at preserving high-conservation value forest and by enhancing forest connectivity.

48. Governments should make efforts to consolidate and improve the extended PA network within the ECE region through investment in management effectiveness, ecological representativeness and connectivity. The whole range of governance types should be used, and other effective area-based conservation measures should be integrated;

49. Governments should take measures to reduce land take further and consistently. Measures should also address the conversion of natural to agricultural ecosystems and the degradation of habitat quality due to biodiversity-unfriendly agricultural practices through, for example, more targeted use of subsidies and other incentives.

50. Governments should mainstream biodiversity conservation across sectors and policies, to eliminate or reform harmful subsidies and incentives, and to develop effective positive incentives for biodiversity conservation and sustainable use.

2. Context

Issues at stake

51. Biodiversity, which encompasses diversity within species, between species and of ecosystems, plays an essential role in maintaining Earth's life-support systems, enabling nature-based solutions to societal challenges and maintaining quality of life. Ecosystem services are recognized as a basis for sustainable socioeconomic development.

52. The pan-European region is characterized by its strong overlap with the Palearctic region and its extensive biomes of boreal coniferous and temperate deciduous forests, temperate grasslands and deserts, Mediterranean forest and Arctic tundra, as well as important marine ecosystems. It comprises the largest continuous forest, grassland and

[101] ECE, "Forest area in UNECE region continues to increase, says FAO report, but greater efforts needed to protect these fragile ecosystems", press release, 23 July 2020, available at https://unece.org/forestry/press/forest-area-unece-region-continues-increase-says-fao-report-greater-efforts-needed.

[102] This trend mostly occurs in Russian Federation, which is also one of the top three countries in the world in terms of area of primary forest.

peatland ecosystems globally. These act as critical carbon sinks, provide ecosystem services and underpin the region's economies.

Policy objectives and challenges

53. The global policy framework for biodiversity in a broad sustainable development context is defined by the relevant Sustainable Development Goals, particularly Goals 15 and 14.

54. The countries of the pan-European region cooperate under various multilateral environmental agreements. The main multilateral environmental agreement on biodiversity is the 1992 Convention on Biological Diversity. Its last Strategic Plan for Biodiversity ran from 2011 to 2020 and was built around the Aichi Biodiversity Targets.[103] Other relevant multilateral environmental agreements are the 1979 Convention on the Conservation of Migratory Species of Wild Animals, the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, the 1971 Convention on Wetlands of International Importance especially as Waterfowl Habitat and the 1979 Convention on the Conservation of European Wildlife and Natural Habitats.

55. The main policy challenge related to biodiversity is to ensure its effective conservation and sustainable use. This implies addressing the drivers and root causes of pressures on species and terrestrial, marine and other aquatic ecosystems, including oceans, and increasingly requires restoration. Strategies include putting in place ambitious policy mixes (regulatory approaches, economic instruments and voluntary approaches), mainstreaming biodiversity across economic and sectoral policies, eliminating illegal exploitation and trade of biodiversity and eliminating illegal, unreported and unregulated fishing. Enforcement of existing legislation and regulation to end illegal activities is critical in this regard. Biodiversity conservation and restoration also requires reforming and removing environmentally harmful subsidies and strengthening the role of biodiversity-relevant taxes, fees and charges.

3. State, main trends and recent developments

Strategic Plan of the Convention on Biological Diversity has only been partly fulfilled and biodiversity loss continues

56. At the global level, only 6 of the 20 Aichi Biodiversity Targets – as the main concretization of Sustainable Development Goals 14 and 15 – have been partly achieved, and none has been fully achieved, according to *Global Biodiversity Outlook 5*.[104]

57. For the pan-European region, ECE environmental indicator D-3 on forests and other wooded land shows that efforts to curb deforestation and forest degradation have met with success. This has been accompanied by a relative reduction in primary forest and a relative increase in planted forest.

58. Large, undisturbed ecosystems – both forest and other types, including wetlands – continue to decline globally. Trends in ecosystems and habitats within the pan-European region may be similar: within the European Union, only 15 per cent of habitat assessments have a good conservation status, with 81 per cent having poor or bad conservation status.

59. The conversion of land from natural to non-natural land cover types is one of the pressures contributing to ecosystem loss and degradation. The intensity of this land take has declined in most but not all countries of the pan-European region over the past 20 years, as is also shown by ECE indicator E-1 on land uptake.

60. Species extinction risk is still increasing, although conservation efforts likely prevented an even steeper increase. Twenty-four per cent of species in well-understood

[103] To be revised in 2022, depending on the outcome of negotiations on a post-2020 global biodiversity framework.

[104] Secretariat of the Convention on Biological Diversity, *Global Biodiversity Outlook 5* (Montreal, 2020).

taxonomic groups will continue to edge towards extinction unless the drivers of their decline are dramatically reduced. Climate change is emerging as an additional pressure on biodiversity, interacting with pre-existing pressures. Species richness continues to decline in agricultural landscapes and production forests; agricultural practices are among the main drivers of biodiversity loss at the global and pan-European levels. Although over the period 2005–2015 European production forests have become more diverse in tree species composition, recent research alerts that overall tree species richness is increasingly at risk in Europe, prominently through invasive species.[105]

61. The same trends may be true for the pan-European region; the report *State of nature in the EU*[106] noted a deterioration of the average conservation status of bird populations. Species associated with agricultural areas display a particularly negative trend.

Area coverage of protected areas has increased, but their effectiveness in contributing to conservation goals needs to be further enhanced

62. Protected areas remain a key instrument for reducing biodiversity loss. The area of terrestrial and marine PAs has grown significantly in the pan-European region. The latter is also supported by ECE indicator D-1 on terrestrial PAs. Meanwhile, there remains considerable room for improvement of the representativeness, connectivity and management effectiveness of PAs, and for enhanced enforcement of existing PA legislation.

There is a need for a broader policy response to biodiversity loss, reflecting its repercussions for human well-being and sustainable development

63. Biodiversity mainstreaming into policies, poverty reduction and development planning has largely been an insular rather than a systematic effort in most countries over the past 10 years. One positive example has been the rise of environmental-economic accounting in some countries. Overall, little progress has been made over the past decade in eliminating, phasing out or reforming subsidies and other incentives potentially harmful to biodiversity, and in developing positive incentives for biodiversity conservation and sustainable use. This also broadly applies to the pan-European region.

64. Resource mobilization for biodiversity improved in some but, by far, not in all countries between 2010 and 2020. The mobilized resources are still not sufficient to meet financial needs and are still outweighed by financial support for activities harmful to biodiversity. This is also true in the forestry context, including regarding reforestation. In contrast, understanding of funding needs and gaps has improved, at least in some countries.

65. The status and trends of biodiversity and ecosystem services are of fundamental importance for human well-being and sustainable development. Encroachment of human settlements onto natural systems and wildlife trafficking disrupt the self-regulatory capacity of these ecosystems, increase the frequency of human-wildlife contacts and can lead to the spread of infectious diseases. For instance, it is possible that illegal exploitation of pangolins led to the transmission of coronavirus disease (COVID-19) to humans.

Links to conference themes

66. The conference theme "Greening the economy in the pan-European region: working towards sustainable infrastructure" responds to the need to mainstream the environment including biodiversity and ecosystems across sectors. This conference theme is directly related to indicator E-1 (land take) as increasing the environmental sustainability of infrastructure development relies partly on reducing its spatial footprint.

67. Tourism is both dependent on and affects the state of biodiversity in the areas where it occurs. By "Applying principles of circular economy to sustainable tourism", the ecological

[105] Forest Europe, *State of Europe's Forests 2020* (Zvolen, Slovakia, Forest Europe, 2020) available at https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf.

[106] European Environment Agency, *State of nature in the EU: Results from reporting under the nature directives 2013–2018*, Report No. 10/2020 (Luxembourg, Publications Office of the European Union, 2020), available at https://www.eea.europa.eu/publications/state-of-nature-in-the-eu-2020.

footprint of touristic activities in biodiversity-rich touristic areas – including pressures related to waste production, eutrophication and resource overexploitation – is reduced. In turn, this enables the provision of cultural ecosystem services and thereby enhances the human well-being benefits and broader development opportunities of these areas.

4. Indicators

Terrestrial protected areas (ECE indicator): overall moderate-to-good status

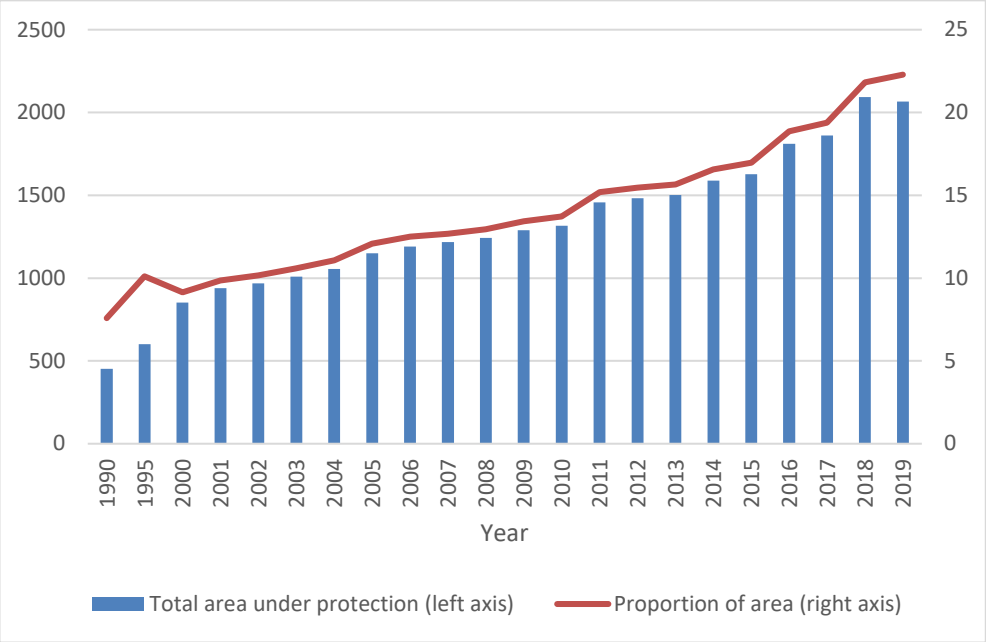
68. This indicator shows the overall area of nationally designated terrestrial PAs in absolute terms and as a share of the countries' total areas.[107] Figure IV overleaf gives this information for all ECE countries combined, for the period 1990–2019. Data availability for this indicator is very good for European Environment Agency member countries and cooperating countries, and fair-to-good for most other countries.

69. The area extent of PAs in the pan-European region has risen strongly over the past 30 years and increased by 60 per cent over the past 10 years. The share of PA in the pan-European area for which data are available stood at over 22 per cent in 2019, significantly above the Aichi Target 11 of 17 per cent. The degree or effectiveness of protection of biodiversity within PA, or about their overall contribution to reducing global biodiversity loss, depend of the PA management effectiveness.

Forests and other wooded land (ECE indicator): overall moderate-to-good status

70. This indicator shows the total area of forests and other wooded land, its ratio to the overall area of the countries, the share of forest areas that are natural and planted, and the contribution of forests designated for production, soil or water protection and the protection of ecosystem services and biodiversity. Figures V and VI overleaf show these statistics for all pan-European countries combined,[108] for 10-year intervals over the period 1990–2020.

Figure IV
Protected areas, total area under protection, 1,000 km^2, and share of country area, per cent (right axis) (1990–2019) *[revise to 2000–2019]*



Notes: Data only for member and cooperating countries of the European Environment Agency, Kazakhstan, the United Kingdom and the countries of Eastern Europe.

[107] The indicator could be calculated for marine protected areas (PAs). However, this would compromise comparability of data from across the ECE region in the case of this assessment.

[108] The Russian Federation alone accounts for 77 per cent of the ECE region's forest area.

Figure V
Total area of forest and other wooded land, million ha (1990–2020)

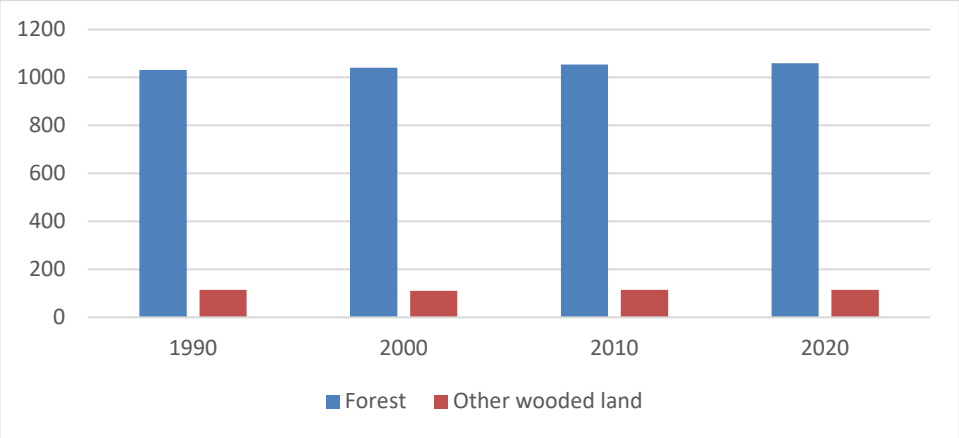
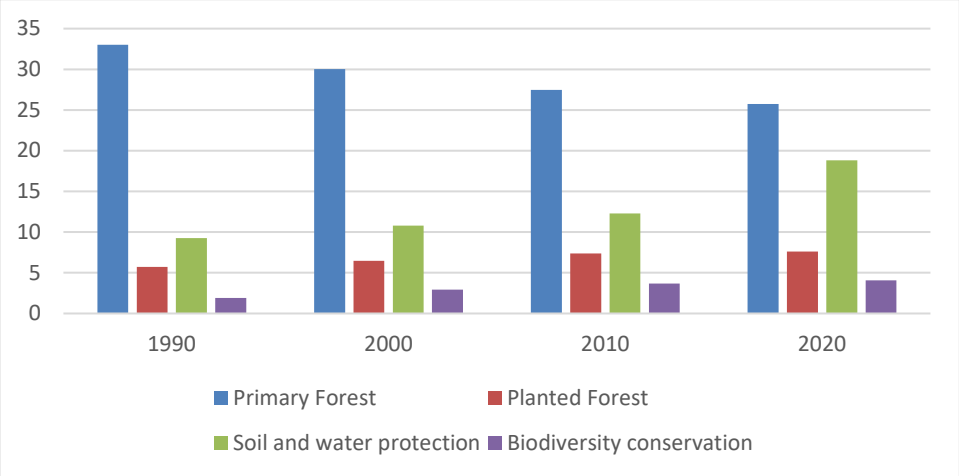


Figure VI
Share of primary and planted forest and share of forest area designated for soil and water protection or biodiversity conservation, per cent (1990–2020)



71. The data for this indicator were sourced from Global Forest Resources Assessments of the Food and Agriculture Organization of the United Nations. Data availability for ECE countries from this source is good-to-very-good.

72. Forest area has increased by 2.6 per cent since 1990, and by 0.5 per cent since 2010. The share of forest area has increased by 1 per cent to 39.2 per cent over the past 30 years. Other wooded land has changed little and contributes another 4.3 per cent, as of 2020. This means that the pan-European region has met target 15.1 of the Sustainable Development Goals and Aichi Target 5 in quantitative terms.

73. The share of primary forests, which tend to be particularly biodiversity-rich, decreased from roughly a third to roughly a quarter over the same period, with a slight flattening of the curve during the 2010–2020 interval. Planted forests became absolutely and relatively more important, increasing from 5.7 per cent in 1990 to 7.6 per cent in 2020. Expansion of planted forest does not always occur at the expense of primary forest; as seen in the previous paragraph the total forest area increased.

74. Over the past 30 years, forest designation has seen a diversification from a narrow focus on production in 1990 to a broader spectrum including protection of soil, water and biodiversity. This diversification of forest designations can be interpreted as a management response aimed at improving the quality of existing forests, including from a biodiversity conservation perspective. Forest areas designated for water and soil protection more than doubled, from 9.3 to 18.8 per cent, and those for biodiversity conservation doubled from 1.9 to 4.1 per cent.

Land uptake (ECE indicator): overall moderate-to-poor status

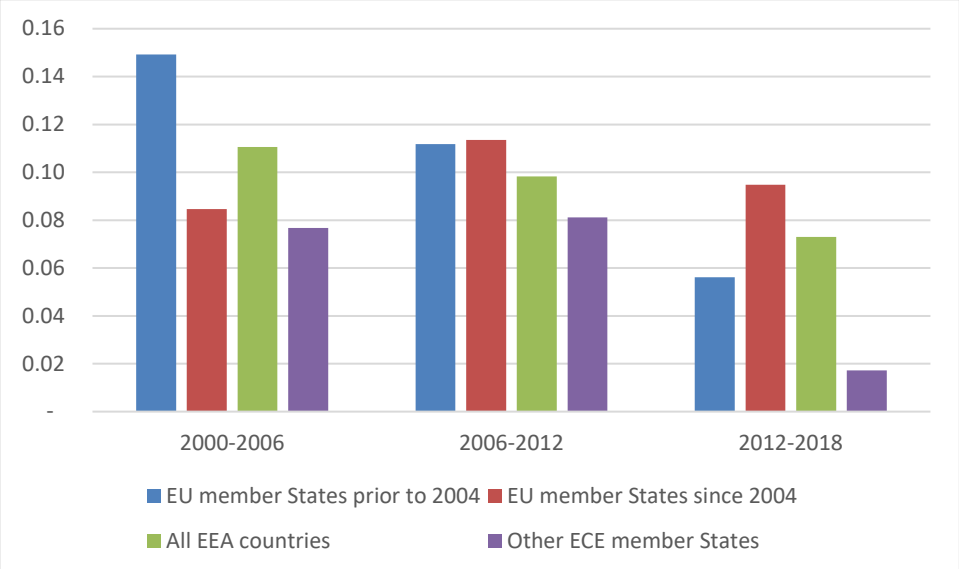
75. A modified version of ECE indicator E-1, based on European Environment Agency indicator "Land take in Europe" (i.e. net conversion of land from non-artificial to artificial land-use categories), has been used in this assessment. The indicator shows only part of the overall relationship between land-use changes and biodiversity. While agriculture is considered a non-artificial use, pressures on biodiversity from habitat loss or degradation are often associated with conversion to agricultural land or change of agricultural practices.

76. The indicator results are most conclusive for European Environment Agency member countries and cooperating countries, while there are some gaps regarding data completeness and consistency of land take data from other ECE countries. Figure VII overleaf shows the indicator for three six-year intervals from 2000 to 2018 for the different subregions.

77. Net land take continues in all subregions, though the rate is decreasing. Land take figures for the countries that joined the European Union since 2004 peaked in the 2006–2012 interval (0.11 per cent) and declined thereafter (0.09 per cent for the 2012–2018 interval), possibly reflecting the adoption of European Union policies and standards. Land uptake in in other ECE countries decreased substantially in the period 2012–2018. This trend shows considerable variability across European Environment Agency countries and there are countries where land take rates continued to increase over the entire 2000–2018 period.

78. Land uptake and land take data from European Environment Agency member and cooperating countries are difficult to compare to those from other countries. This is due to differences in methodology, including the availability of reliable remote-sensing data and consistent criteria to analyse them, the continuity of national monitoring efforts, and apparently also shifts in land classification in the early 2000s. This highlights the need to continue investing in consistent land-cover classifications and monitoring capacity, agree on consistent national information to be fed into the Shared Environmental Information System, and carefully retrofit actual land-cover categories to past data, in order to obtain reliable trend information.

Figure VII
Land take in different subregions across three six-year time periods, per cent of total land area (2000–2018)



Abbreviations: EEA, European Environment Agency; EU, European Union.

5. Case studies

Enhancing area-based biodiversity conservation by recognizing other effective area-based conservation measures

79. Other effective area-based conservation measures are areas under management not primarily dedicated to biodiversity conservation, but where management nevertheless contributes to improved biodiversity status. Examples include cultural heritage areas, military training areas and sustainably managed production forests that generate biodiversity benefits. These sites, which occupy a significant share of the area in many countries, went largely unrecognized and attracted only limited resources and efforts to enhance their biodiversity benefits in the past. This started to change with the 2010–2020 Strategic Plan for Biodiversity under the Convention on Biological Diversity and the inclusion of other effective area-based conservation measures in Aichi Target 11, but is likely to be further enhanced in the post-2020 global biodiversity framework.

80. Other effective area-based conservation measures represent a significant but largely untapped opportunity to extend and consolidate area-based conservation networks in the pan-European region. They could contribute greatly to extending overall ecological representation, linking up existing PAs and engaging additional actors to contribute to better biodiversity status.

81. For the European Union and countries with European Union association agreements transposing European Union water legislation into national legislation, the Water Framework Directive [109] and Floods Directive [110] have the potential to result in land and water management that would be in line with criteria for other effective area-based conservation measures. National forest categories of many States of Northern Eurasia, the Caucasus and Central Asia, such as "protective forest" (i.e., forest with the purpose of protecting groundwater reserves or protecting against landslides on slopes), also generate substantial biodiversity benefits and might be recognized as other effective area-based conservation measures.

82. ECE member States should systematically explore and use the emerging designation of other effective area-based conservation measures to further consolidate their area-based conservation networks.

International cooperation to control pressures from linear infrastructure to migratory mammals in Central Asia

83. Many of the iconic migratory mammals of the Central Asian steppes, such as the Saiga antelope, the Goitered gazelle and the Khulan, are globally threatened, partly owing to significant pressure from habitat fragmentation and degradation along linear infrastructure, for instance roads and railways, pipelines and fences. This is directly relevant to the first conference theme "Greening the economy in the pan-European region: working towards sustainable infrastructure".

84. To reduce and mitigate these pressures, ECE member States from Central Asia are cooperating on various initiatives under the Convention on the Conservation of Migratory Species of Wild Animals, including the Memorandum of Understanding concerning Conservation, Restoration and Sustainable Use of the Saiga Antelope and the Central Asian Mammals Initiative. These are aimed at removing barriers to migration, developing and

[109] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, *Official Journal of the European Union*, L 327 (2000), pp. 1–73

[110] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, *Official Journal of the European Union*, L 288 (2007), pp. 27–34.

supporting regional ecological networks and, ultimately, preserving animal migrations in the Central Asian region as one of the last global “migration hotspots”.

85. The ECE member States in the Central Asian region should continue their cooperation to manage linear infrastructure in such a way that impacts on migratory mammals are minimized.

F. Land and soil

1. Key messages and recommendations

Key messages

3. Land use and land-use change in the pan-European region continue to be mainly driven by agriculture. In Eastern Europe and Central Asia, agricultural production is rising and rapidly approaching Soviet levels, while domestic demand has fallen due to a drop in livestock inventory. The current land-use dynamic shows only a moderate increase of the sown area in fertile soil (steppe and forest-steppe) zones and no sign of agriculture recovering in marginal (forest) areas. However, driven by their desire for a rapidly growing share of the world grain market, countries such as Kazakhstan, the Russian Federation and Ukraine are determined to bring millions of ha of abandoned lands back into cultivation. At the same time, the utilized agricultural area in the European Union is expected to continue declining smoothly towards 2030, though at a slower pace than in the past decade.[111]

4. Soil organic carbon (SOC) content is the most important element of soil due to its role in improving aeration, water retention, nutrient supply, soil biodiversity and climate change mitigation. For example, in Eastern Europe, large-scale land abandonment switched agricultural land from being a small source of atmospheric carbon dioxide (CO_2) to a significant sink of atmospheric CO_2. Conservation agriculture practices in the pan-European region may play an important role in carbon sequestration and raising soil productivity.

5. Land erosion is one of the results of land-use dynamics, and it shows different characteristics throughout the region. Field measurements in European Union countries show an average rate of soil erosion of 0.2–3.2 t ha^{-1} $year^{-1}$ on a per country basis. In Eastern Europe, the average rate of soil erosion has decreased over the past 30 years following massive cropland abandonment and climate change. In the Russian Federation, the total amount of washed soil and the rate of erosion have been reduced by 56.1 per cent and 15 per cent respectively in the past 30 years due to the widespread abandonment of cropland and lower spring runoff. In Central Asia, wind erosion is a dominant type of land degradation, but the contribution of irrigated and rainfed cropland is limited by their relatively small area and relatively low rate of erosion. Erosion can be further reduced in most affected areas by implementing conservation agriculture.

6. The European Union, following changes in consumer behaviour, is increasingly focusing on food safety by developing local, organic, genetically modified organism-free or other types of certified production,[112] which results in more sustainable agriculture practices. Eastern Europe and Central Asia feel the need to prioritize self-sufficiency in key foodstuffs, which might lead to less sustainable agriculture practices.

Recommendations

7. The pan-European countries should increase efforts to provide better guidance to farmers on using soil conservation methods in areas of degraded (eroded) soils. There are already simple models (based on the Universal Soil Loss Equation)[113] allowing farmers to

[111] Land abandonment in the European Union might reach 4.2 million ha, or 3–4 per cent of current utilized agricultural area, by 2030, see Carolina Perpiña Castillo and others, "Agricultural Land Abandonment in the EU within 2015–2030", Joint Research Centre Policy Insights, European Commission, October 2018.

[112] European Commission, Directorate-General Agriculture and Rural Development, *EU agricultural outlook for markets and income, 2019–2030* (Luxembourg, Publications Office of the European Union, 2019).

[113] The Universal Soil Loss Equation model is used to calculate potential erosion on fields as a result of a combination of "pre-disposing factors" such as rainfall pattern, topography, soil texture, cropping systems and management practices. The target audience of the model is farmers who can use the Universal Soil Loss Equation guideline (in a simple table format) to receive advice for their routine practices (A.J. Jones and others, Universal Soil Loss Equation: a Handbook for Nebraska Producers, Nebraska Cooperative Extension Service EC 88-116 (n.p., University of Nebraska-Lincoln, 1987).

explore different options to decrease the rate of erosion on their plots at an economically acceptable cost; however, these methods cannot be used at larger scale or with all types of soils and further research and development is required.

8. Policymakers should strive to maintain a judicious balance between SOC accumulation for higher crop productivity and SOC storage for climate change mitigation, as this is critical for mainstreaming global sustainable initiatives such as "4 per 1,000".[114]

9. The pan-European policy in respect of land resources should focus on consumers' rights to healthy (i.e. free from pesticides and antibiotic, hormone or steroid residues) food, a healthy environment (including animal welfare), stable food prices, and low household expenditures on food. This could be achieved by promoting environmentally sound agriculture practices and a reliable food supply (of domestically produced and imported items) and redirecting investments to storage facilities and transportation where needed.

10. In a condition of intense rural exodus, more active measures should be implemented to reverse the depopulation trend through the diversification of incomes, such as by the development of rural tourism, and the attraction of new settlers. Recognizing the biodiversity value of low-intensity farmland, the European Union provides agroenvironmental subsidies in support of farming in marginal areas, but the economic impact of existing European Union programmes in support of rural tourism is modest, while their effects depend on the specific characteristics of the areas.

2. Context

11. Being parties to the United Nations Convention to Combat Desertification (UNCCD), European and Central Asian countries share an ambition to achieve Land Degradation Neutrality (LDN) by 2030. Having an offsetting scheme is a new component of the LDN approach, meaning that land degradation should be compensated for by the restoration or rehabilitation of degraded lands elsewhere. Yet the methodology related to the LDN target does not exist.

12. Most terrestrial carbon (1,500 Gt) is held in soils, more than twice as much as in vegetation or the atmosphere. The soils in the countries that are members of the European Environment Agency hold around 5 per cent of the global SOC pool, whereas the Russian Federation alone holds about 21 per cent. The increase of SOC in pan-European soils can positively contribute to the mitigation of greenhouse gas emissions globally, but nearly 75 per cent of the territory of the Russian Federation lies in the permafrost zone, whose SOC reserve is susceptible to decomposition upon climate warming, thus contributing to the enhanced emission of greenhouse gases.

13. The members of the European Environment Agency recognize agriculture as essential for maintaining biodiversity of extensive farmland biotopes and early successional habitats, such as heathland and meadows. The biodiversity of low-intensity farming land can be higher than that of rewilded, semi-natural and forested areas, and farmers in those areas are producers of both food and ecosystem services. Therefore, the abandonment of such areas is perceived in the European Union as a serious threat to biodiversity. Depopulation (or "desertification") of rural settlements, and not just cropland abandonment, needs to be reversed.

14. A primary role of land and soil resources is food production. Soil underpins 90 per cent of all food, feed and fibre production. The European Union and Western Europe are observing a shift in consumer behaviour towards local, organic, genetically modified organism-free and other types of certified production. The resulting changes in agriculture should be spread over the rest of the pan-European region into subregions where the consumer's right to healthy food is not clearly articulated in food security strategies.

[114] "4 per 1000" is a voluntary action initiative adopted at the 2015 Paris Climate Change Conference that aims to boost carbon storage in agricultural soils by 0.4 per cent each year (www.4p1000.org/).

3. State, main trends and recent developments

15. The European Union Thematic Strategy for Soil Protection adopted in 2006[115] names the following major threats to soil: erosion, organic matter decline, contamination, compaction, salinization, decline in biodiversity, soil sealing, landslides and flooding. Desertification was later included as a further threat. For most of these threats, neither regional nor subregional assessments have been performed because of a lack of systematic approaches and data.

16. In most European Environmental Agency member countries, information about SOC is obtained from local soil surveys undertaken by different national or regional institutions, making comparison of the data difficult. The most comprehensive SOC observation network, in England and Wales (United Kingdom of Great Britain and Northern Ireland), shows loss of SOC in all types of ecosystems and land-use classes. The reason for loss is probably increasing decomposition of organic matter with higher temperatures caused by climate change.

17. Support from the European Union Common Agricultural Policy could slow the process of cropland abandonment and rural depopulation in the bloc, but it is not expected to reverse it. In Eastern Europe and Central Asia, about 58 million ha of cropland were abruptly abandoned during the 1990s and are unlikely to be fully restored because of rapid depopulation of marginal rural areas and because no support policy like the Common Agricultural Policy exists in these countries.

18. Numerous field studies show a significant reduction in soil erosion on no-tilling land; moreover, carbon sequestration after no-till is higher than after conventional ploughing. However, there are no explicit national or regional policies in respect to conservation agriculture. Conservation agriculture in the pan-European region demonstrates very limited growth (for example, 2.5 million ha of no-tilling arable land in the European Union) as compared with other world regions. Farmers face a trade-off immediately after adopting no-till: on the one hand, crop yields are often lower; on the other, production costs decrease due to limited use of machinery, fertilizers and less working time per unit area. Farmers following a no-till approach often resort to high and regular applications of herbicides, though longer-term benefits can arise from certified organic produce.

19. Rural tourism can be important for revitalization of abandoned rural settlements. Shifting policymakers' concern from cropland abandonment to "desertification" of thousands of villages throughout the pan-European region is necessary, as low yields are unlikely to be the reason for villages to be left, while an intense demographic rural exodus can certainly cause land negligence. Due to the development of new communication technologies, isolation and lack of employment opportunities are no longer reasons for abandoning small rural and mountainous villages, as the response to the coronavirus disease (COVID-19) pandemic has amply demonstrated with the temporary relocation of urban dwellers to rural areas.[116] An analysis of numerous existing projects for recovering abandoned villages in Italy shows that, among different approaches, rural tourism has the largest potential to succeed.[117]

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[115] Commission of the European Communities, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, Thematic Strategy for Soil Protection, COM(2006)231 final. Available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52006DC0231.

[116] Organisation for Economic Co-operation and Development (OECD), "Policy implications of Coronavirus crisis for rural development", 16 June 2020, available at www.oecd.org/coronavirus/policy-responses/policy-implications-of-coronavirus-crisis-for-rural-development-6b9d189a/.

[117] Kristen Elizabeth Sloan, "Reawakening 'Ghost Towns', Alternative Futures for Abandoned Italian Villages", Doctor of Philosophy thesis, University of Wollongong, 2018, available at https://ro.uow.edu.au/theses1/437.

4. Indicators

Proportion of land degraded

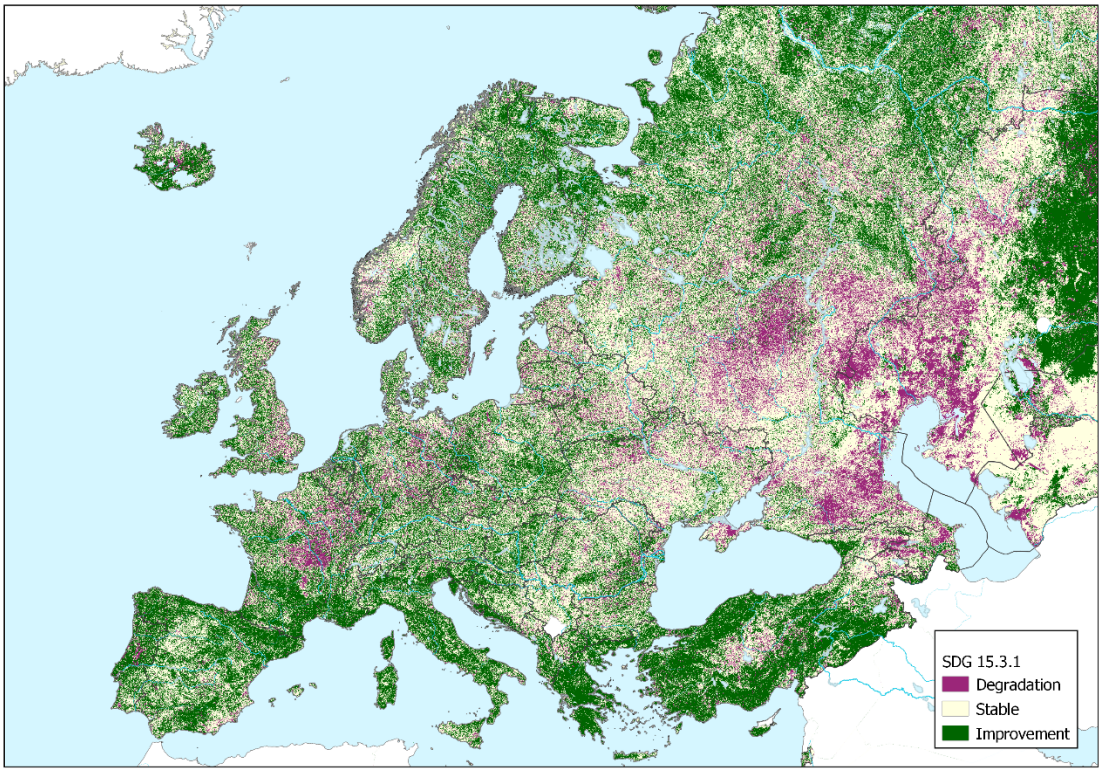
20. Land degradation and erosion is identified by the European Parliament as "probably the most significant environmental problem in Europe".[118] Most research on land degradation assesses territories in terms of potential risk of erosion because field measurement of actual erosion rates is difficult to conduct, especially at a larger scale. No regional pan-European scale assessment of land degradation is available. At the global level, the UNCCD assessment methodology consists of all three subindicators: land cover change, land productivity change and carbon stocks. Parties to UNCCD provide information on the total area of degraded land and level of confidence of assessment,[119] though Conservation International provides complete coverage using remotely sensed data (see figure I below).

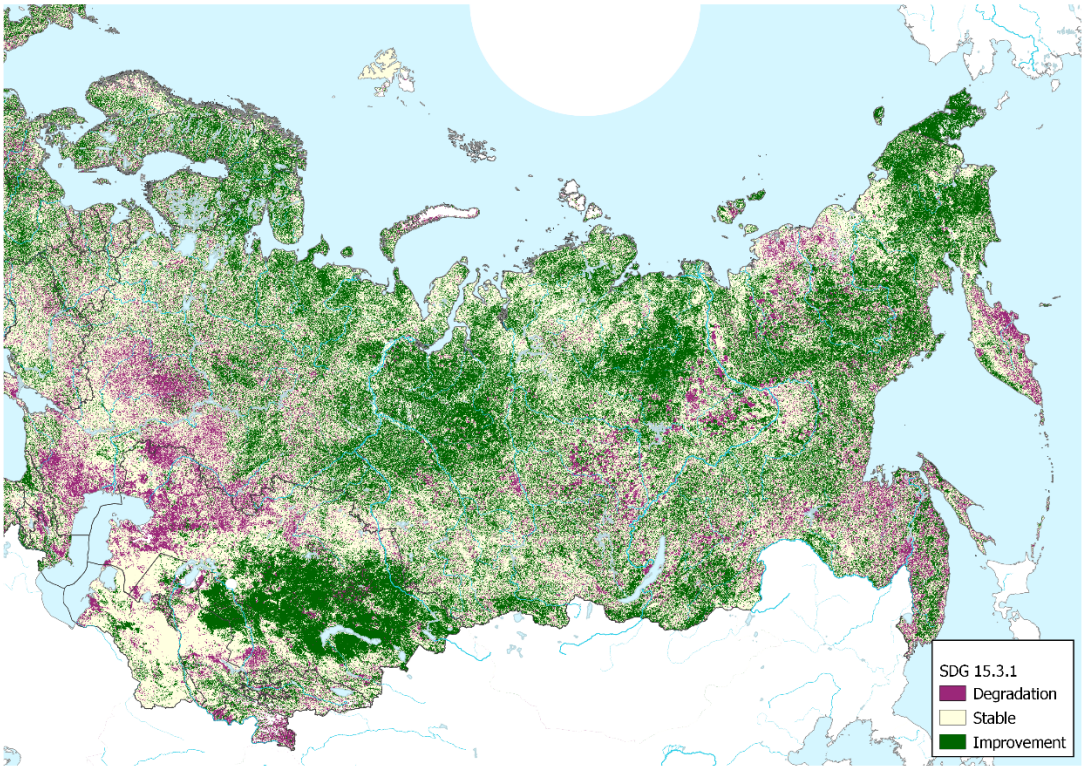
[118] Joint Research Council, *Addressing soil degradation in EU agriculture: relevant processes, practices and policies. Report on the project "Sustainable Agriculture and Soil Conservation (SoCo)"*, (Luxembourg, Office for Official Publications of the European Communities, 2009), available at https://publications.jrc.ec.europa.eu/repository/handle/JRC50424.

[119] ICCD/CRIC(17)/2.

Figure I (revised)

Trends in land degradation in the pan-European region (2005–2019)





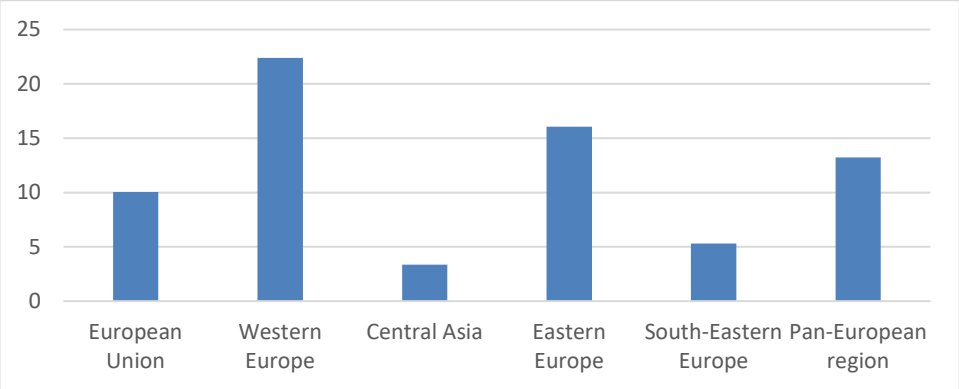
Source: Conservation International.

Note: The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. In particular, the boundaries shown on the maps do not imply official endorsement or acceptance by the United Nations.

Topsoil organic carbon content

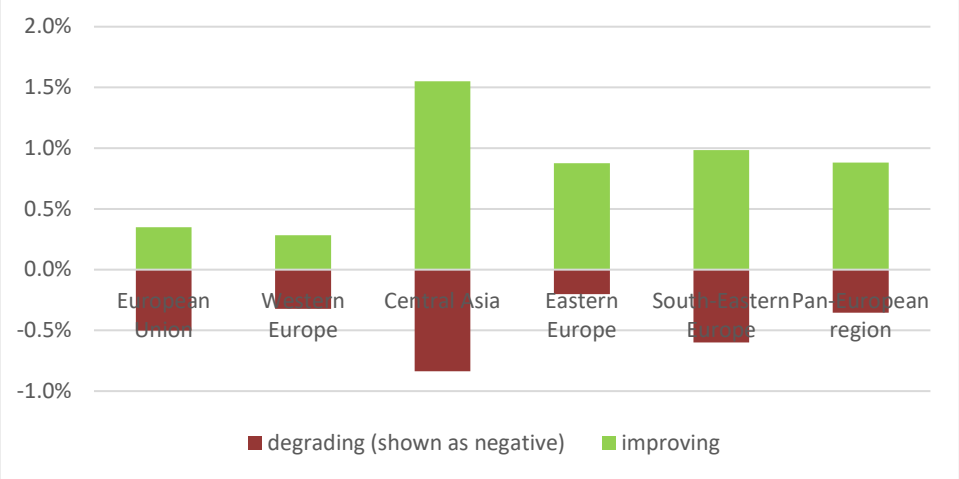
21. The Soil Framework Directive[120] called for the delineation of the areas in Europe threatened by a decline in soil organic matter below a definite critical level and for elaboration of appropriate measures to avoid the decline. The "critical" concentration of SOC at 2 per cent (or 3.4 per cent of soil organic matter according to a standard conversion ratio) is the most cited threshold in policy documents. The European Commission Road map for a resource-efficient Europe[121] proposed a goal that SOC levels should not decrease overall and should increase for soils currently with less than 2 per cent SOC by 2020.[122] Figures II (overleaf) and III (below) illustrate the variation in SOC across the region, with 20 g/kg SOC being equivalent to the 2 per cent threshold (coloured green in figure II).

Figure III
Soil organic carbon content by subregion, weighted average 0–30 cm (g/kg)



Source: Derived from SoilGrids, courtesy of ISRIC – World Soil Information.

Figure (*new*)
Proportion of area with improving or degrading soil organic carbon content, by subregion, percentage (2005–2019)



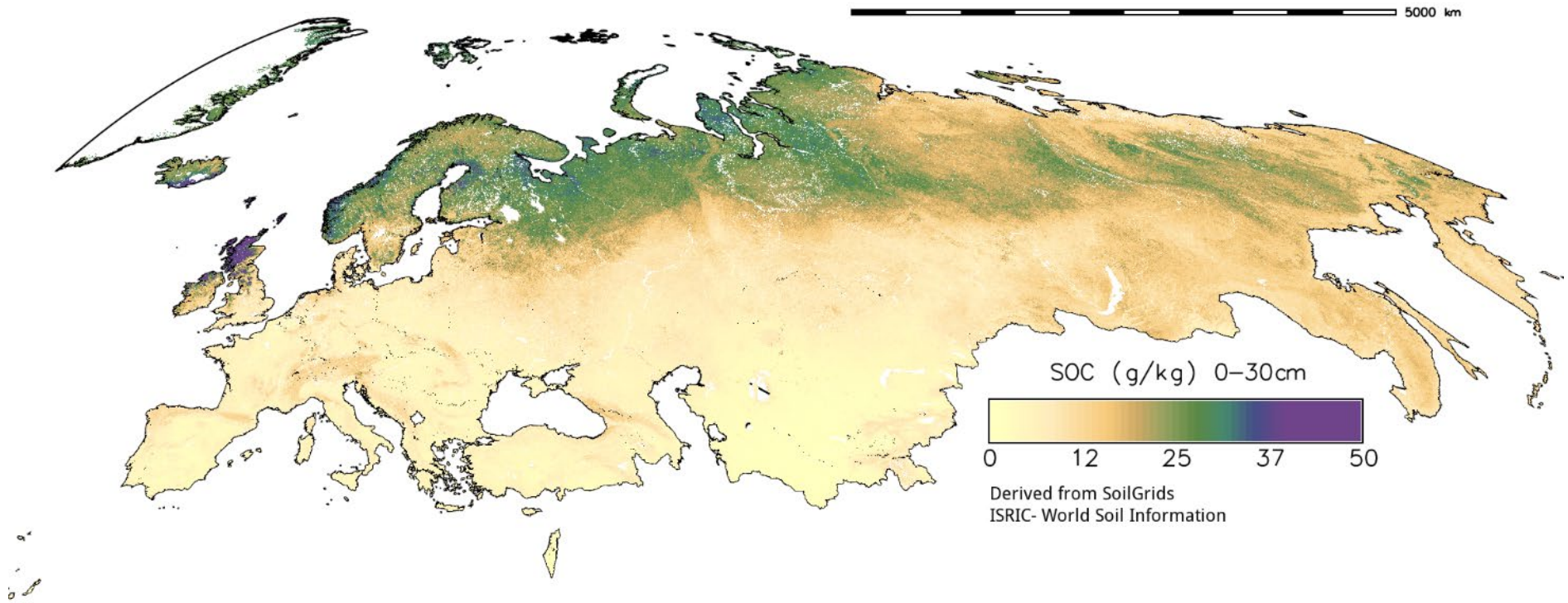
Source: Conservation International

[120] Adopted in 2006 but withdrawn by the European Commission in 2014.

[121] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Road Map to a Resource Efficient Europe, COM(2011) 571 final, available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0571.

[122] Panos Panagos and others, "Estimating soil organic carbon in Europe based on data collected through a European network", *Ecological Indicators*, vol. 24 (January 2013), pp. 439–450.

Figure II
Soil organic carbon content, 0–30 cm, g/kg



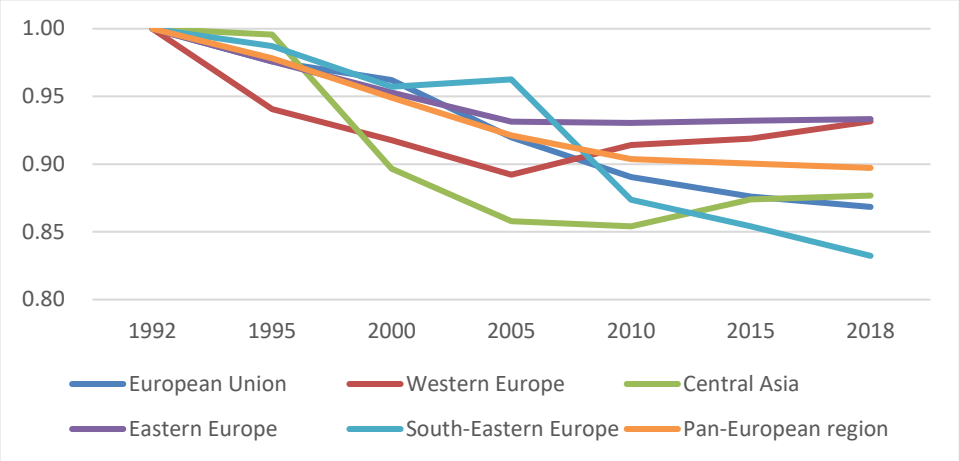
Source: Derived from Soil Grids, courtesy of ISRIC – World Soil Information.[123]

[123] Date will be indicated.

Cropland area

22. There is no definite threshold for agricultural land dynamic, although any decrease of cropland is regarded by default as negative in terms of food security. In the past decade, the long-term trend of a decline in cropland continued in the European Union, though at a slower pace. Moreover, in recent years, a positive trend is observed (see figure IV below). However, the positive trend may reverse in the next decade.[124] Interestingly, in Eastern Europe and Central Asia, current land-use dynamics also show some increase of sown area, especially in productive areas of Kazakhstan, the Russian Federation and Ukraine.

Figure IV
Cropland area in 1992–2018 (1992=1)



Source: Food and Agriculture Organization of the United Nations Statistics, Data – Land Use, available at www.fao.org/faostat/en/#data/RL.

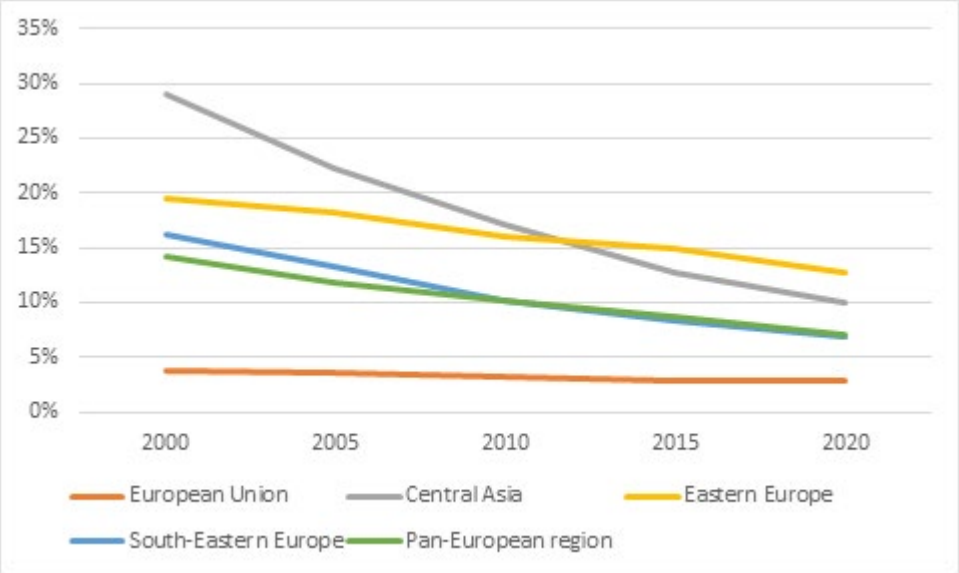
Prevalence of stunting among children aged under five years

23. The malnutrition rate among children aged under five years is an indicator of food security and safety. The indicator is especially important for monitoring progress in the quality of food diet in Eastern Europe and Central Asia. Figure V overleaf demonstrates the impressive progress made this century. The post-Soviet countries can be classified into three broad categories in terms of food and nutrition security: (a) those primarily affected by undernutrition and micronutrient deficiencies (Kyrgyzstan, Tajikistan and Uzbekistan); (b) those facing the triple burden of malnutrition, characterized by residual undernutrition, persisting micronutrient deficiencies and increasing rates of obesity (Kazakhstan); and (c) countries primarily affected by overnutrition (Russian Federation).[125]

[124] Cristian Andronic and others, *The challenge of land abandonment after 2020 and options for mitigating measures* (Brussels, European Parliament/Policy Department for Structural and Cohesion Policies, 2020), available at www.europarl.europa.eu/thinktank/en/document.html?reference=IPOL_STU%282020%29652238.

[125] Saule Burkitbayeva, Johan Swinnen and Nele Warrinnier, "Food and nutrition security in Eurasia: Evolution, shocks and policies", *Russian Journal of Economics*, vol. 6, No. 1 (March 2020), pp. 6–25.

Figure V
Prevalence of stunting among children aged under 5 years, per cent



Source: United Nations Children's Fund (UNICEF), World Health Organization and World Bank Joint Child Malnutrition Estimates Expanded Database: Stunting (Survey Estimates), April 2021, New York, Malnutrition in Children.

Notes: No data for Western Europe (non-European Union), the Russian Federation and Turkey. Within European Union, data for Belgium, Bulgaria, Czechia, Estonia, Germany, Greece, the Netherlands, Poland, Portugal and Romania.

5. Case studies

Portuguese *montado* and Spanish *dehesa*: surviving farming in a marginal environment

24. The Common Agricultural Policy supports marginal farming by providing for agro-environmental subsidies in the framework of its second pillar, on rural development. About 4 per cent of the European Union subsidies are directed to agriculturally Less Favourable Areas, which are supposed to have a high level of biodiversity.[126] Some experts challenge this policy, wishing to see subsidies for marginal land without connection to farming activities.[127] However, though few, some positive examples are available of where farming on marginal lands leads to both environmental and economic benefits. Two of the best examples come from the Portuguese *montado* and the Spanish *dehesa*. These agroforestry systems are dominated by cork oak and holm oak woodland, which produce cork as a forestry product and acorns for livestock breeding, respectively. In between trees, farmers seed pastures and cereals. The biodiversity of these systems is very high and they have retained many of the main characteristics of the original vegetation. Also, many of these farms are economically viable because of this multifunctionality and their large operational spatial scale.[128]

[126] European Commission, *Rural development in the European Union: Statistical and Economic Information – Report 2013* (Luxembourg, Publications Office of the European Union, 2013).

[127] Thomas Merckx and Henrique M. Pereira, "Reshaping agri-environmental subsidies: From marginal farming to large-scale rewilding", *Basic and Applied Ecology,* vol. 16, No. 2 (March 2015), pp. 95–103.

[128] T. Pinto-Correia, N. Ribeiro and P. Sá-Sousa, "Introducing the *montado*, the cork and holm oak agroforestry system of Southern Portugal", *Agroforestry Systems,* vol. 82, No. 2 (April 2011), pp. 99–104.

Mogliazze, Italy: regeneration of "ghost" village

25. In Italy, 267 deserted villages have been well documented. The most frequent reason for their abandonment has been outmigration of residents to cities in the period from the 1950s to the 1980s. The so-called new ruralism movement has brought regeneration to at least 51 of these villages, where different reawakening projects have been successfully implemented, mostly on a crowdfunding basis. "Mogliazze is a small rural village in the hills of Emilia Romagna, part of the municipality of Bobbio, founded by monks in the ninth century a.d. Mogliazze suffered severe population decline because of urban migration and, in the 1950s, lost its entire population to more urbanized areas. In the 1970s, a group of ecological activists recuperated the abandoned homes of Mogliazze to become an eco-village; the Mogliazze Ecovillaggio Cooperative Biologica, which opened at the beginning of the 1980s. Today, the almost entirely renovated village is home to members of a farming cooperative, Soc. Coop Mogliazze, which produces organic fruit and vegetables, honey and grains, which they sell at local farmers' markets and online. The cooperative converted some of the old homes into laboratories where members create secondary products including organic fruit preserves, biscuits and herbal health products."[129]

[129] Sloan, "Reawakening 'Ghost Towns'".

G. Chemicals and waste

1. Key messages and recommendations

Key messages

26. Chemicals and waste management is at the heart of many solutions to the current challenges faced as a part of the transition to a zero carbon and sustainable economy. In the region, capacities to make well-informed decisions on chemicals and waste issues are often either missing or expertise is not well integrated into decision-making processes. Government decision-makers, industry and the public do not have easy access to information and knowledge that will support the making of impact-oriented choices.

27. Chemicals play a vital role in the economy today and are essential in paving the way towards a green economy. However, it remains difficult to capture what is full exposure of humans to hazardous chemicals. No set of impact-oriented indicators is regularly monitored across the region. There is also a lack of information regarding the impact of chemicals on the efficiency and economic viability of circular economy schemes such as recycling.

28. While the waste management hierarchy assigns highest priority to waste prevention, waste generation continues to rise across the region. Even where a strong political commitment to a circular economy exists, such as in the European Union and other western European countries, the quantities of waste generated are growing.

29. A specific challenge is waste electrical and electronic equipment (e-waste), which contains both hazardous and precious components. Average e-waste generation is stabilizing in the region as a whole, but it continues to increase rapidly in the economically less mature subregions. E-waste collection and recycling are highly deficient across all subregions; the recovery rates are low. Thus, an important opportunity is being missed to harness economic value for the region and to reduce the region's dependency regarding the sourcing of critical raw materials, which are bottlenecks in the shift towards resilient future economies.

30. Recycling rates differ significantly among the countries and are particularly low in Eastern Europe and Central Asia. Municipal waste recycling rates above 45 per cent exist only in a few European Union countries and Switzerland. Progress is being achieved in all subregions, but slowly.

Recommendations

31. ECE member States should increase efforts to equip public administrations with a skilled work force, ready to engage with all sectors of society, and to increase broad access to reliable and detailed information, in order to achieve sound management of chemicals and waste. Governance of chemicals and waste must be made fitter for the challenges of today and the years of transition of economies that lie ahead by better balancing risks and opportunities.

32. Governments should strive to further advance full and coherent implementation of multilateral environmental agreements, including the Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters. Administrations should make efforts to establish a region-wide, impact-oriented monitoring scheme, as a form of cooperation between science and policy, to build up a better picture of the adverse impacts of chemicals on human health and the environment, and to address them.

33. ECE and member States should work on establishing a mechanism across countries and sectors to identify and share benchmarks and good practices for resource efficiency in production processes. Sharing of knowledge will allow decision-makers at all levels to tap into the potential gain from using existing good practices.

34. The countries of the region should establish a resource-oriented, pan-European e-waste management partnership, which would aim at the effective collection and sound handling of recyclables to enable the recovery of valuable resources. An urgent priority is the

recovery of secondary resources from e-waste, especially in view of the rapidly growing quantities across Eastern Europe, South-Eastern Europe and Central Asia.

35. Governments should support repair, refurbishment and remanufacturing, including through financial incentives such as tax relief, in order to reduce waste. These waste prevention efforts would improve resource efficiency.

2. Context

36. Usage of chemicals and the occurrence of waste are tightly interwoven with standards of living and economic prosperity. An estimated 40,000 to 60,000 industrial chemicals are commercially traded worldwide[130] and used, for example, in agriculture, health care and the manufacturing of items such as electronics, textiles, furniture and toys. Chemicals also have a major role to play in the transition towards a green economy, since they represent building blocks of resource-efficient technologies and products.[131] However, some chemicals cause risks to the environment and human health. Chemicals released into air, water and soil can influence individual species, alter biodiversity and undermine the resilience of ecosystems. Harmful exposure to chemicals can negatively affect human health through a broad range of implications, including damage to immune, endocrine and reproductive systems, genetic effects and chronic diseases such as cancer, cardiovascular disorders and asthma.

37. The occurrence of large amounts of waste is linked to inefficient use of resources as part of unsustainable consumption and production practices in modern-day societies. Some waste has hazardous properties and its sound handling is an essential element in reducing chemical pollution. Other waste streams cause losses of materials and energy and aggravate pressures on the environment, for example, the introduction of microplastics into the food chains, affecting biodiversity and human health. At the same time, sound and value-oriented management of solid waste can substantially contribute to the mitigation of climate change by potentially displacing around 15 to 20 per cent of greenhouse gas emissions worldwide.[132]

38. The pan-European region faces the dual challenges of protecting the ecosystem services available to current and future human societies and decoupling environmental degradation from economic prosperity. To meet these challenges, the adoption of more sustainable consumption and production patterns, and the sound management of chemicals and waste, as parts of the transition to a green economy, are required. Risks and opportunities must be well understood and responded to with effective measures.

3. State, main trends and recent developments

39. In 2017, the global chemical industry's production capacity amounted to 2.3 billion tons, making the chemical industry the second-largest manufacturing industry in the world in terms of economic relevance.[133] The volume of traded chemicals is expected to significantly grow in the future;[134] the number of new chemicals is also rising.[135] Of the 345 million tons of chemicals consumed in the European Union in 2016, 62 per cent belonged to categories classified as hazardous to human health and 35 per cent were hazardous to the

[130] United Nations Environment Programme (UNEP), *Global Chemicals Outlook II: From legacies to innovative solutions – Implementing the 2030 Agenda for Sustainable Development* (n.p., 2019), available at www.unep.org/resources/report/global-chemicals-outlook-ii-legacies-innovative-solutions.

[131] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Chemicals Strategy for Sustainability Towards a Toxic-Free Environment, COM(2020) 667.

[132] UNEP and the International Solid Waste Association, *Global Waste Management Outlook* (n.p., 2015), available at www.unep.org/resources/report/global-waste-management-outlook.

[133] UNEP, *Global Chemicals Outlook II*.

[134] Ibid.

[135] Beate I. Escher, Heather M. Stapleton and Emma L. Schymanski, "Tracking complex mixtures of chemicals in our changing environment", *Science*, vol. 367, No. 6476 (January 2020), pp. 388–392.

environment.[136] The latest European Environment State and Outlook report identified as a specific issue of concern the potential combined effects of different chemicals.[137] The full extent of exposure to hazardous chemicals and the impacts on environmental and human health are difficult to capture because of the complexity of this field and the high number of different chemicals in use, and because no concise set of impact-oriented indicators is regularly monitored across the region. Methodologies for such risk assessments are still rather fragmented.[138] The knowledge base is reasonably broad although still fragmented for the European Union[139] but strongly deficient for other subregions.

40. A complex body of legislation addresses usage and handling of chemicals. The most stringent regulations exist in the European Union, with approximately 40 legislative instruments.[140] These include the European Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals,[141] which identifies the key characteristics of the listed chemicals. In October 2020, the European Union Chemicals Strategy for Sustainability – Towards a Toxic-free Environment was launched; it aims to phase out the most harmful substances from consumer products and to support financially the uptake of safe and sustainable chemicals.[142] For all countries, the Globally Harmonized System of Classification and Labelling of Chemicals has established standards for hazard classification, labelling and elaboration of material safety sheets since 2002; adoption was much slower than foreseen,[143] but the region is now on the right path.[144] Furthermore, the Strategic Approach to International Chemicals Management, hosted by UNEP, has advanced policy responses to issues of particular concern, including lead in paint,[145] and, together with the chemical manufacturing industry's Responsible Care initiative,[146] has contributed to capacity-building. The mandate of Strategic Approach to International Chemicals Management expired in 2020; designing the process for the period beyond 2020 represents an opportunity to further strengthen multilateral cooperation and advance frameworks that ensure that stakeholders

[136] European Environment Agency, "Consumption of hazardous chemicals", briefing, 26 November 2019, available at www.eea.europa.eu/airs/2018/environment-and-health/production-of-hazardous-chemicals.

[137] European Environment Agency, *The European environment — state and outlook 2020: Knowledge for transition to a sustainable Europe* (Luxembourg, Publications Office of the European Union, 2019), available at https://www.eea.europa.eu/soer/publications/soer-2020.

[138] S. Rotter and others, "Overview on legislation and scientific approaches for risk assessment of combined exposure to multiple chemicals: the potential EuroMix contribution", *Critical Reviews in Toxicology*, vol. 48, No. 9 (2018), pp. 796–814.

[139] Milieu Ltd, Ökopol, Risk and Policy Analysts and the National Institute for Public Health and the Environment of the Netherlands, *Study for the strategy for a non-toxic environment of the 7th Environment Action Programme: Final Report* (Luxembourg, Publications Office of the European Union, Luxembourg, 2017), available at https://op.europa.eu/en/publication-detail/-/publication/89fbbb74-969c-11e7-b92d-01aa75ed71a1.

[140] European Commission, Chemicals Strategy for Sustainability.

[141] Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, *Official Journal of the European Union*, L 396 (2006), pp. 1–849.

[142] European Commission, "Green Deal: Commission adopts new Chemicals Strategy towards a toxic-free environment", press release, 14 October 2020, available at https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1839.

[143] UNEP and ECE, *GEO-6: Global Environment Outlook: Regional assessment for the Pan-European Region* (Nairobi, 2016).

[144] ECE, "GHS implementation", available at https://unece.org/ghs-implementation-0.

[145] UNEP Strategic Approach to International Chemicals Management (SAICM), website, https://www.saicm.org/, accessed 2 September 2021.

[146] International Council of Chemical Associations, "Responsible Care", available at https://icca-chem.org/focus/responsible-care/.

have adequate data and knowledge at their disposal during their decision-making processes, and adequate capacities when it comes to the implementation of measures.[147]

41. Several multilateral environmental agreements regulate the processing of substances that are of high concern for human and environmental health. These instruments establish a powerful framework, but full benefits can only be unlocked if universal ratification is achieved across the region, which is currently not the case. Eight out of fifty-four countries of the pan-European region are not party to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. Only thirty-seven countries of the region are party to the Protocol on Pollutant Release and Transfer Registers.

42. Regarding waste management, strong differences continue to exist between Western Europe and the other subregions. As a common challenge, total waste generation has continued to increase in most countries, even though waste prevention is the top priority in the waste management hierarchy. National waste prevention programmes exist for European Union and European Free Trade Agreement countries – promoting reuse and repair activities is a frequent focus – but only a few programmes explicitly support market-driven reuse activities such as refurbishment or remanufacturing.[148]

43. The European Union waste regulations establish a fairly robust framework for the collection, valorization or sound disposal of waste. Average European Union recycling rates of municipal solid waste have been continuously increasing over the last 10 years and, since March 2020, the new Circular Economy Action Plan is in place as part of the European Green Deal. Countries joining the European Union show pronounced progress on waste management, which illustrates the effectiveness of the bloc's regulations. Across Eastern Europe, South-Eastern Europe and Central Asia, valorization of municipal solid waste has made some progress; however, overall, the recycling rates remain at relatively low levels and the change is slow. This signals that circular economy schemes are not yet effectively in place across these subregions. Some countries, however, have initiated ambitious reforms of waste management frameworks, including the specification of target municipal solid waste recycling rates (Russian Federation, Uzbekistan).

44. Rapidly rising volumes of e-waste across Central Asia, Eastern Europe and South-Eastern Europe are a specific challenge. In the European Union and Western Europe, e-waste quantities are stabilizing, but at a remarkably high level; per capita e-waste generation was more than twice the global average of 7.3 kg per capita in 2019 (see below). Of particular concern are the low shares of e-waste collection; collection is a prerequisite for valorization. Even in the European Union, where advanced schemes are in place, less than 45 per cent of the estimated generated e-waste volume was collected in 2017.[149]

45. Circularity-oriented initiatives have also emerged in the region as an effort of civil society or the private sector. Repair initiatives, sharing approaches and remanufacturing schemes are only a few examples of new business models, community schemes and alternative production systems. They signal that all sectors of society have started to respond to the need for more sustainable resource usage and the prevention of wastes.

46. Implementation of a circular economy represents a major opportunity to ensure future prosperity in the region. One promising element to support sustainable consumption is the introduction of a right to repair. Urgent measures must also be taken to end premature obsolescence of products. Two circular economy schemes to reach an industrial scale are

[147] To be revised in 2022.

[148] European Environment Agency (EEA), *Waste prevention in Europe — policies, status and trends in reuse in 2017*, EEA Report No. 4/2018 (Luxembourg, Publications Office of the European Union, 2018), available at https://circulareconomy.europa.eu/platform/sites/default/files/eea_report_waste_prevention_in_europe_2017_th-al-18-0008-en-n.pdf.

[149] Eurostat, Waste statistics – electrical and electronic equipment, data from August 2020, available at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics_-_electrical_and_electronic_equipment (accessed 29 May 2021).

remanufacturing and industrial symbiosis. Independent and transparent sustainability assessments are essential. International expert groups could help countries analyse their future needs for specific resources and how these can be met.

47. Greenwashing, by misleading consumers and exploiting their environmental concerns, can have severe detrimental impacts and is not acceptable. Countries that manage their transition well today will be the ones with a competitive advantage in a few decades.

4. Indicators

Compliance with multilateral environmental agreements on hazardous waste and other chemicals (indicator 12.4.1 of the Sustainable Development Goals)

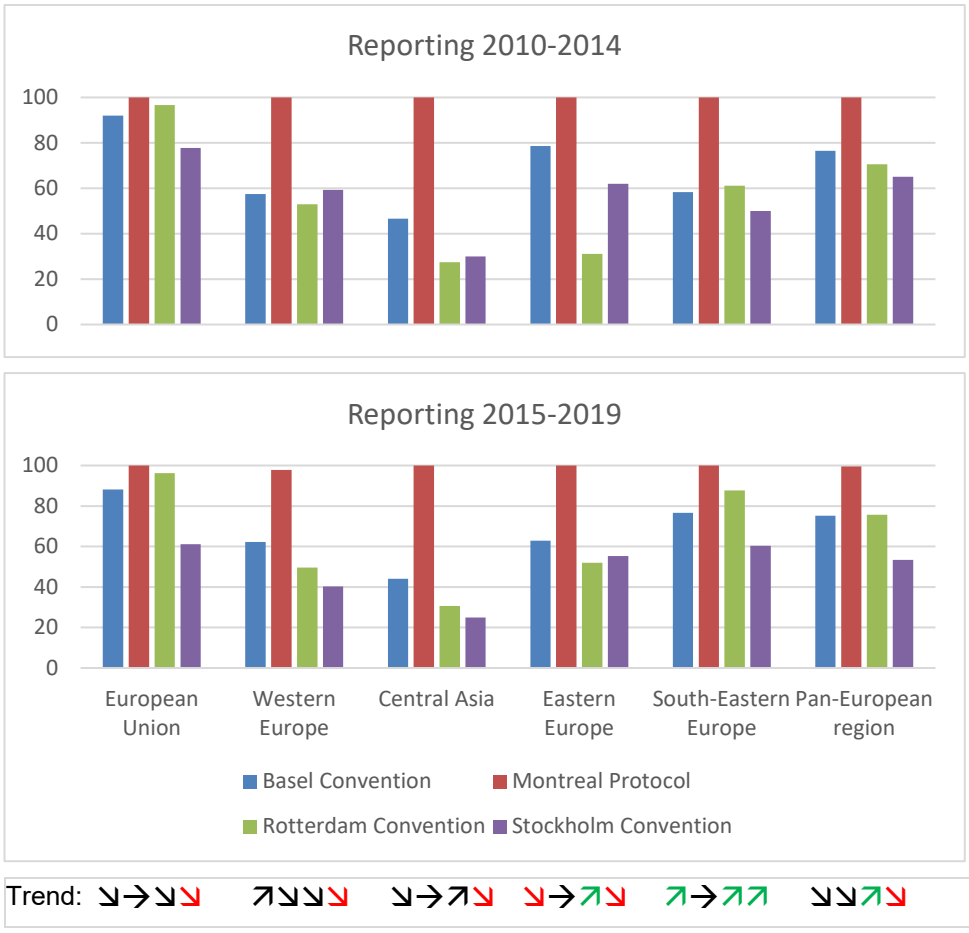
48. This indicator identifies progress in managing chemicals and hazardous wastes in a sound way, as regulated by the Rotterdam Convention, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Stockholm Convention on Persistent Organic Pollutants and the Montreal Protocol on Substances that Deplete the Ozone Layer. The Minamata Convention on Mercury has recently been added; the first full report is due in December 2021.[150] Compliance in meeting reporting obligations as required by the multilateral environmental agreements is monitored in 5-year cycles (annual monitoring is not possible because the multilateral environmental agreements foresee differing time schedules to submit reports). While the region performs well regarding the Montreal Protocol, insufficient performance is recorded regarding the Stockholm Convention with all subregions, apart from South-Eastern Europe, performing worse than in the previous period and average compliance below 60 per cent (see figure VI below). For the Basel and the Rotterdam Conventions, average compliance in the region ranges between 70 and 80 per cent; the European Union and South-Eastern Europe perform better than the other subregions. There has been an improvement across South-Eastern Europe and, for the Rotterdam Convention, also across Eastern Europe.

49. All countries have room for improvement. Participation in multilateral environmental agreements enables Governments to co-shape international negotiations and policymaking in the environmental field and facilitates coordinated measures. Effective implementation of multilateral environmental agreements requires continued efforts and the allocation of sufficient financial resources to the responsible environmental institutions.

[150] To be updated in 2022.

Figure VI

Compliance with multilateral environmental agreements in the reporting cycles 2010–2014 and 2015–2019, per cent with trend also indicated



Source: Global Sustainable Development Goal Indicator Database, https://unstats.un.org/sdgs/indicators/database/, retrieved 18 May 2021.

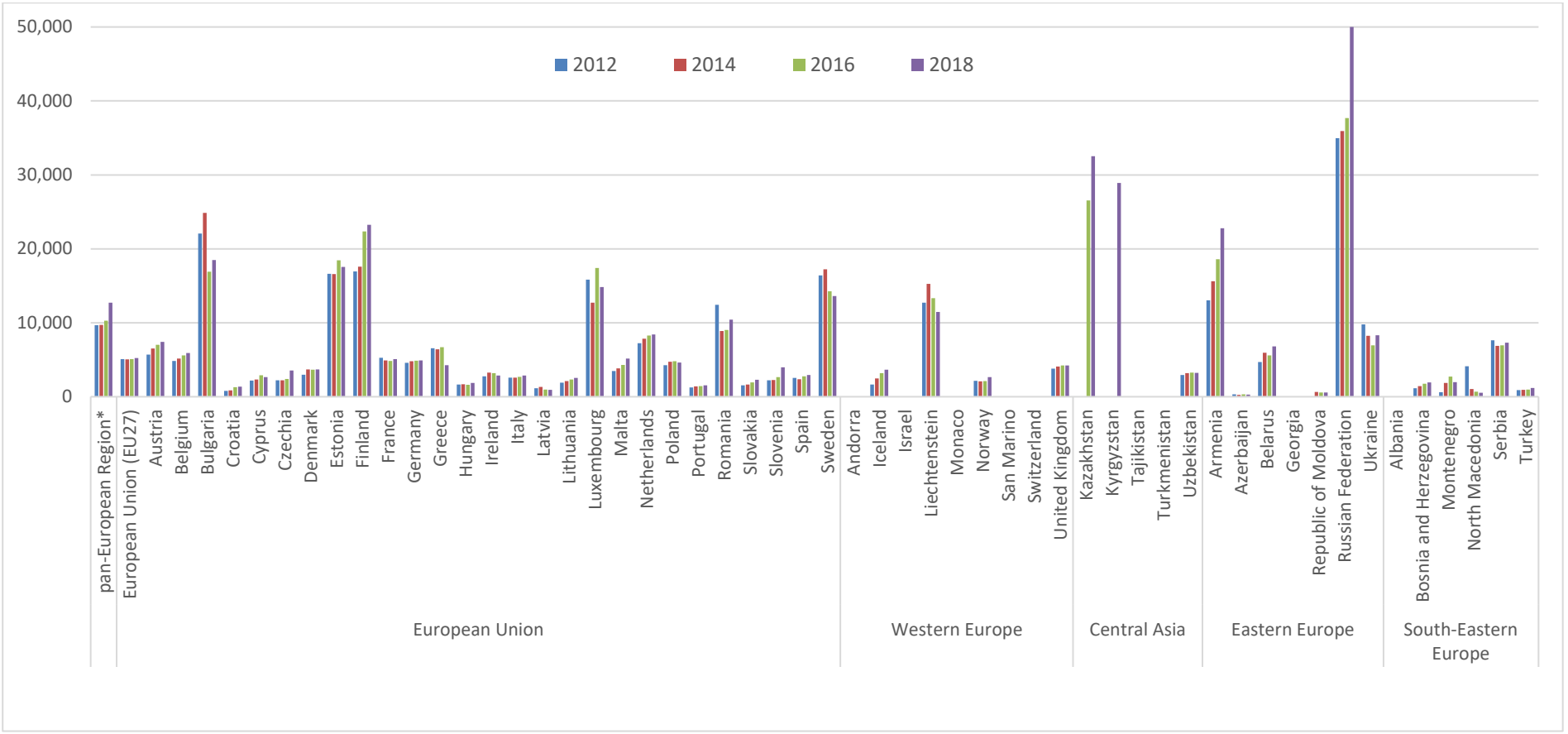
Notes: The trend is calculated as a percentage change between reporting periods 2010–2014 and 2015–2019, with an improvement shown as an upwards arrow and a worsening as a downwards arrow (horizontal arrow means no change). The arrow is shown in black unless the change is an improvement of at least 5 per cent (green) or a worsening of at least -5 per cent (red).

Total waste generation per capita

50. This indicator describes the quantity of total waste (hazardous and non-hazardous) produced in a country per year, by all sectors. Waste generation is an ECE environmental indicator; good progress was reported in the Shared Environmental Information System assessments (ECE/CEP/AC.10/2021/6) and thus it represents a robust indicator. Average waste generation per capita increased in the region by 31 per cent between 2012 and 2018 (see figure VII overleaf), and by 7 per cent when excluding major mineral wastes. Most countries have witnessed growth of waste occurrence. Large variations exist between countries; some of this difference can be explained by specific economic sectors being dominant in certain countries. As an example, in Estonia, much of the waste comes from the oil shale industry, a unique situation in the region. Mining waste largely explains the high quantities across Eastern Europe and Central Asia. Although progress has been made regarding the reporting of relevant data, it is not possible to derive waste quantities excluding major mineral wastes for all countries.

Figure VII

Total waste generation per capita, kg per capita and year, with trends



Trends:	Increase in average waste generation; 21 out of 27 countries with an increase in period 2016–2018	Mixed picture	Increase in nearly all countries in period 2016–2018	Mixed picture

Sources: national statistics; for the European Union, Iceland, Liechtenstein, Norway, the United Kingdom of Great Britain and Northern Ireland, and South-Eastern Europe except Albania: Eurostat data, retrieved 20 May 2021; other countries: national data published by country statistical entities, retrieved May–July 2021.

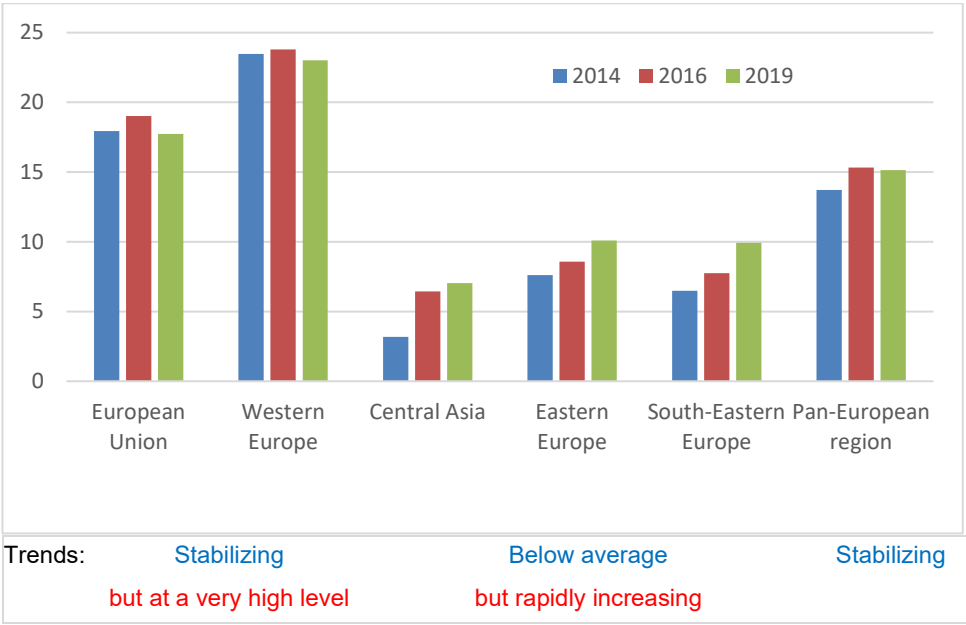
Notes: No data for Andorra, Georgia, Israel, Monaco, San Marino, Switzerland, Tajikistan and Turkmenistan. 2019 value instead of 2018 for Uzbekistan; 2017 value instead of 2016 for the Republic of Moldova. Limited data for the Republic of Moldova, Kazakhstan and Kyrgyzstan. Average value for pan-European region is calculated based on the available country data in each year (weighted average by considering population in each country and year).

51. Despite the commitments of countries to foster waste prevention, overall, waste generation is growing across the pan-European region and all subregions. More efforts are required. Benchmarks are needed to assess the waste quantities that can be prevented in different sectors. To foster waste prevention, economic instruments, such as landfill taxes, deposit-refund systems, tax reductions or other fiscal incentives for innovative businesses and extended producer responsibility, should be explored urgently.

E-waste generation per capita

52. E-waste contains both hazardous components and precious resources such as critical raw materials. For the pan-European region, the average annual e-waste generation per capita is plateauing at around 15 kg, with differing trends in the subregions (see figure VIII below). This is mainly due to a stabilized or slightly declining quantity in the European Union and in Western Europe, while it continues to grow at a rapid pace across Central Asia, Eastern Europe and South-Eastern Europe. The level of e-waste generation in the region is much above the global average,[151] but countries in Western Europe on average generate more than three times the per capita volumes in Central Asia. Separate collection is a prerequisite for high-value valorization of this material stream. However, even across the European Union and Western Europe, where collection and recycling infrastructures are in place, significant quantities of e-waste do not enter the official collection and valorization schemes.[152]

Figure VIII
Domestic e-waste generation per capita in the region and the subregions, kg per capita, with trends



Sources: *Global E-Waste Monitor*, 2014, 2017 and 2020 editions.

Notes: 48–50 countries; no data for Andorra, Liechtenstein, Monaco or San Marino in all years, and no data for Tajikistan and Uzbekistan in 2016 and 2019.

[151] At a global level, e-waste generation per capita increased from 5.8 kg in 2014 to 7.3 kg in 2019, according to Cornelis Peter Baldé and others, *The Global E-waste Monitor 2014: Quantities, flows and resources* (Bonn, United Nations University (UNU), 2015); and Vanessa Forti and others, *The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential* (Bonn, Geneva and Rotterdam, UNU/United Nations Institute for Training and Research/International Telecommunication Union (ITU)/International Solid Waste Association (ISWA), 2020).

[152] Cornelis Peter Baldé and others, *The Global E-waste Monitor 2017: Quantities, flows and resources* (Bonn, Geneva and Vienna, UNU/ITU/ISWA, 2017); and Forti and others, *The Global E-waste Monitor 2020*.

Recycling rate of municipal solid waste

53. There are significant differences in municipal solid waste recycling between the subregions (see figure IX overleaf), but all subregions have made some progress. Some countries of the European Union, such as Austria, Germany, the Netherlands and Slovenia, have the highest recycling rates in the world. The average European Union recycling rate has increased from 37.3 per cent in 2009 to 47.7 per cent in 2019. Five European Union countries still have municipal solid waste recycling rates below 25 per cent. Croatia, Latvia, Lithuania, Slovakia and Slovenia, which joined the bloc around 15 years ago, present the most pronounced improvement. Across Eastern Europe, South-Eastern Europe and Central Asia, no country has a municipal solid waste recycling rate of above 25 per cent and rates tend to be substantially lower than 25 per cent or even negligible. A few positive cases stand out, such as Uzbekistan, where the municipal solid waste recycling rate is currently around 20 per cent (see case study below). Overall, the region is advancing to more recycling and thus to a more circular economy, but progress is slow. To accelerate the transition, a strong commitment by policymakers is required, along with an adequate allocation of financial resources and the readiness to learn from successful schemes.

5. Case studies

Reforming the waste management framework in Uzbekistan

54. Uzbekistan has initiated ambitious reforms of its environmental frameworks, including new institutional arrangements for waste management since 2017 and the launch of a strategy on municipal waste management for the period 2019–2028.[153] Coverage of the population by waste services increased from 22 per cent in 2016 to 53 per cent in 2018.[154] The national target is to reach 100 per cent of the population covered by waste collection services by 2025; furthermore, the strategy aims to achieve 45 per cent municipal solid waste recycling by 2025 and 60 per cent by 2028. The country is on the right path; the municipal solid waste recycling rate in 2019 was close to 20 per cent, up from 9 per cent in 2017.

Chemicals in plastics

55. Recent research identified more than 6,000 different additives in plastic products.[155] Only some are polymerized within the plastic matrix, while many can leach and potentially have an impact on the environment and humans.[156,157] When plastics are recycled, individual chemicals or cocktails of substances can unintentionally be transferred to the new products as contaminants, which creates new risks in the value chains. Such cross-contamination has been identified in, for example, children's toys and food contact articles.[158]

[153] UNEP, *Waste Management Outlook for Central Asia* (n.p., 2017).

[154] *Environmental Performance Reviews: Uzbekistan – Third Review* (United Nations publication, Sales No. E.20.II.E.26).

[155] Nicolò Aurisano, Roland Weber and Peter Fantke, "Enabling a circular economy for chemicals in plastics", *Current Opinion in Green and Sustainable Chemistry*, vol. 31, special issue (October 2021).

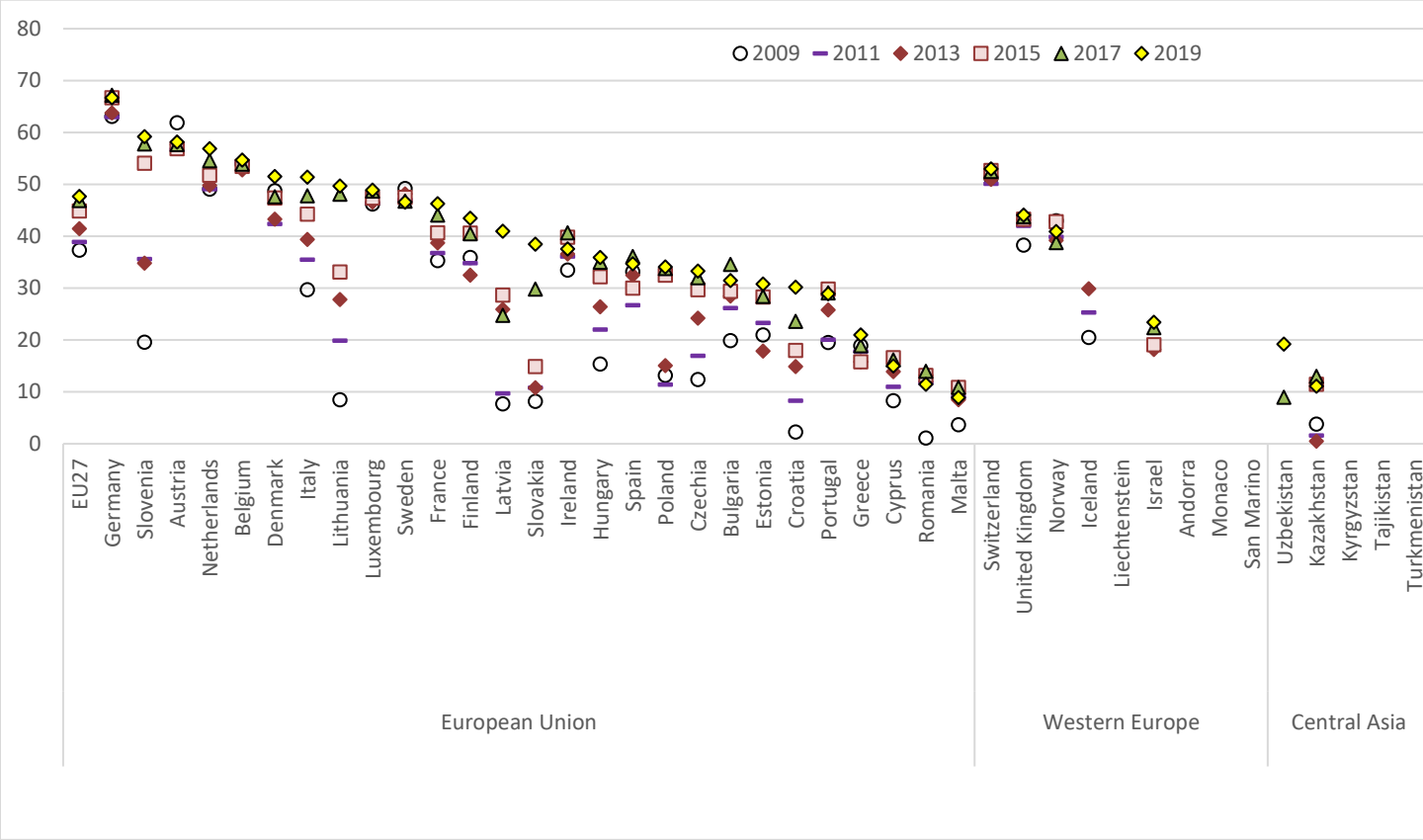
[156] John N. Hahladakis, "An overview of chemical additives present in plastics: migration, release, fate and environmental impact during their use, disposal and recycling", *Journal of Hazardous Materials*, vol. 344 (February 2018), pp. 179–199.

[157] Lisa Zimmermann and others, Benchmarking the in vitro toxicity and chemical composition of plastic consumer products, *Environmental Science and Technology*, vol. 53 (2019), pp. 11467–11477.

[158] Antonella Guzzonato, Franky Puype and S.J. Harrad, "Evidence of bad recycling practices: BFRs in children's toys and food-contact articles", *Environmental Science: Processes and Impacts*, vol. 19, No. 7 (June 2017), pp. 956–963; and Alin C. Ionas and others, "Downsides of the recycling process: harmful organic chemicals in children's toys", *Environment International*, vol. 65 (April 2014), pp. 54–62.

Figure IX

Recycling rate of municipal solid waste, including composting and anaerobic digestion, per cent (biennially 2009–2019)



Status and trends	Average over 45 per cent, with 7 countries over 50 per cent and up to 67 per cent; increasing average, with good improvement in most countries and strong improvement in some countries; 5 countries still below 25 per cent	Mixed picture; only 1 country over 45 per cent	Mixed picture; some countries good progress; all below 25 per cent; for some no data available	Slow change; all countries still below 25 per cent

Sources: National statistics; for the European Union, Iceland, Liechtenstein, Norway, Switzerland, the United Kingdom of Great Britain and Northern Ireland and South-Eastern Europe except Albania: Eurostat data, retrieved 27 May 2021; other countries: data published by country statistical entities, retrieved May–July 2021.

Notes: 2018 instead of 2019 data for Bulgaria, Montenegro, Serbia, the United Kingdom of Great Britain and Northern Ireland; for Ireland 2012 instead of 2013, 2014 instead of 2015, 2016 instead of 2017, 2018 instead of 2019 data; for Israel 2014 instead of 2013; for Belarus 2012 instead of 2011; for the Russian Federation and Turkey 2016 instead of 2015; Albania: urban waste only.

H. Environmental financing

This section is still being developed. .

IV. Themes for the Ninth Environment for Europe Ministerial Conference

78. This chapter will provide an assessment of the two themes of the Ninth Environment for Europe Ministerial Conference. For each theme, key messages and policy recommendations will be presented based on an assessment of the state, trends and outlook towards meeting policy objectives.

A. Greening the economy in region: working towards sustainable infrastructure

This section is being revised and finalized. .

1. Key messages and recommendations relevant for the theme of the sub-chapter

Key messages

There is a recent common understanding that sustainability solutions should be incorporated from the strategic planning phase. However, decision-making processes are still siloed, reducing the capacity to identify synergies at the national and sectoral levels that will allow for a more sustainable strategy.

Infrastructure investment has been recognized as one of the most impactful strategies to build back better in the post-COVID recovery. The lack of sustainable infrastructure pipelines, the lack of capacity, and the urgency to boost economic development and job creation around the world are pushing decision-makers to move towards business as usual projects instead.

Infrastructure needs are more dynamic than ever before. As such, sustainable infrastructure should be flexible, interconnected, and rely on real-time information to adapt to the changing necessities (including climate risk, changes in service demand, and migration patterns, among others).

Ecosystem services preservation, environmental restoration, and biodiversity protection will be key considerations for the future of infrastructure. Achieving these goals while providing the much-needed infrastructure services will require the mainstreaming of Nature-based Solutions (NbS). This approach is already incorporated at the Pan-European Strategic Framework.

Efficient use of materials and a circular economy are at the core of a sound sustainable consumption and production strategy. New technological advancements in resource efficiency, recycling, and reuse, should be considered as key drivers in the planning, design, construction, and operation of infrastructure projects.

Sustainable infrastructure should be environmentally responsible, socially inclusive and economically viable. As such, it is important to guarantee that the needs of all the different stakeholders are identified and addressed.

Recommendations

Ensure an integrated and a full lifecycle approach where the decisions of infrastructure made today are aligned with other national and international targets, such as GHG emission reduction and social inclusion. A short-term thinking approach, such as investing in traditional and polluting energy sources, will prevent countries from achieving the Paris Agreement and the 2030 Agenda, thus closing the already small window of opportunity to achieving a sustainable future.

Still today, there is a significant capacity-building gap that is preventing sustainable infrastructure to be deployed at scale. It is key to create a common understanding of what sustainable infrastructure means, and define a commonly agreed way to quantify progress across nations. The comparative analysis presented in this chapter, and the proposed set of indicators, is the first step in that direction.

Economic and financial incentives should be deployed by the governments in the region to support the implementation of Nature-based solutions (NbS). There is a significant appetite by the private sector to incorporate more NbS into infrastructure projects. However, the lack of demand and incentives does not make it viable in some cases. Special incentives will be required in the short and the medium term.

Similar to the previous case, special incentives and capacity building will be required to strengthen and implement circular economy strategies at the regional and national levels. It is recommended that this is in alignment with the work already conducted on the EU taxonomy and the Pan-European Strategic Framework in sustainable consumption and production patterns.

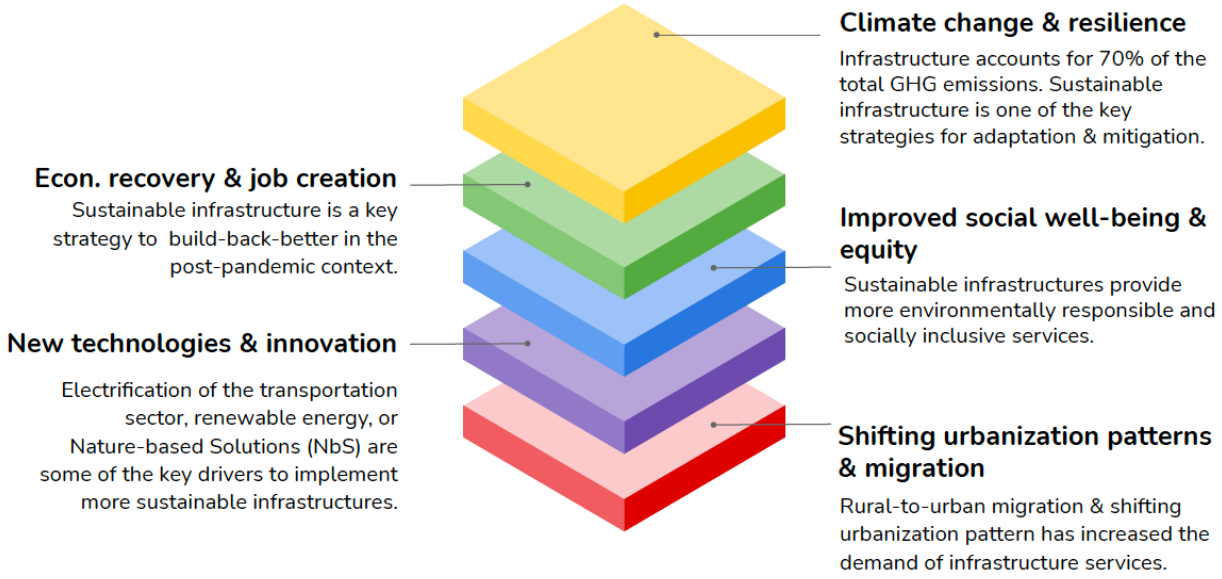
To ensure that the needs of all the stakeholders are identified and addressed, it is key to ensure that Social Impact Assessments (SIA) are conducted. This assessment should include, among other topics, a gender analysis where the specific needs of women are recognized. This will help mainstream gender in infrastructure planning, design, construction, and operation.

2. Context

Infrastructure development has been seen for decades as the backbone of economic growth and development. However, in recent years the world has come to realize that the potential benefits of infrastructure delivery are not always materialized. Environmental degradation, loss of biodiversity, social displacement, and corruption are some of the unintended consequences of unsustainable infrastructure. As such, to achieve sustainable development without “leaving no one behind” it will be of paramount importance to bridge the $15 trillion (Global Infrastructure Hub, 2017) infrastructure gap in a sustainable way. As indicated by Mr. Ban Ki-moon, former United Nations Secretary-General, “there is an urgent need to include sustainable and climate-resilient infrastructure as an integral part of green growth to deliver energy, water, and transportation solutions that will facilitate opportunity, connection, and sustainable growth”.

The pan-European region faces similar challenges, as the energy demand continues increasing, the climate-related hazards are more frequent than ever, and there is a higher demand for improved social well-being and equity. All these drivers and many more will define the needs of tomorrow´s infrastructure.

Image 1
Main drivers for infrastructure demand



Source: Graph developed by the author

Climate change and resilience

The GHG emission in the Pan-European region continues on an upward trajectory, paired with the fact that infrastructure construction and operations account for 70% of the total GHG emissions (The World Bank, 2018), which implies that infrastructure development should be at the core of a sound climate strategy. Infrastructure development will have a dual role in achieving a more climate-resilient future, first as mitigation, and second as an adaptation strategy. Considering the significant contribution that the infrastructure sector (including transportation, energy generation, manufacturing, etc.) has on GHG emissions, it is of paramount importance that we transform the current productive models to a low-carbon intensive one. Secondly, there are significant areas in the Pan-European region, and all around the world, that are already suffering the effects of climate change on a regular basis. This may take the shape of heatwaves, extended droughts, sea-level rise, or flooding, among others. As such, infrastructure solutions are seen by many as a key strategy for climate change adaptation.

For many decades we thought of the value-added of infrastructure as its capability of creating strong and resilient barriers to protect the population from unwanted disturbances such as flooding. However, this approach has been reversed and complemented with nature-based solutions (NbS), sometimes known as green infrastructure[159]. Now we understand that traditional grey infrastructure[160] is not able to prevent climate effects from happening. As such, a combination of NbS and a comprehensive understanding of the ecosystem services that nature provides, together with the predictability from traditional

[159] Green infrastructure refers to natural systems including forests, floodplains, wetlands and soils that provide additional benefits for human well-being, such as flood protection and climate regulation. https://www.conservation.org/docs/default-source/publication-pdfs/ci-green-gray-practical-guide-v07.pdf?Status=Master&sfvrsn=3cc5cf18_4

[160] Gray infrastructure refers to structures such as dams, seawalls, roads, pipes or water treatment plants. https://www.conservation.org/docs/default-source/publication-pdfs/ci-green-gray-practical-guide-v07.pdf?Status=Master&sfvrsn=3cc5cf18_4

grey infrastructure options, offers a broader spectrum of synergies (green-grey) that will better serve the multitude of solutions required based on the context.

Economic recovery and job creation

The COVID-19 pandemic has created an unprecedented global economic downturn unseen in recent decades. This crisis has exposed global gaps in accessibility to basic services, gender equality, and the lack of flexibility and connectedness of our infrastructure systems. According to the International Labour Organization (ILO), the crisis-induced job gap will reach 75 million in 2021 before falling to 23 million in 2022 (Berg J., et al, 2021). Additionally, the employment growth suffered will not be recovered until 2023 (ILO, 2021). However, COVID-19 also creates a one-in-a-century opportunity to build back better by setting up the foundation for the much-needed sustainable and green transition. As identified by many, sustainable infrastructure can be the driver for a new and greener future.

New technologies and innovation

COVID-19 has exposed the interconnectedness of the world around us and the economic domino effect that a health crisis combined with an inequality crisis can create in countries and economies. Many of these effects have been amplified as countries in the Pan-European region and all around the globe rely on infrastructures that are, in many cases, obsolete and not fit for purpose. In this age, when the digital communication technologies update their operating systems every couple of months, we still plan, design, build and operate multimillion-euro infrastructure projects that are rigid, inflexible, and expected to operate unchallenged for decades to come. In this scenario, it is unsurprising that countries worldwide struggle to accommodate the shifting needs for temporary healthcare facilities, teleworking, and the next generation of transportation systems, such as electric vehicles or driverless cars. To better accommodate the future infrastructure needs, it is key to ensure that the infrastructure sector focuses broadly on solutions instead of narrowly on projects. A problem-solving approach promotes innovation, creates opportunities to explore new technologies, and incentivizes more efficient solutions.

As an example, it will be critical to frame the problem as “the need to deliver more potable water”, instead of the solution “creating more water treatment facilities”. The second and more conventional alternative limits the capacity to integrate other non-traditional and more sustainable alternatives, such as Nature-based solutions (NbS), to address the problem at hand.

The data-driven decision making, geospatial design, and simulation will be crucial to ensure that we are able to understand the complexity of the world ahead of us where human needs, environmental and social impacts, and planetary boundaries should all be part of the design of the most optimal solution.

Shifting urbanization patterns and migration

Migration has been a pattern connected to the search for better opportunities all around the world. In the last years, the shifting urbanization pattern has been intensified as the result of climate change, violence, and conflict. According to the International Organization for Migration (IOM), there are an estimated 272 million international migrants – 3.5% of the world’s population (IOM, 2019), surpassing the projections for 2050. Considering the complexity in predicting mitigation patterns due to its close connection with the economic crisis, political instability, and conflict, the lack of predictability puts significant pressure on existing infrastructures, which in many cases become overwhelmed, making it impossible to deliver the needed services for an increased number of users. As a result, it is key to ensure that the upstream planning process of infrastructure takes a long-term view, including demographic changes such as

aging population and potential migration patterns that may result in shifting urbanization patterns and, therefore, higher infrastructure demand.

Improved social well-being and equity

The Creation of healthy and safe environments is central to the delivery of a more sustainable infrastructure. Hence, the direct and indirect safety and health implications of an "unsustainable solution" should also be considered. Exposure to air, water, or soil pollution, as well as other poisonous hazards, can have a long-term impact on people's health and likewise can threaten the safety of the community in other ways. To guarantee well-being and equity for all the potential users of infrastructure, the special needs of certain groups, such as women, should also be addressed. Stakeholder engagement processes, public consultations, and gender mainstreaming strategies, should be core considerations of every infrastructure project, helping in this way to identify and minimize the risk of social exclusion in the area of influence.

3. State, main trends, and recent developments

Climate change, population growth, growing inequality, or the COVID-19 pandemic illustrate a few of the various challenges that humanity will have to face in the years to come. In response to all of them, global initiatives looking for a more inclusive, responsible, and sustainable development model have emerged in recent decades. Some examples are the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs) or the Paris Agreement. Although these initiatives address specific topics, they all agreed on something: a paradigm shift towards a more sustainable development model is necessary to face the crucial challenges of the 21st century. The achievement of this new paradigm is only possible through coordinated actions in which governments, public and private institutions, the academic world, and civil society are actively engaged.

The ongoing COVID-19 pandemic has shone a spotlight on the great opportunity that sustainable infrastructure represents to build back better in the post-COVID recovery era. In this regard, the role of sustainable infrastructure in supporting inclusive growth and productivity, as well as in accelerating the transition toward low-carbon and climate-resilient economies, is now well-recognized (Bhattacharya et al., 2019). However, global efforts to foster the green economy and the development of more sustainable and resilient infrastructure were an active topic of conversation previous to the pandemic. The Pan-European Strategic Framework for Greening the Economy, developed in 2016 by the ECE Committee on Environmental Policy with support and cooperation from ECE, UNEP, and many other key players, is only one example.

The main goal of this Framework is "to guide the Pan-European region in its transition to an inclusive green economy by 2030" (ECE, 2016), in alignment with the outcomes of the Rio+20 Conference and the 2030 Agenda for Sustainable Development. The Framework envisions the Pan-European region "pursuing a development pattern that ensures economic progress, social equity and the sustainable use of ecosystems and natural resources", thus ensuring that the needs of the present generations will be met without compromising the needs of future generations. The implementation of the Strategic Framework is supported by the Batumi Initiative on Green Economy (BIG-E). The BIG-E Initiative, which encompasses the period 2016-2030, comprises voluntary commitments on the green economy by countries and both public and private organizations. Up to date, over 30 countries and organisations have submitted more than 100 commitments to the BIG-E platform[161].

[161] The commitments are available in the platform: https://www.greengrowthknowledge.org/big-e

Achieving all these ambitious goals requires cooperation among countries, as well as regulatory and policy instruments that support and embrace the transition to a more sustainable way of development. Equally important, all these efforts should take place in an early stage of the development process. A good example that illustrates the significance of all these elements is the Convention on Environmental Impact Assessment in a Transboundary Context, also known as the "Espoo (EIA) Convention". According to the Espoo Convention, adopted in 1991, "parties are obligated to assess the environmental impact of certain activities at an early stage of planning" (ECE, 1991). The Espoo Convention builds on the idea that "adverse environmental consequences and threats do not respect national borders". As such, it imposes an obligation of consultation between parties on all major projects that might cause a negative environmental impact across borders, thus contributing to reducing environmental threats and potential damages. The Espoo Convention laid the foundations for the introduction of the Strategic Environmental Assessment (SEA), a systematic decision support process aiming to ensure that environmental and other sustainability aspects are considered effectively in policy, plan, and program making.

The COVID-19 crisis has reinforced the urge to invest in sustainable and more resilient projects. Finance mobilization toward sustainable investments can have a great impact on achieving sustainable development projects. Tools such as thematic bonds -mainly green, social, and sustainable bonds- can greatly contribute to supporting the SDGs and a sustainable recovery from the impacts of the COVID-19 pandemic. However, sustainable finance has been part of the international conversation for years, before the pandemic. In this regard, back in 2015, the Paris Climate Agreement included the commitment to "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development" (UN, 2015).

In addition to the already existing commitments, in the last couple of years, initiatives like the European Union Taxonomy (EU TEG, 2020) have been put in place. The Taxonomy, created in 2020, is a classification system that establishes a list of environmentally sustainable economic activities. Besides its importance in the sustainable recovery path from the pandemic, the Taxonomy also plays a relevant role in meeting the EU's climate and energy commitments and implementing the European Green Deal. Other institutions, like the Centre for European Policy Studies (CEPS), also believes that "the need to ensure greater resilience has now become the top priority for EU institutions". Under this premise, CEPS launched in November 2020 the Task Force "Toward a resilient and sustainable post-pandemic recovery" (CEPS, 2020), a multistakeholder initiative that includes eight working groups (one of them named "European Green Deal") aiming to explore policy recommendations.

4. Indicators

Current landscape of sustainable infrastructure initiatives

Due to the wide spectrum of actors involved in the project lifecycle of infrastructure projects, numerous initiatives have been developed to define indicators to quantify progress around sustainable infrastructure. The different approaches identified range in scope and intent, from (i) high-level aspirational principles, (ii) safeguard and good practices, (iii) infrastructure sustainability rating systems and schemes, to (iv) and reporting guidelines.

High-level principles

High-level principles aim to provide aspirational lines of action at a global scale, these are in most cases published by international groups. Examples of high-level principles include the G20 Principles for Quality Infrastructure Investment.

Safeguard policies

Multilateral Development Banks (MDBs) and other International Financial Institutions have traditionally incorporated safeguards and good practices aimed to provide a minimum baseline for due diligence processes to support decision-making. These environmental and social considerations have been the foundation to achieve a better understanding of the potential unintended consequences and other risks associated with infrastructure development. Examples of well-known and widely applied safeguard and risk management frameworks include the International Financial Corporation Performance Standards and the Equator Principles. Most MDBs have their own safeguard policies as the baseline for due diligence processes.

Infrastructure sustainability rating systems and schemes

Numerous infrastructure sustainability rating systems have been developed in different geographic locations. These frameworks aim to provide comprehensive guidance and scoring criteria to rate projects across its 50+ indicators. The application of these tools are in many cases linked to the achievement of a certification or sustainability award. Examples of some of the best infrastructure sustainability rating systems include Envision (USA), CEEQUAL (UK), SuRe (Switzerland), and IS-Scheme (Australia).

Reporting guidelines

To monitor and to communicate the sustainability performance of a given project -not infrastructure necessarily-, several reporting guidelines have been developed in the last few years. Examples of reporting guidelines include the Global Reporting Initiative and the Dow Jones Sustainability Index.

The complexity of infrastructure development, diversity of sectors, phases within its lifecycle, and stakeholders engaged, has created a significant amount of tools and frameworks to quantify progress for sustainable infrastructure. This has created the need to be able to access the information and better understand the use of the currently existing tools to find the one that better fits the needs of the user. As a result, a German development agency, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, created a platform called “The Sustainable Infrastructure Tool Navigator” to help users identify the most relevant tools for their needs and goals. This new initiative provides access to a comprehensive database of sustainable infrastructure tools that users can navigate by keyword or filter by types of tools, sectors, and infrastructure lifecycle phases, amongst other things. This initiative has been recently supported by UNEP as a partner.

List of indicators proposed

As previously identified, a significant number of frameworks and quantification criteria for sustainable infrastructure have been developed in the last years. However, different stakeholders have recognized the need for consolidation and harmonization of approaches and indicators. Some of the key initiatives working on consolidation include the MDB Infrastructure Cooperation Platform (ICP) [162] and the newly created initiative called

[162] The ICP was formed in January 2018 in response to the growing consensus over the role of MDBs in supporting the preparation and financing of infrastructure investments, as well as in mobilizing private finance for the purpose of closing the global infrastructure services gap. The intention of the ICP is to reinforce the coordination of MDB activities in areas such as infrastructure standards, project preparation, and credit enhancement. The Multilateral Development Bank (MDB) Infrastructure Cooperation Platform (ICP) is supported by the G20 Infrastructure Working Group (IWG).

"Finance to Accelerate the Sustainable Transition-Infrastructure[163]", best known as Fast-infra, among others. These initiatives together with other different efforts coming from public and private groups, as well as international institutions, are presented in the cross-comparative analysis below (see Table 1).

This comparative analysis include six relevant frameworks: (i) Pan-European Strategic Framework, (ii) MDB Common Set of Aligned Sustainable Infrastructure Indicators, (iii) UNEP International Good Practice Principles for Sustainable Infrastructure, (iv) The G20 principles for Quality Infrastructure Investment, (v) Finance to Accelerate the Sustainable Transition-Infrastructure (Fast – Infra), and (vi) European Union Taxonomy for Sustainable Activities. These frameworks are compared for main categories: i) environmental sustainability and resilience, ii) social sustainability, iii) institutional sustainability, and iv) economic and financial sustainability. The common sustainability criteria defined as part of this analysis have informed the eight indicators proposed in Table 2 and their units of measurement.

Table 1
Cross comparative analysis of sustainability criteria

Core elements / Frameworks	Environmental sustainability and resilience	Social sustainability	Institutional sustainability	Economic and financial sustainability
Pan-European Strategic Framework	• Natural capital • Ecosystem services • sustainable production patterns	• Healthy living & well-being • Sustainable consumption • Public participation	• Externalities & natural capital • Green & fair trade	• Externalities & natural capital • Green and decent jobs, & human capital
MDB Common Set of Aligned Sustainable Infrastructure Indicators (SII)	• GHG reduction • Climate risk, resilience • Biodiversity • Pollution control & moni. • Efficient use of materials • Energy & water efficiency	• Access and affordability • Stakeholder engagement • Human & labor rights • Disability & special needs • Gender integration • Health & safety	• Anti corruption protocols & procedures • Corporate sustainability disclosure	• Positive economic & social return (ERR) • Job creation
UNEP International Good Practice Principles for Sustainable Infra.	• Resilience • Environmental impacts and nature	• Equity inclusiveness & empowerment	• Lifecycle assessment • Strategic planning • Transparent, inclusive & evidence-based decision-making	• Fiscal sustainability & innovative finance • Enhancing economic benefits
The G20 principles for Quality Infrastructure Investment		• Community Development • Stakeholder engagement • Displacement • female jobs	• Participatory project identification, • Procurement standards • Conflict of interest and ethics • Sustainability Certification	• ROR/ contingencies • Training and education • Permanent & construction jobs
Fast-Infra		• Stakeholder Engagement • Human & Labour Rights • Land Acquisition & Resettlement Mitigation • Gender & Inclusivity • Health & Safety	• Sustainability & Compliance Policies • Anti-corruption Policies & Procedures • Transparency & Accountability	• Embedding Government Policies for Project Fiscal Transparency & Procedures
EU Taxonomy for Sustainable Activities	• Climate change mitigation • Climate change adaptation • Biodiversity and ecosystems. • Pollution and control • Circular economy • Water and marine resources	———	———	———

[163] FAST-Infra was conceived in early 2020 by Climate Policy Initiative, HSBC (a bank), the International Finance Corporation (IFC), OECD, and the Global Infrastructure Facility under the auspices of President Macron's One Planet Lab. Over 50 global entities, representing governments at all levels, the financial sector, investors, DFIs, insurers, rating agencies and non-governmental organizations are now actively participating in developing the FAST-Infra initiative. This new FAST-Infra Sustainable Infrastructure Label (SI Label) is designed to enable project sponsors, developers and owners to signal the positive sustainability impact of infrastructure assets, and attract investors seeking assets that positively contribute to sustainable outcomes.

Source: Table developed by the author

The cross-comparative analysis conducted has informed the proposal of eight different indicators. The indicators, definition, and the unit of measurement proposed are presented in Table 2.

Table 2
Sustainability infrastructure indicators

Indicator	**Definition**	**Indicator at the national level and unit of measurements**	
Climate change adaptation and mitigation	Infrastructure projects should reduce/avoid Greenhouse Gas (GHG) emissions, be climate-resilient and integrate adaptation and mitigation strategies through the full cycle.	GHG emission reduction: Disaster risk reduction: Strategies to prevent resilience and climate-related hazards and natural disasters.	-Total CO2 emissions reduction according to NDCs. (% decrease CO2 emissions). -SDG 13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030.
Environmental conservation and biodiversity protection	Infrastructure projects should avoid negative impacts and/or restore biodiversity and the environment while preserving ecosystems and ecosystem services during the entire life cycle.	Biodiversity: Progress towards national biodiversity targets Ecosystem services Resources available for ecosystem services protection.	- SDG 15.9.1Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 -SDG 15.b.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
Resource efficiency and circular economy	Infrastructure projects should be planned and designed, constructed, and operated considering the efficient use of resources (including materials, energy, and water, among others), as well as principles of circular economy.	Circular economy: Reduction of waste generation through prevention, reduction, recycling, and reuse. Resource efficiency: Definition of national targets for water, energy, and materials efficiency.	-SDG 12.5.1 National recycling rate, tons of material recycled. -SDG 6.4.1 Change in water-use efficiency over time. -SDG 7.2.1 Renewable energy share in the total final energy consumption. -SDG 8.4.1 Material footprint, material footprint per capita, and material footprint per GDP.
Equity, inclusiveness, and gender empowerment	Infrastructure projects should promote social inclusion, gender equality, and human rights protection by fostering economic empowerment and social mobility, and equal opportunities for all. The integration of adequate and timely stakeholder engagement should also include other vulnerable groups, such as indigenous people.	Gender equality Guarantee equal opportunities for all. Empowerment Allocation of resources for women empowerment.	-SDG 11.2.1 Proportion of population that has convenient access to public transport, by sex, age, and persons with disabilities. -SDG 5.5.2 Proportion of women in managerial positions. -SDG 5.c.1 Proportion of countries with systems to track and make public allocations for gender equality and women's empowerment.

Positive economics and social returns	Infrastructure projects should consider the net economic and social returns, as well as the real cost of economic activities and natural capital over the entire project life cycle, taking into consideration both positive and negative externalities.	Life-cycle cost accounting Apply cost-benefit analysis techniques that adequately capture the net economic and social returns generated.	-Social Return on Investment (SROI) -Return on Investment (ROI)
People´s health and well-being	Infrastructure projects should improve physical and economic access to services, healthy living, and well-being.	Access to resources: Guarantee access to resources for all (including water, electricity, transportation, digital communications, and housing).	-SDG 1.4.1 Proportion of population living in households with access to basic services. -SDG 6.1.1 Proportion of population using safely managed drinking water services -SDG 7.1.1 Proportion of population with access to electricity. -SDG 9.1.1 Proportion of the rural population who live within 2 km of an all-season road. -SDG 9.c.1 Proportion of population covered by a mobile network, by technology.
Transparency and anticorruption	Infrastructure development should be planned and designed, constructed, and operated in a transparent manner to guarantee that relevant information is available and accessible to all stakeholders. Projects should have anti-corruption and anti-bribery management systems in place for long-term monitoring.	Transparency and anticorruption Ensure transparency and the existence of anti-corruption procedures.	-SDG 16.6 Develop effective, accountable, and transparent institutions at all levels. -SDG 16.5 Substantially reduces corruption and bribery in all their forms.
Fiscal sustainability and innovative finances	Infrastructure development should guarantee the fiscal sustainability of the assets through the full lifecycle. Some of the aspects to consider are fiscal transparency, financial integrity, debt sustainability, risk allocation, and mobilization of innovative sources of capital at scale.	Sustainability investment	-% of the national budget is devoted to sustainability in infrastructure, green infrastructure, and development.

Source: Table developed by the author.

Abbreviation: SDG = Sustainable Development Goal (indicator).

5. Case Studies

Lower Danube Green Corridor: floodplain restoration for flood protection

More than two decades ago, the governments of Bulgaria, Moldova, Romania, and Ukraine, came together to define what has been known as the Lower Danube Green Corridor. This 1000 km corridor project aims to have a positive effect on flood management, water purification, and climate change mitigation while restoring areas of high ecological value (WWF, 2015). As defined in the Declaration of Cooperation for the

Creation of a Lower Danube Green Corridor, signed on June 5th, 2000 in Bucharest, Romania, by the Ministers of the Environment of the four respective countries, the scope of the project includes "a minimum commitment of 773.166 ha of existing protected areas, 160.626 ha of proposed new protected areas, and 223.608 ha areas proposed to be restored to natural floodplain" (Ministers of the Environment, 2000).

Currently, 70% of the floodplain along this section of the river has been lost or damaged. This project has the potential to restore 25% of the total floodplain. The restoration of the former wetlands could store up to 1,6 billion m3, significantly minimizing the flooding risk in the area (WWW, 2010). From the economic viability point of view, floodplain restoration along the Lower Danube Green Corridor has been estimated to cost 183 million euros. On the other side, the annual earning associated with ecosystem services[164] has been estimated at 111.8 million € per year.

Beyond the previously mentioned project benefits (flood risk prevention, natural connectivity, etc), the restoration of ecosystem services, and the use of Nature-based solutions (NbS) provide significant positive additional externalities. Some of the main ones include the key role of wetlands as carbon sinks, the restoration of biodiversity in the area of influence, the development and protection of economic zones, and the reduction of water pollution in floodplains and wetlands (Ministers of the Environment, 2000).

This project illustrates the importance of environmental restoration and the positive externalities associated with the protection of natural capital. Green infrastructure solutions help mitigate the imminent effects of climate change, environmental degradation, and biodiversity loss (Climate ADAPT, 2021).

Image 2: Main drivers for infrastructure demand

Source: Climate ADAPT

[164] The main ecosystem services identified are flood control, water purification, groundwater replenishment, sediment and nutrient retention, reservoirs of biodiversity, recreation, tourism, etc.

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B. Applying principles of circular economy to sustainable tourism

This section is going to be revised. .

1. Key messages and recommendations

Key messages

4. Circular thinking in tourism is still in its infancy, apart from some individual cases. Opportunities may be most straightforward in building and (food) waste management. Also, opportunities exist in sustainable aviation fuels (e-fuels). Many sharing economy initiatives currently have too many non-circular counter effects.

5. Sustainable development in tourism is still to achieve momentum. With the rapid growth of tourism, its impacts are growing despite efficiency improvements. Key areas with a strong relation to both Sustainable Development Goals and the circular economy are energy use and emissions in transport, accommodation and restaurants, waste management of accommodation and restaurants (including food waste), water consumption and production of wastewater in general, and resource usage in building, for interiors, and in amenities.

6. Due to its cross-sectoral nature, a circular approach in tourism is complex but also holds opportunities to become driven through other sectors.

7. Indicator development for sustainable tourism is still evolving. Digitalization holds promise for better and more uniform measurement and monitoring.

8. A pan-European circular tourism economy will be more resilient to and better equipped to cope with future crises, be they economic, health-related, or derived from the environmental challenges that face the region.

Recommendations

9. Governments should increase efforts to help reduce energy use and greenhouse gas emissions from tourism transport, as large gains can be achieved with relevance for climate policy and the 2030 Agenda for Sustainable Development. Actions include, amongst other things, the scaling-up of international, long-distance rail infrastructure and travel, electric charging infrastructure in tourism destinations, facilitating the transition towards renewable energy use by accommodation, and the sharing of good practices.

10. The Governments of the pan-European region should take the opportunity when elaborating coronavirus disease (COVID-19) recovery plans to prioritize domestic tourism and international tourism from nearby countries, as these are more resilient to crises, have lower impacts on climate, and product loops are closer and easier to make circular than those of medium and long-distance international tourism products.

11. Decision-makers and entrepreneurs in the region should apply circular economy principles across the tourism value chain. A value chain approach could accelerate the transformation to more circularity in tourism and increase its long-term health and resilience. Tourism has the potential for long-lasting positive impacts beyond the sector itself, due to its interlinkages with other economic activities and the direct producer-consumer interaction.

12. The member States and governing bodies of the United Nations Economic Commission for Europe (ECE) should select a number of specific key-impact tourism indicators to be included in ECE statistical databases. Indicators for circular economy in tourism should be aligned with those being developed for the monitoring of sustainable development in tourism (particularly with the most promising) and be compatible with Sustainable Development Goals. Circular economy indicator development could follow the approach adopted by the initiative of the United Nations World Tourism Organization (UNWTO) towards a Statistical Framework for Measuring the Sustainability of Tourism (SF-

MST),[165] i.e.: (a) further integration of established measurement frameworks (Tourism Satellite Accounts, System of Environmental-Economic Accounting, European Tourism Indicator System and MST) to provide a platform for the measurement of sustainable and/or circular tourism; (b) further engagement with the definition and measurement of Sustainable Development Goal indicators, including the development of a complementary set of circular tourism indicators; and (c) advancing the development of subnational tourism statistics recognizing the importance of location-specific information in decision-making on tourism.

2. Context

13. Over the past half-century the extraction of minerals has tripled, with the extraction and processing of natural resources accounting for over 90 per cent of biodiversity loss and water stress and about 50 per cent of climate change impacts.[166] Critical resources are already becoming scarce, while ecosystem services are increasingly degraded, and man-made pollution and waste have become increasingly difficult to absorb.[167] Over the past decades, tourism has become a major industry, reaching 1.5 billion international tourist arrivals in 2019.[168] It consists of various resource-consuming practices including flights, accommodation, restaurants and attractions. These practices follow the traditional linear economy paradigm that has an impact on climate and environment. The environmental issues mentioned most for tourism are energy use and emissions, biodiversity loss, water use, overconsumption and waste. Tourism currently represents 10 per cent of global employment and 10 per cent of global gross domestic product (GDP).[169]

14. Tourism's share of global fossil energy consumption and associated emissions of carbon dioxide (CO_2) was already 5 per cent in 2008, of which tourism transport was responsible for 75 per cent.[170] Using a wider scope, the contribution of tourism to climate change has been estimated to be 8 per cent.[171] Under a business-as-usual scenario, worldwide tourism may cause more emissions than were agreed in the Paris Agreement for all sectors and households by 2060–2070.[172] This relates to the high energy use in tourism, notably in transport and accommodation, increasing with luxury.

15. Travel distance and modal choice are the key determining factors in tourism transport emissions. UNWTO and the International Transport Forum (ITF) forecast the number of domestic and international arrivals to reach 15.6 billion and 1.8 billion by 2030 respectively. Tourism arrivals by surface modes of transport will grow by 70 per cent between 2016 and 2030 (almost 5 billion trips more), but emissions from these trips will grow by 12 per cent (691 million to 775 million tonnes of CO_2), representing 44 per cent of the total (compared to 50 per cent in 2016). In contrast, in 2030, tourism arrivals by air (both international and

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[165] United Nations World Tourism Organization (UNWTO), "SDG Indicators for 'Sustainable tourism': A UNWTO contribution to the IAEG-SDG", 2 March 2016, available at https://webunwto.s3-eu-west-1.amazonaws.com/2019-08/unwtosdgtourismindicators02032016_unlocked.pdf.

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[167] Will Steffen and others, "Planetary boundaries: Guiding human development on a changing planet", *Science*, vol. 347, No. 6223 (13 February 2015), with abstract available at http://science.sciencemag.org/content/347/6223/1259855.abstract.

[168] UNWTO, "International Tourism Growth Continues to Outpace the Global Economy", 20 January 2020, available at www.unwto.org/international-tourism-growth-continues-to-outpace-the-economy.

[169] UNWTO and the International Transport Forum (ITF), *Transport-related CO_2 Emissions of the Tourism Sector – Modelling Results* (Madrid, 2019).

[170] UNWTO and UNEP, *Climate Change and Tourism: Responding to Global Challenges* (Madrid, 2008).

[171] Manfred Lenzen and others, "The carbon footprint of global tourism", *Nature Climate Change*, vol. 8 (May 2018), pp. 522–528.

[172] P.M. Peeters, "Tourism's impact on climate change and its mitigation challenges: How can tourism become 'climatically sustainable'?", doctoral thesis, Delft University of Technology, 2017.

domestic) are expected to represent 33 per cent of the total arrivals but to produce 56 per cent of emissions.[173]

16. Water use in tourism is problematic in a range of destinations due to travel taking place in warm countries during dry seasons, but also, for instance, in the production of artificial snow for winter tourism.[174] Food consumption in tourism, with an estimated 75 billion meals a year, leads to a range of sustainability issues.[175] For instance, food waste in the tourism food service industry is considerable.[176] The food waste share of hospitality waste and of restaurant waste is 40 per cent and 60 per cent, respectively.[177] In 2011, the United Nations Environment Programme (UNEP) estimated that international tourism alone was responsible for 14 per cent of total global municipal solid waste. Tourism waste can stress the local waste management infrastructure, particularly during the high season and in destinations where facilities are still underdeveloped. Tourism contributes to biodiversity loss through land conversion, indirectly through its share in greenhouse gas emissions, overexploitation of natural resources, the spread of invasive species and various types of pollution.[178] Land-use for tourism is not regarded as an issue in absolute terms, but tourism is identified as one of a few competitive sources for very high-value land, particularly (fragile) coastal areas.[179] Local competing use can be at stake here.

17. Next to these environmental issues is the relatively recent problem of overtourism, which describes situations "in which the impact of tourism, at certain times and in certain locations, exceeds physical, ecological, social, economic, psychological, and/or political capacity thresholds".[180] The underlying factors of overtourism are often related to those causing some of the above-mentioned environmental problems. In this respect, and in this day and age, it is also necessary to mention that tourism can be a direct and indirect vector of pandemics, primarily through transport.[181]

18. Modelling shows that the resource use of energy and emissions, water, land and food will double within 25 to 45 years.[182] This will contribute to already significant anthropogenic stress on a number of planetary boundaries,[183] and is in conflict with policy objectives such as those formulated in the Paris Agreement and the Sustainable Development Goals. Many of these stresses already have, or will have, impact on tourism itself, like climatic changes that may lead to shifts in the attractiveness of destinations, causing tourist flows to change, increasing water and snow shortages impacting the tourism offer, or weather extremes damaging tourism infrastructure.

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[173] UNWTO and ITF, *Transport-related CO_2 Emissions*.

[174] Stefan Gössling, "New performance indicators for water management in tourism", *Tourism Management*, vol. 46 (February 2015), pp. 233–244.

[175] Stefan Gössling and others, "Food management in tourism: Reducing tourism's carbon 'foodprint'", *Tourism Management*, vol. 32, No. 3 (June 2011), pp. 534–543.

[176] Carlos Martin-Rios and others, "Food waste management innovations in the foodservice industry", *Waste Management*, vol. 79 (September 2018), pp. 196–206.

[177] Sanaa I. Pirani and Hassan A. Arafat, "Solid waste management in the hospitality industry: A review", *Journal of Environmental Management*, vol. 146 (December 2014), pp. 320–336.

[178] UNWTO, *Tourism and Biodiversity – Achieving Common Goals Towards Sustainability* (Madrid, 2010).

[179] Ward Anseeuw and others, *Land rights and the rush for land: Findings of the Global Commercial Pressures on Land Research Project* (Rome, International Land Commission, 2012).

[180] Paul Peeters and others, "Research for TRAN Committee - Overtourism: impact and possible policy responses. European Parliament, Policy Department for Structural and Cohesion Policies", (Brussels, European Parliament, Policy Department for Structural and Cohesion Policies, 2018), p. 22.

[181] Stefan Gössling, Daniel Scott and C. Michael Hall, "Pandemics, tourism and global change: a rapid assessment of COVID-19", *Journal of Sustainable Tourism*, vol. 29, No. 1 (April 2021), pp. 1–20.

[182] Stefan Gössling and Paul Peeters, "Assessing tourism's global environmental impact 1900–2050", *Journal of Sustainable Tourism*, vol. 23, No. 5 (March 2015), pp. 639–659; See also UNEP and UNWTO, *Tourism in the Green Economy – Background report* (Madrid, 2012).

[183] Steffen and others, "Planetary boundaries: Guiding human development on a changing planet".

19. While the transformation to a more sustainable development of tourism has been pursued at all levels for at least two decades, attempts have not succeeded on a broad scale. The circular economy is regarded as very promising for contributing to the achievement of a number of Sustainable Development Goals, particularly Goal 7 on energy, Goal 8 on economic growth, Goal 11 on sustainable cities, Goal 12 on sustainable consumption and production, Goal 13 on climate action, Goal 14 on oceans and Goal 15 on life on land. UNWTO acknowledges that approaches "such as the circular economy – promoting business models based on renewable resources, longer and diverse product life cycles, shared consumption and interconnected value chains – can play a significant role when designing and improving resource management systems not only in the tourism sector, but also for the sustainable development of destinations".[184] The United Nations Development Programme (UNDP) and UNEP identify tourism as one of a few sectors that are key to the economic development of all countries and also providing opportunities for climate change mitigation through resource efficiency and increasing circularity.[185] They recommend a circular or value chain approach to tourism, to allow for the identification and assessment of its interdependencies with other sectors, for example those defined for climate action. Under a circular economy approach, responses could be developed that would drive (climate) action across all the various sectors on which tourism depends. Tourism's strong relation to food production, distribution and disposal is named as an example. In particular, UNDP sees potential for a circular economy approach in tourism in countries where tourism is a large economic force.[186]

20. The main policy challenge related to circular economy is to ensure its effective definition and implementation in the tourism sector, specifically because the tourism sector is an amalgam of parts of other sectors – from building to transport – and is mainly a service sector.

3. State, main trends and recent developments

21. The *Circularity Gap Report 2020*[187] estimates the global circularity rate at 8.6 per cent, down from 9.1 per cent in the 2018 edition of the same report. Progress in the development of a circular economy in the pan-European region is varied.

22. ECE reports an increase in the efficiency of resource use in the ECE region from 2000 to 2017. While domestic material consumption per unit of GDP decreased by about 10 per cent, aggregate output increased by 40 per cent. Again, there are large differences between ECE countries, with an average 3.1 per cent decrease of domestic material consumption by European members of the Organisation for Economic Co-operation and Development (OECD) versus an increase in eastern ECE States. In the same period, the material footprint continued to grow by 18 per cent in the ECE region, partly due to the import of raw materials, substituting domestic production. ECE also points to the major role of ECE countries in global material demand and a consequent responsibility (in a transition towards more sustainable consumption and production) beyond the ECE region.[188] This issue is also extremely present in international tourism. Material resource use in the ECE region is very much a mirror of the economic level of States: in less advanced economies, growth is accompanied by high resource use, whereas in more developed (service) economies material use is less intensive.

23. In the European Union, the circular material use rate (recovered materials as a percentage of overall materials used) increased from 8.2 per cent in 2004 to 11.2 per cent in

[184] UNWTO and United Nations Development Programme (UNDP), *Tourism and the Sustainable Development Goals – Journey to 2030* (Madrid, 2018). See p. 94.

[185] UNDP, *A 1.5°C World Requires a Circular and Low Carbon Economy* (New York, 2020).

[186] Ibid.

[187] Marc de Wit, Jelmer Hoogzaad and Caspar von Daniels (n.p., Circle Economy, 2020), available at www.circularity-gap.world/2020.

[188] E/ECE/1495, paras. 2–3.

2017, though with little change since 2012.[189] The Netherlands, for instance, is regarded as a global circularity front-runner (rate of 24.5 per cent), whereas a country like Norway (2.4 per cent) lags far behind the global average.[190]

24. The European Commission, as part of its European Green Deal[191] and for aligning to new strategies, presented a new circular economy action plan in March 2020,[192] following an earlier version.[193] In its circular economy action plan, the European Commission notes that "Scaling up the circular economy from front-runners to the mainstream economic players will make a decisive contribution to achieving climate neutrality by 2050 and decoupling economic growth from resource use, while ensuring the long-term competitiveness of the [European Union] and leaving no one behind". In order to achieve this, the "[European Union] needs to accelerate the transition towards a regenerative growth model that gives back to the planet more than it takes, advance towards keeping its resource consumption within planetary boundaries, and therefore strive to reduce its consumption footprint and double its circular material use rate in the coming decade". The action plan includes proposals on product design, circular production processes, waste reduction and consumer empowerment. The European Parliament followed up with a resolution on the action plan, demanding additional measures aiming for a fully circular economy by 2050.[194] The resolution underlines the major contribution that the circular economy make give to reaching the goals of the Paris Agreement and the Convention on Biological Diversity, as well as to achieve the Sustainable Development Goals.

25. Circular approaches have yet to make it into direct European Union tourism policy, the Commission's current framework being from 2010.[195] The Council of the European Union encourages European Union member States to consider a number of challenges and opportunities when developing tourism strategies and policies, of which "sustainability, including resource efficiency, circular economy, seasonality and the management and distribution of increasing tourism flows" is one. Policies are to contribute to European Union climate goals, the Paris Agreement and the Sustainable Development Goals.[196]

26. The development of circular economy in tourism in ECE countries is still very limited. The COVID-19 pandemic crisis does offer opportunities for a reset of contemporary tourism,

[189] de Wit, Hoogzaad and von Daniels, *Circularity Gap Report 2020.*

[190] Laxmi Adrianna Haigh, "Countries: The crucial piece to finish the circular economy puzzle", Circle Economy, 2 November 2020, available at www.circle-economy.com/blogs/countries-the-crucial-piece-to-finish-the-circular-economy-puzzle.

[191] European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, The European Green Deal, COM(2019) 640 final.

[192] European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, A new Circular Economy Action Plan. For a cleaner and more competitive Europe, COM(2020) 98 final.

[193] European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, Closing the loop – An EU action plan for the Circular Economy, COM(2015) 614 final.

[194] European Parliament, European Parliament resolution of 10 February 2021 on the New Circular Economy Action Plan, (2020/2077(INI)).

[195] European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, Europe, the world's No 1 tourist destination – a new political framework for tourism in Europe, COM(2010) 352 final.

[196] Council of the European Union, Outcome of Proceedings, The competitiveness of the tourism sector as a driver for sustainable growth, jobs and social cohesion in the EU for the next decade, 9707/19 TOUR 10 IND 186 COMPET 434.

reducing impacts and increasing resilience.[197] The COVID-19 pandemic has had a devastating effect on international tourism in particular. UNWTO reports that, in 2020, international arrivals dropped by 74 per cent due to travel restrictions and various socioeconomic challenges.[198] This collapse of international tourism alone is estimated to represent a loss of $1.3 trillion in export revenues and around 120 million direct jobs at risk. UNWTO acknowledges that the COVID-19 crisis "has raised awareness of the importance of local supply chains and the need to rethink how goods and services are produced and consumed, both key elements of a circular economy. Integrating circularity and further advancing resource efficiency in the tourism value chain represent an opportunity for the tourism sector to embrace a sustainable and resilient growth pathway".[199] Thus, for a circular economy transition in tourism, UNWTO recommends investing in transforming tourism value chains, integrating circular economy processes, prioritizing sustainable food approaches for circularity, and shifting towards a circularity of plastics in tourism. Even though UNWTO concludes that there is growing consensus among tourism stakeholders that recovering from the pandemic must also involve tackle the underlying reasons and sustainability challenge, the time for a genuine transition appears short now that many tourism-dependent countries and businesses are desperate to reopen after various lockdowns, and consumers are longing for holidays away from home. A return to business-as-usual seems likely, with implications for (additional) investments in sustainable or circular tourism development. In terms of energy use (and emissions), the faster recovery of domestic tourism that some countries experienced is positive in circular economy terms.

4. Indicators

27. As the literature on circular economy in tourism is still in its infancy, there are very few direct references to indicators for measuring the circular economy in tourism. Their use is recommended, but typical indicators are not specified. UNWTO and UNEP assert that "embracing circularity implies robust measurement and monitoring of the sustainable development impacts of economic activities".[200] Effective indicators need to be relevant to core issues, (statistical) data for evaluation need to be available and should be comparable over time. Others recommend not making indicator (sets) too ambitious.[201] This may be politically and scientifically appealing but is not necessarily practicable. They also advise against a "choice overload", suggesting that the focus be on a small set of meaningful indicators. Indicators to monitor the sustainable development of tourism could be generated as a result of policymaking related to the establishment of the pan-European Shared Environmental Information System.[202] Digital platforms are widely seen as an opportunity to

[197] Gössling, Scott and Hall, "Pandemics, tourism and global change: a rapid assessment of COVID-19"; Organisation for Economic Co-operation and Development (OECD), "Tourism Policy Responses to the coronavirus (COVID-19)", 2 June 2020, available at www.oecd.org/coronavirus/policy-responses/tourism-policy-responses-to-the-coronavirus-covid-19-6466aa20/; UNWTO, "One planet vision for a responsible recovery of the tourism sector", available at www.unwto.org/covid-19-oneplanet-responsible-recovery-initiatives; and United Nations Sustainable Development Group, "Policy Brief: COVID-19 and Transforming Tourism", August 2020, available at https://unsdg.un.org/resources/policy-brief-covid-19-and-transforming-tourism.

[198] UNWTO, "2020: Worst Year in Tourism History with 1 Billion Fewer International Arrivals", 28 January 2021, available at www.unwto.org/news/2020-worst-year-in-tourism-history-with-1-billion-fewer-international-arrivals.

[199] UNWTO, *Recommendations for the Transition to a Green Travel and Tourism Economy* (Madrid, 2021).

[200] UNWTO and UNEP, *Baseline Report on the Integration of Sustainable Consumption and Production Patterns into Tourism Policies* (Madrid, 2019), p. 66.

[201] Elizabeth Agyeiwaah, Bob McKercher and Wantanee Suntikul, "Identifying core indicators of sustainable tourism: A path forward?" *Tourism Management Perspectives*, vol. 24 (October 2017), pp. 26–33.

[202] *Sharing our vision for the pan-European region: Setting strategic goals and objectives for the Working Group on Environmental Monitoring and Assessment* (United Nations publication, ECE/CEP/187).

harmonize indicators, allowing for a comprehensive outlook taking into account the economic, sociocultural and environmental aspects.

28. Circular economy indicators themselves are still being developed. A simple and effective monitoring framework was called for in the first European Union circular economy action plan, supported by both the Council of the European Union and the European Parliament. In 2018, the European Commission presented a new set of measures including a Monitoring Framework for the Circular Economy,[203] which was operationalized by Eurostat.[204] The framework consists of 10 indicators, some of which are broken down into subindicators, and aims at measuring progress towards a circular economy in a way that encompasses its various dimensions at all stages of the lifecycle of resources, products and services. Indicators cover four thematic areas: (a) production and consumption; (b) waste management; (c) secondary raw materials; and (d) competitiveness and innovation. The list is constructed to be short and focused. It uses available data while also earmarking areas where new indicators are in the process of being developed, in particular for green public procurement and food waste. The European Commission indicators are largely restricted to the circulation of materials and focused on waste, partly due to the availability and reliability of data, and the lack of other options.[205] In its 2021 resolution, the European Parliament calls on the Commission to propose binding European Union targets for 2030, to be monitored with new indicators to be adopted by the end of 2021, as part of an updated Monitoring Framework for the Circular Economy. The European Commission relates these new indicators to the focus areas in its action plan, but it also desires interlinkages between circularity, climate neutrality and the zero pollution ambition.

29. To propose relevant indicators for measuring and monitoring circular economy development in tourism in ECE member States, a starting point is to identify the key issues in tourism that are both relevant in terms of their impacts, contribution to the Sustainable Development Goals and potential for circular processes. This is rather similar to the identification of hotspots as part of the Hotspot Analysis framework advocated in the UNEP Lifecycle Initiative.[206] UNEP considers an environmental impact to be a hotspot if it contributes to more than 50 per cent of total lifecycle impact across all of the product or service lifecycle stages in any given impact category (for example, greenhouse gas emissions, energy or water use, and waste), ensuring that most of the impact is considered.[207]

30. In the reminder of this section, a simplified approach is taken to arrive at indicators at the national level, where the main elements of tourism are compared with the key environmental impact categories. Indicators could then follow from these hotspots, i.e. where the contribution of a certain tourism element to an impact category is significantly larger or more relevant than that of other tourism elements. In warm spots, this contribution is average, and in cold spots below average or even irrelevant. Through this analysis, based on the impact literature summarized in the preceding subsection on context, several hotspots are identified

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[203] European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions on a Monitoring framework for the circular economy, COM(2018) 29 final.

[204] Eurostat, Circular Economy – Monitoring Framework, available at https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework.

[205] Opinion of the European Economic and Social Committee on the 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a monitoring framework for the circular economy', *Official Journal of the European Union*, C 367 (2018), pp. 97–102; and Gustavo Moraga and others, "Circular economy indicators: What do they measure?", *Resources, Conservation and Recycling*, vol. 146 (July 2019), pp. 452–461.

[206] Mark Barthel and others, *Hotspots Analysis: An overarching methodological framework and guidance for product and sector level application* (UNEP, 2017).

[207] One Planet Network, "How to map tourism value chains and identify key actions: Online training #1 – Sustainable Tourism Programme", video, 29 March 2019, available at www.oneplanetnetwork.org/webinar-tourism-value-chains.

for accommodation operations, origin-destination transport, and events and activities (see table 1 below).

Table 1
Validating and prioritizing tourism hotspots

Tourism element \ *Impact category*	*Energy use*	*Water use*	*Other resource use or over-consumption*	*Waste*	*Climate change*	*Bio-diversity*
Accommodation: Buildings	Warm	Warm	Warm	Warm	Warm	Warm
Accommodation: Operations	Hot	Hot	Hot	Hot	Hot	Cold
Restaurants and bars: Buildings	Warm	Warm	Cold	Warm	Cold	Cold
Restaurants and bars: Operations	Warm	Warm	Warm	Hot	Warm	Cold
Transport: Local	Warm	Cold	Cold	Cold	Warm	Warm
Transport: Origin to destination	Hot	Cold	Hot	Cold	Hot	Warm
Activities: Events, attractions and festivals	Warm	Warm	Hot	Hot	Cold	Warm
Services (tour operators, travel agencies, financial and booking services)	Cold	Cold	Cold	Cold	Cold	Cold

Notes: Cold spot | Warm spot | Hotspot

31. Tourism strongly contributes to waste production, energy consumption, climate change and, to a smaller extent, water issues, through a variety of non-circular processes within its value chain. These four hotspots correspond to the four core accounts identified by UNWTO in its initiative towards a Statistical Framework for Measuring the Sustainability of Tourism.[208] For biodiversity, only warm spots were identified, thus it was not selected as a key indicator area for circular economy in tourism, even though speed of travel and global connectiveness of aviation play a significant role in the spread of invasive species and pathogens,[209] and land conversion, greenhouse gas emissions and the overexploitation of natural resources lead to biodiversity loss. Overconsumption is a clear issue with transport to the destination. The combination of strong increases in transport speed and low fares through the development of air transport were the main drivers of overconsumption of travelled distances.[210] All the impact categories in table 1 above can be linked to relevant Sustainable Development Goals and have strong links to circular processes. These are shown in table 2 below, next to some first coarse indicator topics for each impact category.

[208] UNWTO, Linking the TSA and the SEEA: A technical note (Madrid, 2019).

[209] T. Kelly and J. Allan, "Ecological effects of aviation", in *The Ecology of Transportation: Managing Mobility for the Environment*, John Davenport and Julia L. Davenport, eds. (n.p., Springer, 2006).

[210] Peeters, "Tourism's impact on climate change and its mitigation challenges".

Table 2
Tourism impact categories and Sustainable Development Goals

Impact category	*Relevant Sustainable Development Goals*	*Coarse indicator topics*
Energy use and climate change	13 – Climate action	Energy use
	7 – Affordable and clean energy	Renewable energy use
		Greenhouse gas emissions
		Transport mode shares
		Arrival and departure numbers
Biodiversity loss	15 – Life on land	Protected area
	14 – Life below water	Transport infrastructure
Water (shortage)	6 – Clean water	Water consumption
		Water management
Waste (production)	12 – Responsible consumption and production	Waste production
		Waste management
		Construction materials
Resource use and overconsumption	12 – Responsible consumption and production	Resource consumption

32. The final step is to define core indicators and measure their performance, to determine the current state of circularity in tourism. In the discussion on indicators in the following sub-sections, preliminary indicators for monitoring circular economy in tourism are presented, including the origin of or a database for each indicator. Each indicator is discussed in terms of the state and trends in ECE member States, data comparability and data availability.

33. Due to data limitations, sometimes only selected ECE countries from each subregion (European Union, Western Europe, Eastern Europe, South-Eastern Europe and Central Asia) are compared to show how circularity has developed over the past decade. A European Union bias could mostly, but not always, be avoided, due to data availability.

Waste generation

34. Reducing waste is a focal point in aiming for circularity, and tourism contributes significantly to local waste production. Tourism inflows significantly increase municipal solid waste generation, up to a turning point where more arrivals contribute to lowering municipal waste per capita.[211] More tourism arrivals lead to more tourists per resident and, consequently, more waste per resident.

35. The European Tourism Indicator System suggests determining percentage waste recycled per tourist compared to total waste recycled per resident per year.[212] However, the example of the Netherlands, Norway and Turkey shows that waste disposal shares differ greatly from country to country. While the Netherlands disposes of 2.6 per cent of its total generated waste, Norway disposes of 9.7 per cent and Turkey 88.4 per cent. And whereas the Netherlands has cut its disposal rate in half since 2010, Norway has increased its disposal

[211] Italo Arbulú, Javier Lozano and Javier Rey-Maquieira, "Tourism and solid waste generation in Europe: A panel data assessment of the Environmental Kuznets Curve", *Waste Management*, vol. 46 (December 2015), pp. 628–636.

[212] European Union, *The European Tourism Indicator System: ETIS toolkit for sustainable destination management* (Luxembourg, Publications Office of the European Union, 2016).

share, mainly due to an increasing amount of waste. To determine the real impact of tourism on national waste production, more specific indicators must be measured.

36. Future policies may use tourism income to invest in recovery plants, or to introduce a maximum tourism capacity where necessary to manage the amount of waste. Furthermore, tourism businesses may be asked to actively reduce waste production by banning non-recyclable packaging and encouraging restaurants and hotels to donate food leftovers.

Water consumption

37. There is strong evidence that tourists use considerably more water than they do when at home and compared to local inhabitants.[213] Water consumption in tourism is closely linked to energy and food production, and best addressed in accommodation, where much of the consumption in tourism takes place.[214]

38. To make water usage circular, all demand must be covered by renewable water sources. Therefore, no fossil water sources (groundwater, ice) should be used. As tourism concentrates in the warm and dry season, many (summer) tourism destinations suffer from water shortages. In destinations with concerns about the availability of water to support tourism activity, it will not be sufficient to record only the levels of water use by tourism activities.[215] Information on the stock of water and changes in this stock also need to be recorded.

39. The preliminary indicator proposed for water circularity in tourism is derived from Gössling and others[216] and consists of two (national) subindicators: the share of water used for tourism; and the share of renewable water in overall supply (the stock). Figures in the pan-European region differ, with frequently high tourism water shares in Mediterranean countries, while shares of renewable water vary. The share of water extracted from renewable sources depends on water scarcity and therefore differs greatly between countries.

40. Using national figures can mask water scarcity at the regional and local scales.[217] Simultaneously, trends show an increasing demand for fresh water in destinations, which puts pressure on renewable resources, and water scarcity is becoming an increasing problem due to climate change.

41. Future policy responses may focus on demanding the use of water-saving technologies and a water management plan in dry regions that accounts for the allocation of water between tourism, agriculture and the local inhabitants. Furthermore, research has shown that informing tourists about their water consumption footprint and water shortage issues can have a positive impact on lowering water demand.[218] Advanced water generation methods may also become indispensable for tourism in the coming decades.

Energy use in tourism

42. Figure I below shows the share of CO_2 emissions from tourism. The largest contribution comes from transport by air or car. Accommodation and restaurants account for one fifth of the emissions.

[213] Stefan Gössling and others, "Tourism and water use: Supply, demand, and security. An international review", *Tourism Management*, vol. 33, No. 1, pp. 1–15.

[214] Gössling, "New performance indicators for water management in tourism".

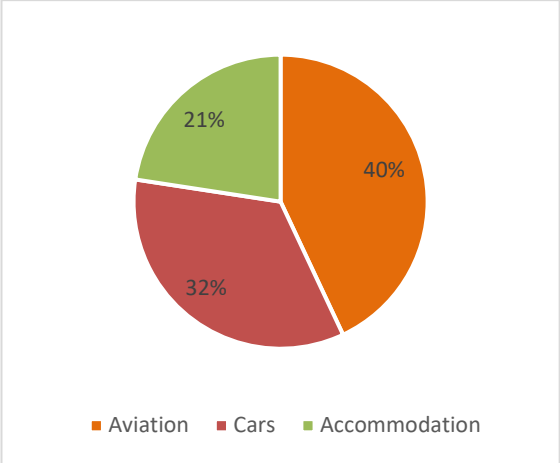
[215] UNWTO, Statistical Framework for Measuring the Sustainability of Tourism. Consultation Draft. Draft prepared for discussion with the Working Group of Experts on Measuring the Sustainability of Tourism (October 2018).

[216] Gössling and others, "Tourism and water use: Supply, demand, and security".

[217] Ibid.

[218] Lluís Garay, Xavier Font and August Corrons, "Sustainability-oriented innovation in tourism: An analysis based on the decomposed theory of planned behaviour", *Journal of Travel Research*, vol. 58, No. 4 (April 2018), pp. 622–636.

Figure I
Share of CO_2 emissions from tourism



Source: UNWTO and UNEP, Climate Change and Tourism: Responding to Global Challenges.

Energy use by accommodation and restaurants

43. Accommodation and restaurants account for 21 per cent of tourism emissions and are tourism's main energy consumer at the destination.[219] Substantial differences in the energy consumption of tourists and inhabitants can occur, notably depending on the level of luxury and facilities of accommodation. On the other hand, the amount of emissions caused by energy use can be reduced by using renewable energy sources and energy-saving technologies.

44. The European Tourism Indicator System suggests measuring the annual amount of energy consumed from renewable sources compared to overall energy consumption at the destination level per year to better define the energy consumption of tourism.[220] The ECE Dashboard for Sustainable Development Goals[221] includes data on renewable energy for each member State. Therefore, the share of renewable energy in total final energy consumption can function as an indicator for circularity in tourism's non-transport energy consumption.

45. One of the limitations is that the share of renewable energy in the energy mix differs greatly from country to country. For example, Iceland produces 76.7 per cent of its energy from renewable sources, while Turkmenistan uses 99.9 per cent non-renewable sources.[222] The ECE member State average is 21.5 per cent renewable energy in the energy mix. Historic development of energy supply determines the status quo. Between 2000 and 2017, both positive and negative trends in the usage of renewable energy can be observed.

46. Future policies should focus on pushing the transition towards renewable energy, also in remote tourism destinations, and demand the implementation of energy-saving technologies in new facilities or during renovation.

Energy use and contributing to climate change through tourism transport

47. Tourism transport almost completely depends on fossil fuels and is the main source of tourism's CO_2 emissions (see figure I above). Transport between the tourist's home and the destination produces the bulk of the travel distance and thus of the energy use and emissions. To define circularity measures for this hotspot area, it is important to know how tourists arrive at and depart from their destinations: by aeroplane, car, or a more sustainable

[219] UNWTO and UNEP, *Climate Change and Tourism: Responding to Global Challenges*.

[220] European Union, *The European Tourism Indicator System*.

[221] Available at https://w3.unece.org/SDG/en.

[222] United Nations Economic Commission for Europe, Indicator 7.2.1: Renewable energy share in the total final energy consumption, %, available at https://w3.unece.org/SDG/en/Indicator?id=23.

mode of transport like bus or train. The more tourists use alternative modes of transport and travel shorter distances, the more emissions can be prevented. The opportunities to decarbonize transport using renewable energy are also much greater for other modes than the aeroplane. The choice of travel mode is related to the availability of transport modes and the psychological default of transport modes of citizens of a country.

48. As there are no good indicators for tourism transport's energy use, it is proposed to look at the proportion of trips that are domestic and the proportion of international trips that are made by air.

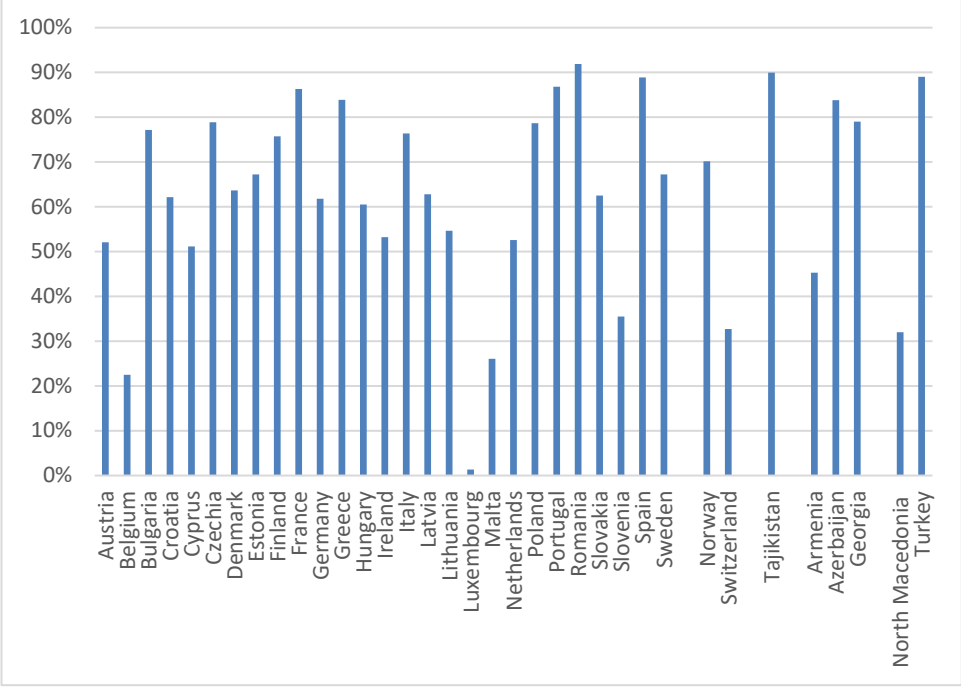
49. With some reservations for large countries, domestic tourism trips are expected to create lower emissions than outbound travel, due to shorter distances and a transport mix that should contain less air travel. In 2019, 73.3 per cent of trips taken in the ECE countries shown in figure II below were domestic,[223] with the proportion strongly correlated with country area.[224] Between 2012 and 2019, 0.4 per cent more domestic trips were taken in European Union countries.[225]

50. In 2019, 48.6 per cent of inbound tourism in the ECE countries shown in figure III below involved arrival by air. In 2019, 49.3 per cent of outbound tourism trips from the European Union (minus Sweden but plus Switzerland) were by air, up from 46.1 per cent in 2012. Between 2012 and 2019, outbound travel by air increased in these countries by 34.8 per cent (see figure IV below), which represents 61.5 per cent of the total increase in outbound travel.

51. Future policies should invest in infrastructure for low-emission transport modes such as rail, instead of aviation, and increase marketing for domestic tourism.

Figure II

Proportion of trips that are domestic, selected countries grouped by subregion, per cent (2019)



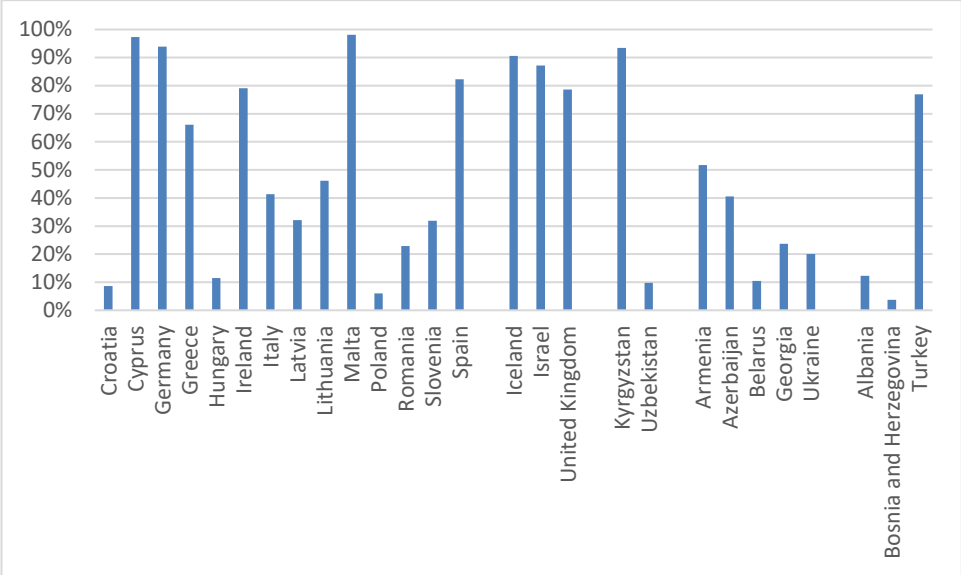
[223] Eurostat, "Number of trips by mode of transport", 21 April 2021, available at https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=tour_dem_tttr&lang=en; and UNWTO. (2021). Compendium of Tourism Statistics data set [Electronic], Series 2.9: Domestic tourism - Total trips by mode of transport – Thousands, and Series 3.2: Outbound tourism - Departures of overnight visitors (tourists) - Thousands. UNWTO.

[224] Area from ECE Statistical Database, 2020.

[225] No data for Sweden.

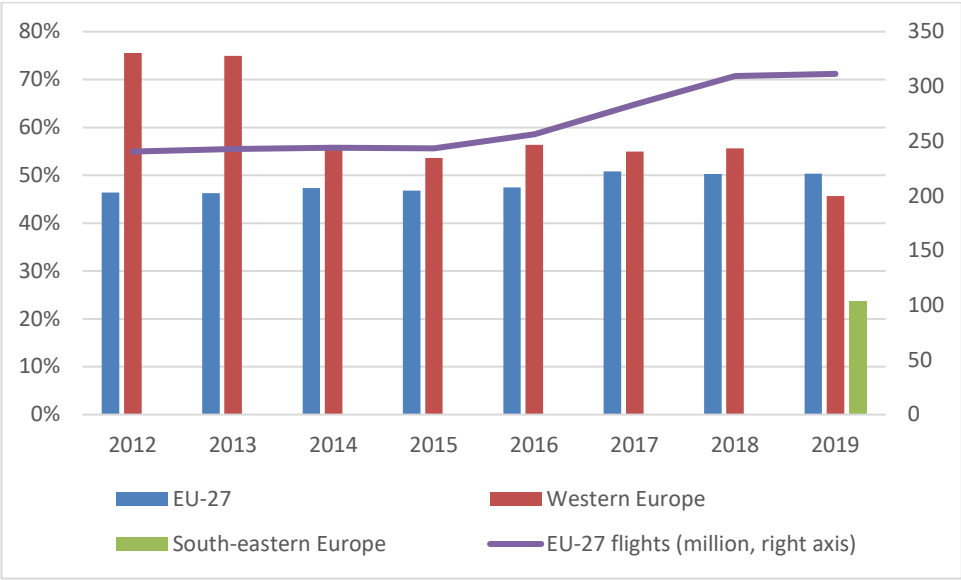
Source: UNWTO and Eurostat.
Notes: Norway and Tajikistan – 2018.

Figure III
Proportion of in-bound arrivals by air, selected countries grouped by subregion, per cent (2019)



Source: UNWTO.

Figure IV
Proportion of outbound trips by air, and total number of flights, per cent (left axis) and million flights (right axis) (2013–2019)



Source: Eurostat.
Notes: No data for Sweden in 2012–2013 (for number of flights, the value for 2014 is used); for Western Europe, only Norway (2013–2018), Switzerland (2012–2019) and the United Kingdom of Great Britain and Northern Ireland (2012–2013); for South-Eastern Europe, only North Macedonia (2019). The step change in the proportion of outbound trips by air from 2013 to 2014 in Western Europe is explained by the lack of data for the United Kingdom of Great Britain and Northern Ireland after 2013.

Resources for construction and maintenance

52. Resource use in the construction and maintenance of tourism facilities (for example, accommodation) is high and can well be addressed with a circular economy approach. These aspects are as yet unmeasured, so this section cannot report on their state.

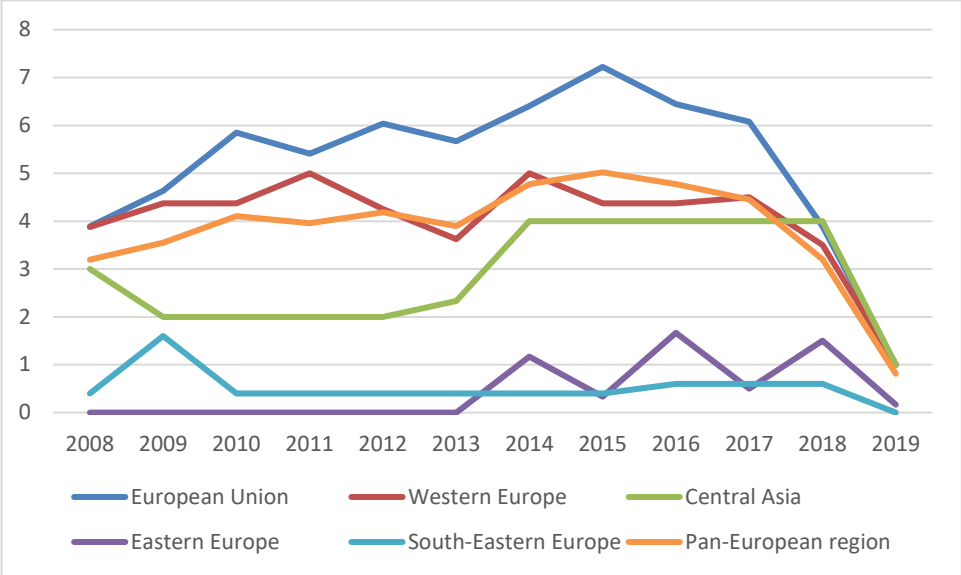
53. To increase circularity within tourism facilities, suggestions include using the share of circular building material flows, remanufacturing furniture, leasing contracts for high-end appliances and usage of easy-to-repair materials and interiors,[226] but these will be a challenge to use as an indicator. There are some cases where circularity in construction has been used for marketing purposes.

54. Future policies should support the usage of recycled resources and circular building material flows and make it mandatory to offer repairs for appliances.

(Sustainable) tourism management plans

55. Under Sustainable Development Goal 12 on responsible consumption and production, indicator 12.b.1 "Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools" is relevant to this theme. Sustainable tourism development plans are defined as guidelines and management practices for all types of destinations that refer to the balance between economic, sociocultural and environmental aspects of tourism to guarantee long-term sustainability.[227] This entails the optimal use of environmental resources that can be achieved with circular development. Figure V below shows the gradual growth in the implementation of standard accounting tools to monitor the economic and environmental aspects of tourism, the practical measure used for indicator 12.b.1, with the number of tables (Tourism Satellite Account and the System of Environmental-Economic Accounting) increasing from a regional average of 3 in 2008 to 5 in 2015; the more recent decline is a reflection of the lag in reporting.

Figure V
implementation of standard accounting tools to monitor the economic and environmental aspects of tourism, number of tables (2008–2019)



Source: United Nations Global Sustainable Development Goal Indicators Database.

[226] Jesper Manniche and others, *Destination: A circular tourism economy – A handbook for transitioning toward a circular economy within the tourism and hospitality sectors in the South Baltic Region* (Nexoe, Denmark, Centre for Regional and Tourism Research, 2017).

[227] UNEP and UNWTO, *Making tourism more sustainable: A Guide for Policy Makers* (Madrid, 2005).

Notes: No data for Albania, Azerbaijan, San Marino, Tajikistan or Turkmenistan. Data missing for North Macedonia (2019), the Russian Federation (2008) and Ukraine (2008).

56. In their report on sustainable consumption and production patterns, UNWTO and UNEP review 73 national tourism policies and their extent of reporting on sustainable consumption and production is presented.[228] The report shows that biodiversity and sustainable land-use have entered tourism sustainability reports in countries across the world. However, policies on water efficiency are lacking. A similar pattern has been observed where tourism development plans focus on policies that facilitate growth and economic benefit, such as nature conservation, but do not define sustainability as the core of their overall strategy.[229]

57. To achieve circular practices at destinations, future policies should favour funding destination marketing organizations that base their tourism development plans on circular frameworks and opportunities to learn about circular tourism. In addition, policymakers should identify barriers to circular tourism development and provide a policy framework necessary to overcome those challenges.

5. Case studies

E-fuels for aviation

58. International aviation has been identified as one of the sectors difficult to align with climate targets,[230] despite the European part of aviation being part of the European Union Emissions Trading System. E-fuels are based on the well-developed power-to-liquids process: producing jet fuel (Jet A) from CO_2, water and a substantial amount of renewable energy.[231] The CO_2 source could be a large industry, but ultimately it could be the atmosphere itself. In the latter case, one would completely close the carbon cycle (hence the term "circular kerosene" is used sometimes). E-fuels need 80 per cent less land than other sustainable aviation fuels, very little water and do not compromise feedstocks, nature and agriculture. The development of e-fuels for (international) aviation is a perfect transnational case for a circular development related to tourism, which also directly contributes to international targets for mitigating climate change, in line with Sustainable Development Goal 13 (Climate Action).

59. Various projects are under development. In the Netherlands, the start-up Synkero, in collaboration with the Port of Amsterdam, Schiphol Airport, KLM and SkyNRG, aims to develop a commercial plant in the Port of Amsterdam, using waste CO_2 and green hydrogen.[232,233] SkyNRG is also building a factory for e-fuels in Delfzijl (Netherlands), with KLM, Schiphol Airport and SHV Energy.[234] The Zenid initiative, with Uniper, Rotterdam The Hague Airport, Climeworks, SkyNRG and Rotterdam The Hague Innovation Airport, aims to construct a demonstration factory for sustainable kerosene using captured CO_2 from

[228] UNWTO and UNEP, *Baseline Report on the Integration of Sustainable Consumption*.

[229] Manniche and others, *Destination: A circular tourism economy*.

[230] Energy Transitions Commission, *Mission possible: Reaching net-zero carbon emissions from harder-to-abate sectors by mid-century* (n.p., Energy Transitions Commission, 2018).

[231] Patrick Schmidt and others, "Power-to-Liquids as Renewable Fuel Option for Aviation: A Review", *Chemie Ingenieur Technik*, vol. 90, No. 1–2 (January/February 2018), pp. 127–140.

[232] Synkero, "Synkero: Futureproof aviation", available at https://synkero.com/wp-content/uploads/2021/06/Synkero-White-Paper.pdf.

[233] The mention of commercial companies, services or products does not imply endorsement by the United Nations or its Member States.

[234] SkyNRG, "SkyNRG, KLM and SHV Energy announce project first European plant for sustainable aviation fuel", 7 May 2019, available at https://skynrg.com/press-releases/klm-skynrg-and-shv-energy-announce-project-first-european-plant-for-sustainable-aviation-fuel/.

the air as a raw material in Rotterdam.[235] The Norwegian consortium Norsk e-Fuel is planning a commercial plant for hydrogen-based renewable aviation fuel.[236] In February 2021, KLM announced having carried out a passenger flight partly flown on sustainably produced synthetic kerosene, based on CO_2, water and renewable energy from solar and wind energy.[237]

60. The production process does require a very high amount of energy, however, which could further increase the mismatch between the demand for and failing increase in renewable electricity supply, and these fuels will be two to six times more expensive than Jet A was in 2017. E-fuels cannot enter the market without a very substantial tax on fossil kerosene and/or subsidies, or through the application of a mixing mandate with an increasing share over time, up to 100 per cent in 2050.[238] A mandate would be the most direct and secure way to reach the goal of zero aviation emissions in 2050, with the costs falling on airlines and thus passengers (polluter-pays principle). Mixing mandates are already included in national level aviation policies in Germany, the Netherlands, Norway and Sweden. The European Union announced its "Fit for 55" package of regulatory proposals on 14 July 2021, of which a part is a blending mandate for sustainable aviation fuel.[239]

[235] SkyNRG, "Consortium launches Zenid – Sustainable Aviation Fuel from Air", 8 February 2021, available at https://skynrg.com/press-releases/consortium-launches-zenid-sustainable-aviation-fuel-from-air/.

[236] Norsk e-fuel, "Supplying your renewable fuel. Unlimited.", available at www.norsk-e-fuel.com/en/.

[237] KLM, "World first in the Netherlands by KLM, Shell and Dutch ministry for Infrastructure and Water Management: first passenger flight performed with sustainable synthetic kerosene", 8 February 2021, available at https://news.klm.com/world-first-in-the-netherlands-by-klm-shell-and-dutch-ministry-for-infrastructure-and-water-management-first-passenger-flight-performed-with-sustainable-synthetic-kerosene/.

[238] Jörgen Larsson and others, "International and national climate policies for aviation: a review", *Climate Policy*, vol. 19, No. 6 (January 2019), pp. 787–799.

[239] European Commission, Proposal for a Regulation of the European Parliament and of the Council on ensuring a level playing field for sustainable air transport, COM(2021) 561 final.

V. Strengthening environmental governance

This section is DRAFT. Something more on gender might be included. .

A. Introduction

"Today's multilateral system is too limited in its instruments and capacities, in relation to what is needed for effective governance of managing global public goods." – Secretary-General of the United Nations, to the General Assembly on 21 September 2021.

This chapter examines environmental governance based on indicators and how it may be improved. Environmental governance relates to decision-making on the environment and natural resources and the interactions that take place between different actors, whether the state, private sector or civil society and at different levels, from global to local. This chapter focuses on the regional to national levels of governance. Our main interest here is in decisions, often commonly agreed, that further environmentally-sustainable development.

Given that the Ninth Environment for Europe Ministerial Conference is being held in conjunction with a meeting of Ministers of Environment and Education, and the importance of education for participative and informed decision-making, this chapter also addresses education for sustainable development.

B. Intergovernmental bodies

1. Regional and subregional bodies

The highest-level regional meeting on environment is the Environment for Europe Ministerial Conference, prepared by the ECE Committee on Environmental Policy but also functioning informally as a regional forum for the United Nations Environment Assembly.

Numerous other international bodies support environmental governance at a subregional level, including:

(a) The GREEN Action Programme Task Force, established under the Environment for Europe Ministerial Process and serviced by OECD, with its focus supporting countries in Eastern Europe, the Caucasus and Central Asia to reconcile their environment and economic goals;

(b) The Executive Committee of the International Fund for saving the Aral Sea, which promotes cooperation between the Central Asian Governments in the field of water resources and environmental management. Its subsidiary bodies include the Interstate Commission on Sustainable Development;

(c) Bodies of the European Union, notably the European Environment Agency, whose task is to provide sound, independent information on the environment through its European environment information and observation network (Eionet), which brings together member (European Union members, plus Iceland, Liechtenstein, Norway, Switzerland and Turkey) and cooperating (West Balkan) countries.

With the dissolution of the Regional Environmental Centre for Central and Eastern Europe, only two (sub-) regional centres remain: that for the Caucasus and that for Central Asia.

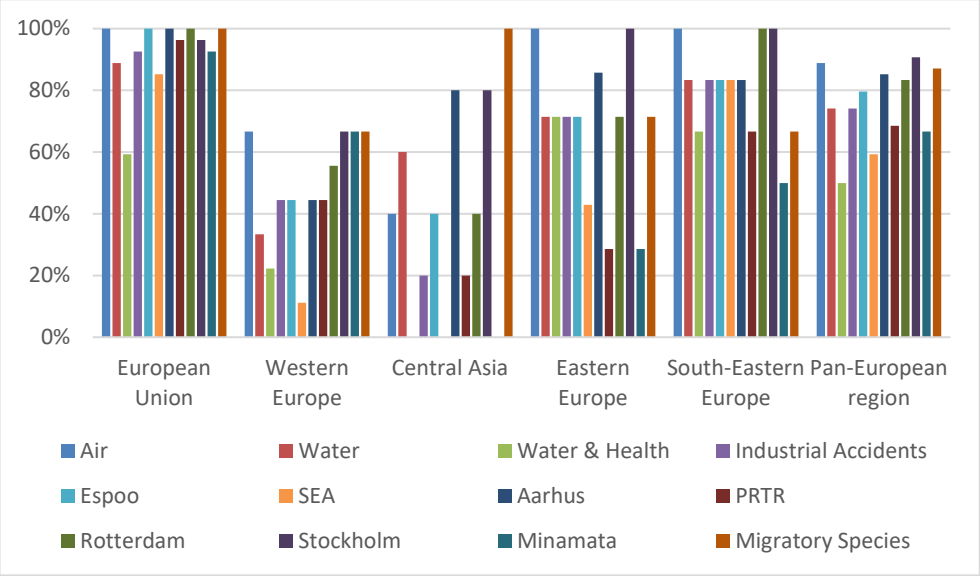
2. Treaty bodies

The region's multilateral environmental agreements also provide a forum for environmental governance through their treaty bodies, including governing bodies, working groups and implementation or compliance bodies. These agreements include the ECE environmental treaties as well as, for example, the Barcelona Convention, the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas, the Framework Convention on the Protection and Sustainable Development of the Carpathians and, aiming at the protection and sustainable development of the Alps, the Alpine Convention.

Membership of these agreements (see figure below) and attendance at meetings of their governing bodies is not sufficient to ensure improved environmental governance, though the level of membership plainly exceeds the level of 50 per cent noted in the regional GEO-6 report. However, the effectiveness of some of these agreements can be measured through reporting, implementation and compliance mechanisms and, indirectly, by the achievement of their aims. For example, one of the obligations of Parties to the ECE Water Convention is to enter into agreements on transboundary water cooperation. This obligation corresponds to SDG indicator 6.5.2 on the proportion of transboundary basin area with an operational arrangement for water cooperation" (see figure below, in which improvements reflect better reporting rather than new agreements).

In the case of the Air Convention, one of the basic obligations is to report national emission inventories. Emission inventories reported by Parties to the Convention in 2019 demonstrate in more than 90 per cent of cases a reduction in air pollutant emissions in the region. Regular reporting by countries of their emissions inventories enables the assessment of emission reduction trends and emission control strategies in support of informed policymaking and decision-making. In that regard, in the 2016 Scientific Assessment Report of ECE, it was detailed how reductions in particulate matters concentrations at European measurement sites and in the United States of America had declined by approximately one third between 2000 and 2012 and declined by 4 per cent in Canada, leading to an estimated prevented 600,000 premature deaths annually.

Figure
Membership of selected regional and global multilateral environmental agreements, by subregion, per cent of countries in each subregion that are parties

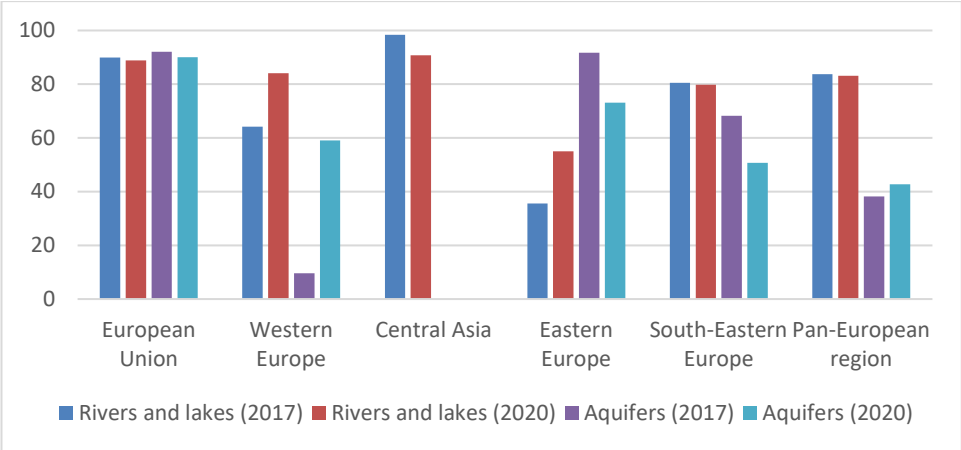


Source: United National Treaty Collection and websites of treaties.

Notes: Expand names.

Figure

Proportion of transboundary basin area with an operational arrangement for water cooperation, by subregion, for rivers and lakes and for aquifers, per cent (2017 and 2020)



Source: UN Stats SDG indicator database. National values weighted by area in a transboundary basin, whether surface or groundwater, to generate subregional values. No data for Israel, Russian Federation, Tajikistan or Turkey, nor – in the case of aquifers, and among others – Finland, France, Portugal, Spain or Turkmenistan. No reported arrangements for aquifers in Central Asia.

ECE Convention secretaries have been invited to propose some measures of effectiveness of MEAs, e.g., compliance cases under the Aarhus or Espoo Conventions, or Protocol on SEA. .

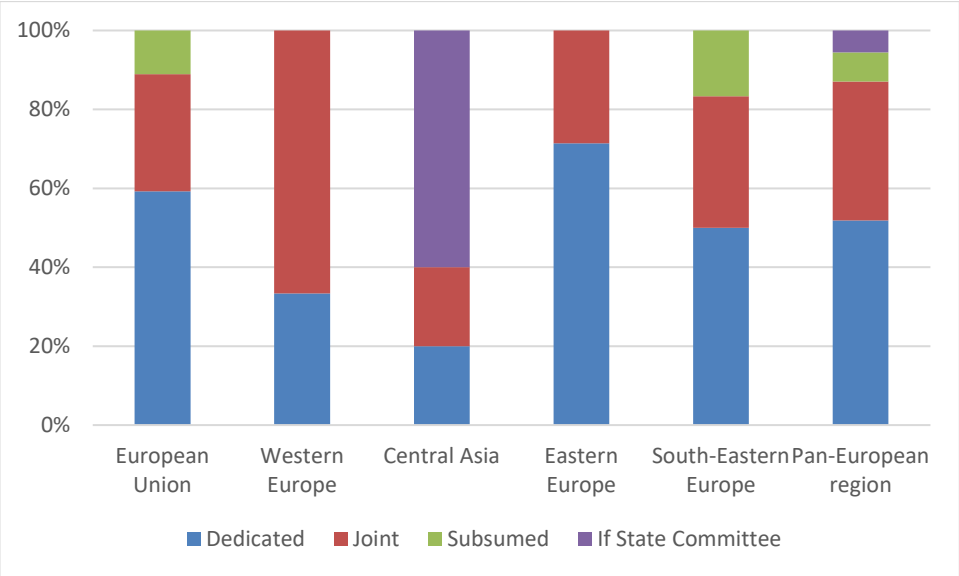
C. National institutions and legislation

At the national level, the weight given the national environmental policy authority reflects the political priority given to environmental protection and is rather even across the region (the smaller States in Western Europe often have ministries leading on multiple portfolios, including the environment, because of the low number of ministers).

National legislation – application and compliance – might be measured through the number of environmental court cases and rate of prosecution, the number of inspections or the completeness of legislation (implementing regulations). .

Figure[240]

Status of the main national environmental policy authority in each country, grouped by subregion, per cent (as at 1 March 2021)



Source: ECE website

Notes: "Dedicated" ministry, including if with climate change, water, forests, spatial or planning, natural resources, or sustainable development; "Joint" ministry with at least one other economic sector; "Subsumed" ministry if no mention of the environment in the ministry's name; "If State Committee" includes "State Agency".

D. Civil society

The role of civil society in environmental governance is generally framed by three topics: public participation in decision-making, access to information and access to justice in environmental matters.

These are also the three pillars of the Aarhus Convention and the general SDG indicator on access to information (16.10.2, the number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information) is closely tracked by the number of Parties to the Convention (see figure below).

SDG indicator 16.7.2 (the proportion of population who believe decision-making is inclusive and responsive, by sex, age, disability and population group) could provide a similar picture for the pillar on public participation in decision-making, but data are severely lacking at present.

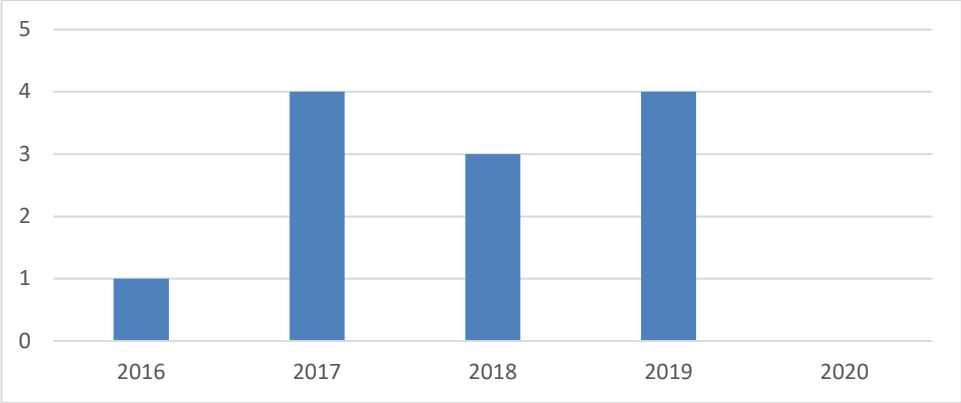
Access to justice is even more difficult to track. The number of environmental defenders killed might be used, but the tally is mercifully in the pan-European region (see figure). The number of environmental courts or courts with environmental units, or the number of environmental lawyers, per capita might provide more positive measures of access to justice in environmental matters.

A paragraph might be added per pillar from the latest *Synthesis report on the status of implementation of the Aarhus Convention* (ECE/MP.PP/2021/6), prepared further to the sixth reporting cycle (2017–2020) under the Aarhus Convention.

For decision-making, a paragraph might be added using the *Third Review of Implementation of the Protocol on Strategic Environmental Assessment (2016–2018)* (ECE/MP.EIA/SEA/14), in relation to public participation. .

[240] Should be checked in 2022.

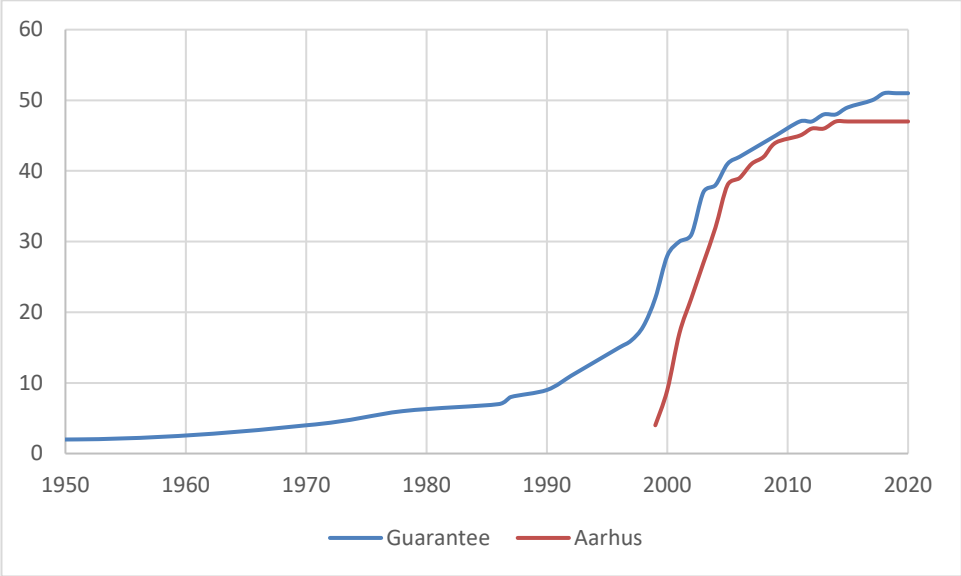
Figure
Number of environmental defenders killed each year (2016–2020)



Source: Global Witness, annual reports, 2017–2021

Note: Zero reported deaths in 2020.

Figure
Cumulative number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information (SDG indicator 16.10.2) and number of Parties to the Aarhus Convention (to date)



Note: Sweden adopted such a guarantee in 1766. The Aarhus Convention was adopted in 1999.

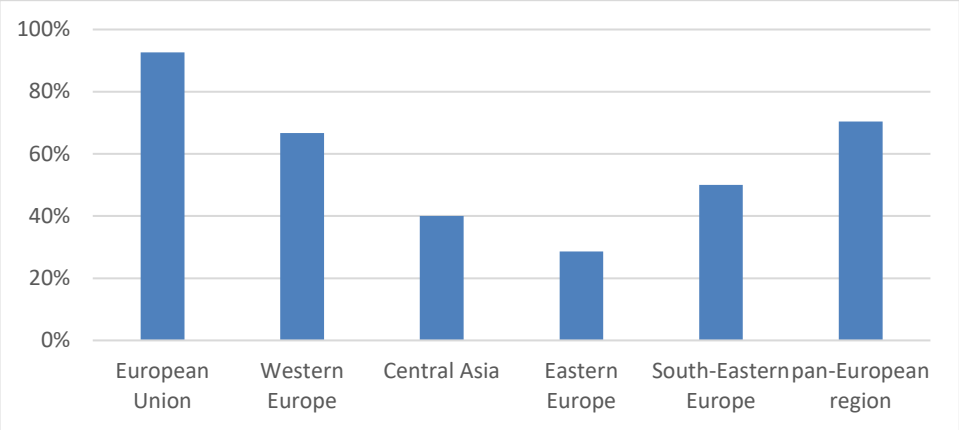
E. Private sector

One indicator of the engagement of the private sector is sustainability reporting (SDG indicator 12.6.1). A simple measure of whether any company in a country publishes a minimal report gives a fairly predictable picture across the subregions (see figure below), but the sparsity of the reporting undermines any possible message. As reporting improves, more meaningful values may emerge. The reporting obligations of large companies within the

European Union (Corporate Sustainability Reporting Directive) should alter the picture for European Union member States.

Figure

Proportion of countries in each subregion in which at least one company published a minimum requirement sustainability report (SDG indicator 12.6.1), per cent



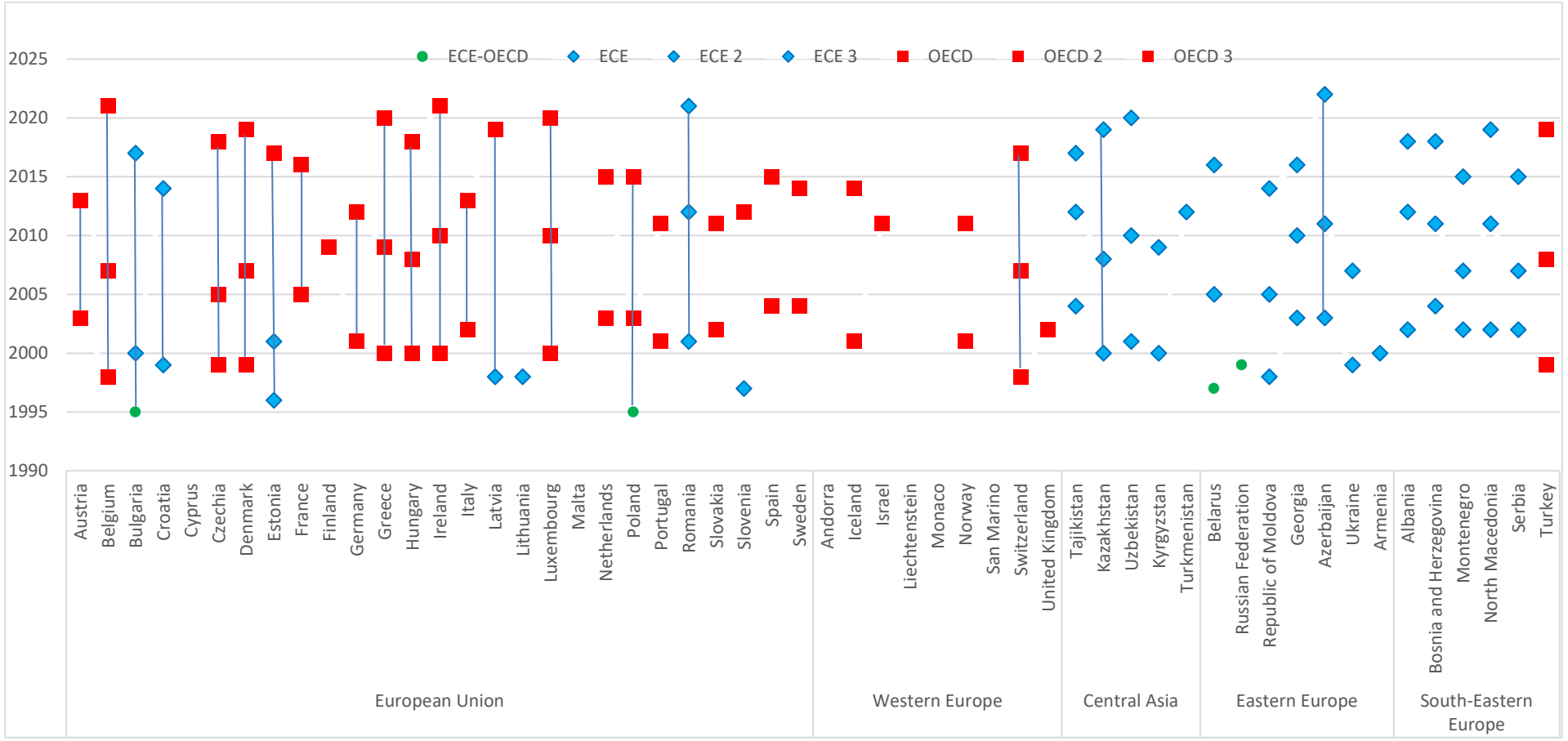
Notes: Notes will be on data availability

F. Reviewing progress made and guiding future steps

The peer-reviewed environmental performance reviews (EPRs) carried out by ECE and OECD provide a mechanism for the regular impartial review of progress in environmental governance. The reviews also provide recommendations on how environmental performance and governance may be improved. The figure records EPRs carried out in the pan-European region since their instigation in 1995. The methodologies employed by ECE and OECD have evolved over the past 25 years. The latest, fourth cycle of ECE reviews introduces …

The figure shows some gaps in coverage by the EPR programmes and the opportunities that exist for countries to benefit from further reviews employing the latest methodologies.

Figure
Environmental performance reviews (1995–2022)



Note: The Third Review of Romania was published in late 2021; the third review of Azerbaijan was underway in 2022. [*Markers for a country might be joined as a sequence, with a few examples shown above*.]

G. Education for sustainable Development

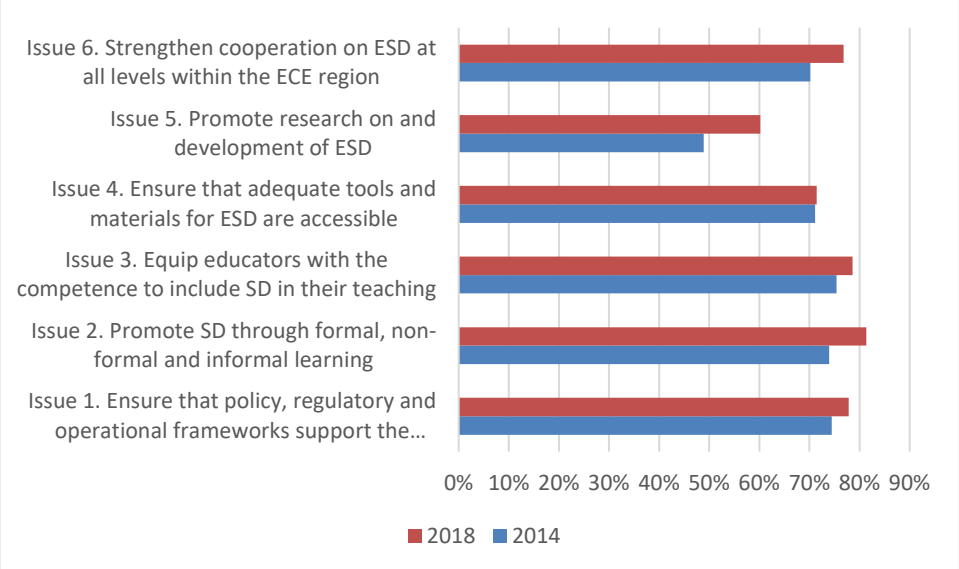
Education for sustainable development (ESD) equips people with knowledge and skills to give them opportunities to lead healthy and productive lifestyles in harmony with nature and with concern for social values, gender equity and cultural diversity. Such education also endows people with capacities to play an active role in environmental governance. The UNECE Strategy for Education for Sustainable Development provides a framework for ESD in the pan-European region.

Periodically, a questionnaire is issued to member States to gather information on the state of ESD in each country. The two latest rounds of information gathering were in 2014 and 2018. Six issues are monitored against a series of 51 criteria. The first figure below shows progress made across all six issues. For five of the issues the level of achievement has risen from above 70 per cent to close to 80 per cent; only for the issue of research and development is a lower level of achievement evident.

ESD is also reflected in the 2030 Agenda for Sustainable Development and in initiatives of UNESCO. For example, UNESCO published an ESD roadmap in 2020 (having adopted it in 2019, https://unesdoc.unesco.org/ark:/48223/pf0000374802.locale=en) and gathers detailed data in relation to the related SDG indicator (4.7.1, 12.8.1 or 13.3.1), as shown in the figure below for a few countries. For the countries for which data are available, it is apparent that more female students show an adequate understanding of issues relating to global citizenship and sustainability than their male counterparts. There is also a great disparity in levels of understanding between countries, even those that are members of the European Union.

Also in 2019, the General Assembly adopted a resolution (A/RES/74/223) on ESD in the framework of the 2030 Agenda. It called upon the international community to provide inclusive and equitable quality education at all levels so that all people may have access to lifelong learning opportunities that help them to acquire the knowledge and skills needed to exploit opportunities to participate fully in society and contribute to sustainable development.

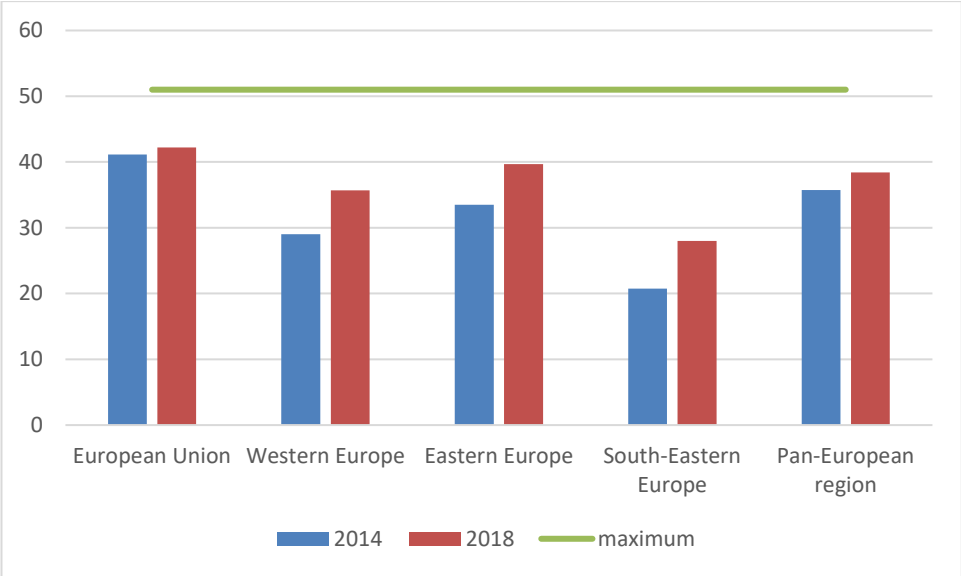
Figure
Proportion of maximum number of criteria met, by issue, per cent (2014 and 2018)



Source: ECE

Figure

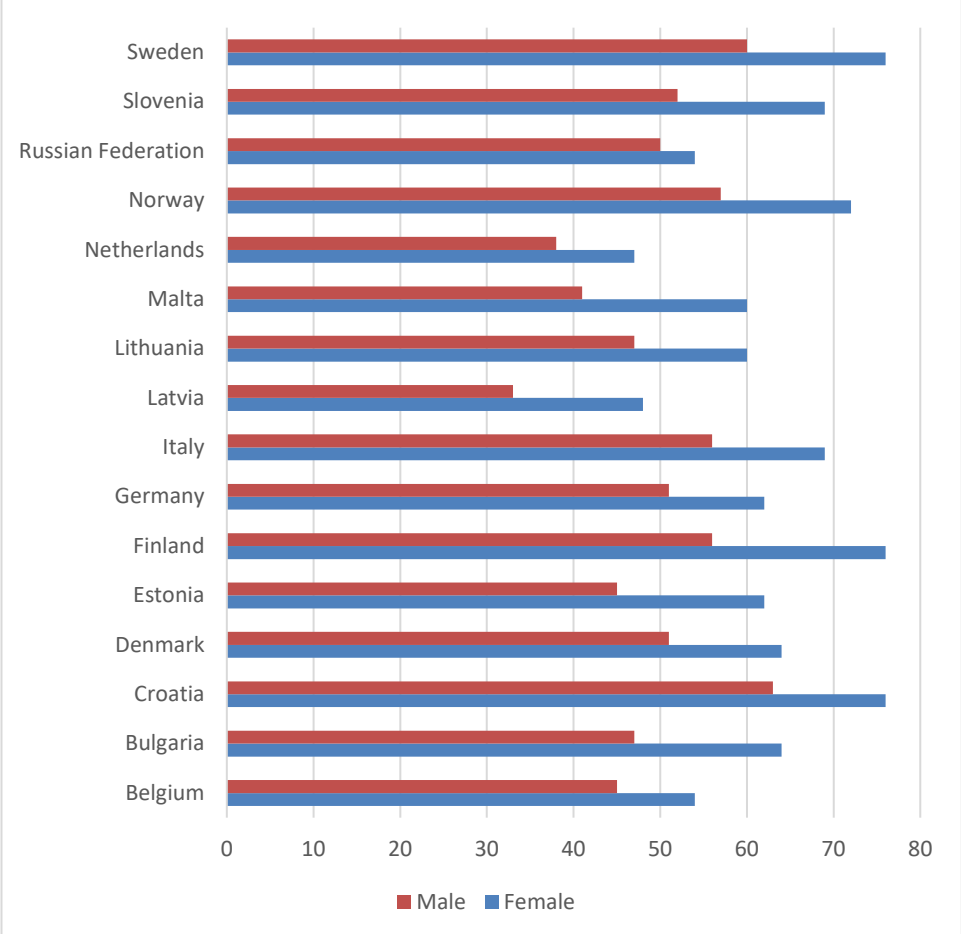
Total number of criteria met by subregion, with a maximum possible of 51 (2014 and 2018)



Source: ECE …

Figure

Proportion of students in lower secondary education showing adequate understanding of issues relating to global citizenship and sustainability, by sex (countries reporting), per cent (2016)



Source: UNESCO …

H. Recommendations to address governance gaps

Recommendations to address policy and governance gaps will be included here, for example, on parallel structures and competition, contradictions, gaps, macro to micro coherence, etc. .

Encourage reporting on SDG indicator 16.7.2 (proportion of population who believe decision-making is inclusive and responsive, by sex, age, disability and population group).

The Regional Environmental Centres should be strengthened so that they may continue to perform in implementing initiatives to improve environmental governance at all levels.

Encourage countries to benefit from the ECE and OECD environmental performance review programmes by undertaking further reviews.

VI. Way forward

This section is still being developed. At present it is in list format but will be a narrative. .

In general, countries should assume the principle of "common but differentiated responsibilities", but not necessarily when it comes to reporting obligations.

International organizations should facilitate medium- and long-term sustainable mobilization of funds for climate action, by promoting the use of available regional and global funds and mechanisms, and providing technical assistance addressing real needs.

ECE should urge donors to contribute to the adequate replenishment of the Multilateral Fund for the implementation of the Montreal Protocol in order to accelerate the phasing out of hydrochlorofluorocarbons globally.

Cooperation should be enhanced so that non-European Union countries in the region could have the possibility to benefit from the experience on the European Union zero-pollution action plan.[241]

ECE should implement a programme promoting the maintenance of a judicious balance between SOC accumulation for higher crop productivity and SOC storage for climate change mitigation, as this is critical for mainstreaming global sustainable initiatives such as "4 per 1000".[242]

In a condition of intense rural exodus, more active measures should be implemented to reverse the depopulation trend through the diversification of incomes, such as by the development of rural tourism, and the attraction of new settlers. Regional programmes can be devised on promoting rural sustainable tourism, on recognizing the biodiversity value of multi-species forests, low-intensity farmland, and farming in marginal areas.

ECE and governments should take urgent action to reduce key pressures to halt the degradation of coastal waters, marine ecosystems and seas. In particular, joint efforts should be taken where subregional measures are deemed necessary, as in the Caspian Sea where there is no reliable information on the presence or amount of litter discharged into the coastal or marine environment. More generally, climate change, biodiversity loss and pollution threats are intricately connected and constitute the triple planetary crisis.

The theme "Coastal waters, marine ecosystems and seas", associated indicators and dataflows should be included as a theme within the ECE set of environmental indicators. Promising new developments related to data (e.g. earth observation, artificial intelligence, citizen monitoring, models and novel in-situ measurements) should be considered to improve the spatial and temporal coverage, including the need for long-term time-series data to understand climate-change impacts.

Efforts should be done in the region regarding knowledge sharing that allow decision-makers at all levels to tap into the potential gain from using the existing good practices. Governance of chemicals and waste must be made fitter for the challenges of today and the years of transition of our economies that lie ahead of us by better balancing risks and opportunities.

ECE and member States should work on establishing a mechanism across countries and sectors to identify and share benchmarks and good practices for resource efficiency in production processes. Administrations should make efforts to establish a region-wide chemicals and waste impact-oriented monitoring scheme, as a cooperation between science

[241] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Pathway to a Healthy Planet for All EU Action Plan: "Towards Zero Pollution for Air, Water and Soil" (COM/2021/400 final), available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0400&qid=1623311742827.

[242] "4 per 1000" is a voluntary action initiative adopted at the Paris climatic summit in 2015 that aims to boost carbon storage in agricultural soils by 0.4 per cent each year (https://www.4p1000.org/).

and policy, to achieve a better picture of the adverse impacts of chemicals on human health and the environment, and to address them.

A pan-European e-waste management partnership should be established. This partnership would aim at the effective collection and sound handling of recyclables to enable the recovery of valuable resources. An urgent priority is the recovery of secondary resources from e-waste, especially in view of the rapidly growing quantities across Eastern Europe, South-Eastern Europe and Central Asia.

Pan-European region decision makers and entrepreneurs should apply circular economy principles across the tourism value chain. A value chain approach could accelerate the transformation to more circularity in tourism and increase its long-term health and resilience. Tourism has the potential of long-lasting positive impacts beyond the sector itself, due to its interlinkages with other economic activities and the direct producer-consumer interaction;

The ECE member states and governing bodies select number of specific key-impact tourism indicators to be included in ECE statistical databases.

Abbreviations

To be added later. .

Glossary

To be added later. .

Sources

To be added later. .