Revised Guidelines for the Application of Environmental Indicators (completed parts)

Note by the Joint Task Force on Environmental Statistics and Indicators

Summary

This document presents the completed parts of the Revised Guidelines for the Application of Environmental Indicators after discussion at the nineteenth session of the Joint Task Force on Environmental Statistics and Indicators and its approval in form of a silence procedure.

The organization of the environmental indicators follows the structure of the United Nations Framework for Development of Environment Statistics.

This is a background document of the "Regional training on air quality and emissions to air statistics and indicators" (Geneva, 4-5 May 2023) and requires further editing.

I.   Background

1.   At its fourteenth session, the Joint Task Force on Environmental Statistics and Indicators emphasized the need to keep the Guidelines on Environmental Statistics and Indicators under review and work towards their alignment with the 2030 Agenda for Sustainable Development. In its following sessions, the Joint Task Force requested the secretariat to review the United Nations Economic Commission for Europe (ECE) set of environmental indicators and the associated guidelines in particular to:

(a)   Inform better the recent global policies (such as the 2030 Agenda, Paris Agreement and Sendai Framework for Disaster-risk Reduction);

(b)   Link them with statistical frameworks, such as the United Nations Framework for the Development of Environment Statistics (FDES)[1] and the System of Environmental-Economic Accounting – Central Framework (SEEA-CF);

(c)   Increase user-friendliness of the metadata.

2.   In consultation with members of the Joint Task Force the secretariat has:

(a)   Revised the organization and content of the indicators presented in the first version of the Guidelines to better align it with FDES;

(b)   Updated the methodological descriptions, policy references and methodological references;

(c)   Proposed new indicators (e.g., Sustainable Development Goal (SDG) indicators) and suggested the replacement or deletion of existing indicators.

3.   At its seventeenth session (Geneva (hybrid), 26 October 2020) the Joint Task Force agreed to the proposal of the secretariat to make a distinction between indicators and underlying data and statistics using FDES as the overall framework and structure. Furthermore, the Joint Task Force emphasized the importance of harmonizing the indicators with the indicator system employed by the European Environment Information and Observation Network (EIONET) of the European Environment Agency.

4.   At its eighteenth session (Geneva (hybrid), 18–19 October 2021) (followed by a silence procedure), Joint Task Force members agreed on the list of indicators to be part of these guidelines, including a list of priority indicators. Priority indicators will be implemented by countries with priority, and the ECE secretariat has given them priority for finalizing their detailed description in the form of metadata sheets.

5.   Additional indicators used in the pan-European environmental assessment (see ECE/NICOSIA.CONF/2022/9) were added.

II.   Alignment of the list of indicators with the United Nations Framework for the Development of Environment Statistics

A.   Clarification of terminology

6.   The first version of the ECE *Guidelines for the Application of Environmental Indicators* (published in 2007)[2] did not define the term "indicator", which created some confusion for users. The term "indicator" was used for different issues, such as thematic areas, indicators (in a traditional sense) and their underlying data.

7.   A clear conceptual distinction between "environmental indicators", "environment statistics" and "environmental data" is important for producers and users of these statistics, and for structuring these revised *Guidelines for the Application of Environmental Indicators*.

---

[1] As endorsed in 2013 and available at https://unstats.un.org/unsd/envstats/fdes.cshtml.

[2] See https://www.unece.org/env/indicators.html.

8.   To align the revised Guidelines with FDES to the maximum extent possible, the FDES definitions of environmental data, environmental statistics and environmental indicators are used.[3]

B.   Distinction between "indicators" and "data and statistics" in the revised Guidelines

9.   The revised Guidelines make a clear distinction between "environmental indicators" and "underlying data and statistics". Generally speaking, "data and statistics" are data items that have to be produced only once and can be used for the calculation of multiple indicators. Some of them can be also considered as "indicators" in themselves.

10.   The revised Guidelines therefore:

        (a)   Describe indicators mainly from the perspective of policy relevance and how to calculate them (including which data and statistics are needed);

        (b)   Present a list of environmental data and statistics (linked with FDES and existing methodological guidance) that can be used for calculating the indicators.

11.   This approach avoids redundancies in the Guidelines, but also helps National Statistical Offices, Ministries of Environment and other data producers in their efforts to develop comprehensive official environmental statistics that can be used for multiple purposes.

C.   Grouping of the list of indicators

12.   The first version of the Guidelines organized the list of indicators under 10 environmental themes, resulting in a list of 49 "indicators" (some of them still placeholders).

13.   As explained earlier, the list of environmental indicators is actually much larger than presented in the first version of the Guidelines. Furthermore, some of the groupings in the first version were not straightforward, for example:

        (a)   Theme B – climate change:

                (i)   Climate change is a cross-cutting issue that should cover all main climate change phenomena related to climate change drivers, greenhouse gas emissions, climate change impacts, climate change mitigation and adaptation;

                (ii)   In the first version of the guidelines, the indicator group included atmospheric phenomena (temperature and precipitation) as well as greenhouse gas emissions;

                (iii)   Important climate change-related issues were also addressed in other groupings (e.g., in environmental themes related to air pollution and energy);

        (b)   Theme C – water:

                (i)   This theme combined issues related to freshwater resources, water use, freshwater quality, access to water-related services, wastewater treatment and quality of coastal waters;

                (ii)   This combination resulted in a relatively large theme with many "indicators" that are actually related to different policy frameworks and use different types of underlying data and statistics.

14.   The revised Guidelines therefore use a different grouping of indicators by using the FDES hierarchical structure of components, subcomponents and topics. Using the FDES themes helps to link the production of indicators and underlying statistics with this internationally agreed framework. Furthermore, the grouping is (with some exceptions)

---

[3] Missing components, subcomponents and topics can be taken from FDES in case further indicators are added in the future.

mutually exclusive. Important policy domains such as climate change are mentioned as cross-cutting (meaning they require indicators, statistics and other data from several domains), but are not considered as a separate topic in FDES. The revised Guidelines also benefit from the core set of climate change-related indicators adopted by the Conference of European Statisticians, hereinafter referred to as the "CES climate indicators".

15.   This approach also allows the organization of the indicators and underlying statistics and data in the hierarchical structure of FDES, which is according to components, subcomponents and topics.

16.   Applying the structure of FDES results in renaming indicator groups, splitting indicator groups and moving some indicators to other groups as shown in table 1.

Table 1
Revised grouping of indicators

Previous environmental theme	New grouping used in the revised guidelines	FDES topic
A – Air pollution and ozone depletion	Air quality	1.3.1
	Exposure to ambient pollution	5.1.4
	Emissions of greenhouse gases (GHGs)	3.1.1
	Consumption of ozone depleting substances (ODSs)	3.1.2
	Emission of other substances to air	3.1.3
B – Climate change	Atmosphere, climate and weather	1.1.1
C – Water	Water resources	2.6.1
	Abstraction, use and returns of water	2.6.2
	Access to selected basic services	5.1.2
	Freshwater quality	1.3.2
	Marine water quality	1.3.3
	Generation and pollutant content of wastewater	3.2.1
	Collection and treatment of wastewater	3.2.2
	Discharge of wastewater to the environment	3.2.3
D – Biodiversity	Ecosystems and biodiversity	1.2.2
	Forests	1.2.3
	Use of forest land	2.3.2
E – Land and soil	Soil characteristics	1.1.4
	Land use	2.3.1
F – Agriculture	Release of chemical substances	3.4.1
G – Energy	Production, trade and consumption of energy	2.2.2
H – Transport	Environmental concerns specific to urban settlements	5.1.5
I – Waste	Generation of waste	3.3.1

Previous environmental theme	New grouping used in the revised guidelines	FDES topic
	Management of waste	3.3.2
J – Environmental financing	Environmental protection and resource management expenditure	6.1
	Environmental regulation and instruments	6.2.2

D. Organization of the list of indicators in the revised guidelines

17.   The FDES structure is used to organize the revised list of ECE environmental indicators in table 2. This helps to check the completeness of the list of indicators, identify new indicators and assign them to the right place in this indicator framework.

Table 2
Revised structure of organizing the environmental indicators

Component	Subcomponent	Topic
Environmental conditions and quality	Physical conditions	Atmosphere, climate and weather
		Soil characteristics
	Land cover, ecosystems and biodiversity	Ecosystems and biodiversity
		Forests
	Environmental quality	Air quality
		Freshwater quality
		Marine water quality
Environmental resources and their use	Energy resources	Production, trade and consumption of energy
	Land	Land use
		Use of forest land
	Soil resources	Soil resources
	Water resources	Water resources
		Abstraction, use and returns of water
Residuals	Emissions to air	Emissions of greenhouse gases (GHGs)
		Consumption of ozone depleting substances (ODSs)
		Emissions of other substances to air

Component	Subcomponent	Topic
	Generation and management of wastewater	Generation and pollutant content of wastewater
		Collection and treatment of wastewater
		Discharge of wastewater to the environment
	Generation and management of waste	Generation of waste
		Management of waste
	Release of chemical substances	Release of chemical substances
Extreme events and disasters	Natural extreme events and disasters	Natural extreme events and disasters
		Impact of natural extreme events and disasters
Human settlements and environmental health	Human settlements	Access to selected basic services
		Exposure to ambient pollution
		Environmental concerns specific to urban settlements
Environmental protection, management and engagement	Environmental protection and resource management expenditure	
	Environmental governance and regulation	Environmental regulation and instruments
		Participation in multilateral environmental agreements and environmental conventions
	Extreme event preparedness and disaster management	Preparedness for natural extreme events and disasters
	Environmental information and awareness	Environmental information
		Environmental education

18. The first version of the Guidelines did not cover the full scope of FDES. Furthermore, the seventh pan-European environmental assessment identified policy areas that cannot be informed sufficiently with environmental indicators, such as circular economy, sustainable tourism and sustainable infrastructure. Therefore, the Joint Task Force is invited to discuss

whether the scope of ECE environmental indicators should be broadened, for example to also include indicators and statistics related to:

(a)   Extreme events and disasters (FDES component 4);

(b)   Hydrographical characteristics (FDES topic 1.1.2);

(c)   Geological and geographical information (FDES topic 1.1.3);

(d)   Soil pollution (FDES topic 1.3.4);

(e)   Noise (FDES topic 1.3.5);

(f)   Land use (FDES topic 2.3.1);

(g)   Institutional strength (FDES topic 6.2.1);

(h)   Indicators for emerging policy themes (e.g., circular economy, sustainable infrastructure).

E   Data disaggregation

19.   Different users need environmental indicators and statistics at different levels of aggregation and depths of information. They may need cross-cutting environmental indicator data sets, for instance regarding climate change or circular economy. In other cases, they may be interested only in particular topics and themes pertaining to specific sectoral analysis and policymaking. Policy- and decision-makers at the highest levels and the general public would tend to use environmental indicators and more aggregated statistics. Environmental administrators, researchers, analysts and academics may be more inclined to examine extensive and detailed environment statistics. International agencies typically have well-articulated needs for environment statistics based on environmental agreements or international data collection processes.20. While it is important to align the temporal aggregations of environmental data with those used in economic and social statistics to ensure their proper integration, a uniform calendar or fiscal year often does not correspond to the diversity of natural phenomena. Therefore, different time scales—or longer or shorter time periods—must also be used to aggregate environmental data over time. The environmental data used in environment statistics are measured or monitored at various frequencies. Certain features of natural growth of biomass (e.g., in a natural, slow-growing forest that is not subject to logging) or processes such as changes in land cover or soil erosion do not justify or require frequent, diligent monitoring because the most relevant changes may be observed on an annual, or even much less frequent, basis. Other environmental processes, however, change so quickly that measurements are needed hourly or even more frequently (e.g., air quality).

21.   The occurrence and impacts of environmental phenomena are distributed spatially without regard for political-administrative boundaries. The most meaningful spatial units for environment statistics and indicators are either: natural units, such as watersheds, ecosystems, eco-zones, landscape or land cover units; or management and planning units based on natural units, such as protected areas, coastal areas or river basin districts. While environment statistics are usually collected and aggregated for natural physical, geographical and administrative areas, the concept of economic territory is used for environmental-economic accounting. This involves a geographic boundary that defines the scope of an economy. Economic territory is the area under the effective control of a single government. It includes the land area of a country, including islands, airspace, territorial waters and territorial enclaves in the rest of the world. Economic territory excludes territorial enclaves of other countries and international organizations located in the reference country.

22.   In addition to the above temporal and spatial considerations, other disaggregation dimensions may be considered for the production and sharing of the proposed indicators, including economic activity, ethnicity, gender and household income. These disaggregation dimensions are, for example, relevant in the context of the central transformative promise of the 2030 Agenda for Sustainable Development and its Sustainable Development Goals: Leave no one behind.

III.   Selection of the proposed indicators

23.   The indicator metadata are maintained by ECE in an electronic database, which is still in development and currently not accessible by external users. However, the finalized metadata will be made available as an informal document and gradually posted on the ECE website.

24.   This chapter presents the status of work on revising the indicators as of March 2023. The structure as outlined in section 2.3 is applied.

25.   Each indicator has received a unique identification number. The number provides a link back to the structure used in the first indicator Guidelines, by using the letter of the original indicator grouping and the number of the original "indicator".

26.   For example, indicator B-1.2 (Annual average temperature) was originally part of indicator B1 (Air temperature), in environmental theme B. Climate change. As the "indicator" B1 actually consists of four different indicators, a consecutive number has been added after B-1 and the indicator is in the revised guidelines part of the topic "atmosphere, climate and weather".

27.   The indicator selection is based on a review of the full list of ECE environmental indicators in the first version of the Guidelines,[4] and a careful review carried out in close collaboration with the Joint Task Force (for example, as a result of the discussions held at the sixteenth (Geneva, 28–29 October 2019), seventeenth and eighteenth sessions of the Joint Task Force) and by the secretariat with support of external consultants. In a silence procedure following the Joint Task Force's eighteenth session, the list of indicators as presented herein was agreed upon. The ECE secretariat added additional indicators used for the pan-European environmental assessment.

28.   The revised list of proposed indicators takes into account various policy frameworks, multilateral environmental agreements and related indicator frameworks.

29.   The indicators are presented in tables having the following four columns:

(a)   ID: Unique identifier. The identifier is a combination between the originally used indicator coding (e.g., B1) and a consecutive number added to it. See explanation given above;

(b)   Name of the indicator: "*" indicates that this indicator is used in the pan-European environmental assessment (PEEA);

(c)   "Priority indicator": The Joint Task Force agreed that this indicator has priority for national implementation and finalization of related metadata sheets;

(d)   Comments.

A.   Component "environmental conditions and quality"

30.   In alignment with FDES component 1, this component includes indicators of the physical, biological and chemical characteristics of the environment and their changes over time. These fundamental background conditions are strongly interrelated and determine the types, extent, conditions and health of ecosystems. Many of these natural conditions change very slowly as a result of natural processes or human influence. Others may show immediate and dramatic effects. Importantly, changes in environmental conditions and quality are the result of combined and accumulated impacts of natural and human processes. Connecting the changes with individual activities or events is thus not a straightforward process.

---

[4]   As available at https://unece.org/guidelines-application-environmental-indicators (status as of 30 August 2021).

1. Subcomponent "physical conditions"

31. The subcomponent on physical conditions captures those physical aspects of the environment that change relatively slowly because of human influence. It contains indicators on meteorological, hydrographical, geological and geographical conditions and soil characteristics. See FDES subcomponent 1.1.

A. Topic "atmosphere, climate and weather" (list of indicators)

32. This topic covers indicators of atmospheric, climatic and weather conditions across territories and over time. See FDES topic 1.1.1. These indicators were previously part of the environmental theme 'B. Climate change' and are listed in table 3.

Table 3
Indicators of the topic "atmosphere, climate and weather"

ID	Name of indicator	Priority indicator	Comments
B-1.1	Mean temperature anomaly (compared to climate normal 1961–1990)	Yes	
B-1.5	Mean temperature anomaly (compared to climate normal 1991–2020)		The World Meteorological Organization will release the new climatic normal in August 2023
B-1.2	Annual average temperature (in country, in capital, second major city, area or region)	Yes	
B-1.3	Maximum monthly average temperature (in country, in capital, second major city, area or region)		
B-1.4	Minimum monthly average temperature (in country, in capital, second major city, area or region)		
B-2.1	Annual deviation from the average precipitation (in country, in capital, second major city, area or region)		
B-2.2	Annual precipitation (in country, in capital, second major city, area or region)	Yes	
B-2.3	Maximum monthly precipitation (in country, in capital, second major city, area or region)		
B-2.4	Minimum monthly precipitation (in country, in capital, second major city, area or region)		
B-2.5	Percentage of land area suffering from unusually wet or dry conditions (Standard Precipitation Index)		
B-2.6	Occurrence of extremes of temperatures and precipitation		

B. Topic "soil characteristics" (list of indicators)

33. Soil is a multifunctional part of the environment. It provides the physical base to support the production and cycling of biological resources, provides the foundation for

buildings and infrastructure, constitutes the source of nutrients and water for agriculture and forestry systems, provides a habitat for diverse organisms, plays an essential role in carbon sequestration and fulfils a complex buffering role against environmental variability, ranging from dampening diurnal and seasonal change in temperature and water supply to the storage and binding of a range of chemical and biological agents. The main environmental concerns about soil pertain to its degradation through soil erosion or nutrient depletion, among other processes. See FDES topic 1.1.4. These indicators were previously part of the theme "E. Land and soil" and are listed in table 4.

Table 4
Indicators of the topic "soil characteristics"

ID	Name of indicator	Priority indicator	Comments
E-2.1	Agricultural area affected by water erosion		
E-2.2	Agricultural area affected by wind erosion		
E-2.4	Proportion of land that is degraded over total land area (SDG indicator 15.3.1)*	Yes	
E-3.1	Progress in management of contaminated sites (number of identified and remediated contaminated sites)		

2. Subcomponent "land cover, ecosystems and biodiversity"

34. This subcomponent organizes environmental indicators on land cover, ecosystems and biodiversity, as well as their recordable changes over time and across locations. Land cover is defined by the Food and Agriculture Organization of the United Nations (FAO) as "the observed (bio)physical cover on the earth's surface." Changes in land cover are the result of natural processes and changes in land use. Ecosystems can be broadly defined as a community of organisms, together with their physical environment, viewed as a system of interacting and interdependent relationships. Biodiversity is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, including diversity within species, between species and of ecosystems. It is also a measure of ecosystem health. Biodiversity is a fundamental characteristic of ecosystems, while variability among ecosystems is a fundamental driver of biodiversity.

A. Topic "ecosystems and biodiversity" (list of indicators)

35. This topic covers physical quantitative as well as qualitative information about a country's main ecosystems, including the extent, chemical and physical characteristics, and biological components (biodiversity) of the ecosystems. The extent and conditions of the ecosystems determine their capacity to produce ecosystem services. See FDES topic 1.2.2. These indicators were previously part of the theme "D. Biodiversity" and are listed in table 5.

Table 5
Indicators of the topic "ecosystems and biodiversity"

ID	Name of indicator	Priority indicator	Comments
D-7.3	Red list of Ecosystems		CBD headline indicator A.1

ID	Name of indicator	Priority indicator	Comments
D-1.1	Share of total protected areas (categories of the International Union for the Conservation of Nature (IUCN)) in the country area*	Yes	PEEA uses "Total area under protection and share of country area"
D-7.2	Extent of natural ecosystems		CBD headline indicator A.2
D-4.4	Red List Index (SDG indicator 15.5.1)	Yes	CBD headline indicator A.3
D-5.3	Proportion of populations within species with an effective population size > 500		CBD headline indicator A.5
D-1.7	Area under restoration		CBD headline indicator 2.2
D-1.8	Coverage of protected areas and other effective area-based conservation measures (OECMs)		CBD headline indicator 3.1
D-6.1	Rate of invasive alien species establishment		CBD headline indicator 6.1
D-1.2	Share of total protected areas (national categories) in the country area		National categories are not comparable across countries, therefore using indicator D-1.1 instead is recommended. However, countries which have not yet implemented IUCN categories may continue using D-1.2 as an alternative.
D-1.3	Coverage of protected areas in relation to marine areas (SDG indicator 14.5.1)*		
D-1.5	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type (SDG indicator 15.1.2)		
D-4.2	Share of species threatened (mammals, birds, fishes, reptiles, amphibians, invertebrates, vascular plants, mosses, lichens, fungi, algae)	Yes	
D-5.1	Volume and distribution of selected species (keystone species, flagship species, endemic species and other species)		
D-2.2	Conservation status of habitats of high importance for biodiversity conservation (conservation status for habitats according to conservation status criteria)		.
C-17.1	Hazardous substances in marine organisms		
D-2.3	Ecosystem coverage		

ID	Name of indicator	Priority indicator	Comments
D-5.2	Proportion of marine fish stocks within biologically sustainable levels (SDG indicator 14.4.1)*	Yes	CBD headline indicator 5.1 (Proportion of fish stocks within biologically sustainable levels)

Note: CBD headline indicators are the headline indicators of the Monitoring framework for the Kunming-Montreal Global Biodiversity Framework as adopted by the Conference of the Parties to the Convention on Biological Diversity at the fifteenth meeting (CBD/COP/DEC/15/5).

B. *Topic "forests" (list of indicators)*

36. Forests provide livelihoods for millions of people around the world. They offer timber, food, shelter, fuel and medicinal products, perform significant ecosystem functions such as hydrological regulation, soil protection and biodiversity protection and act as carbon sinks. Therefore, it is crucial to understand the extent and characteristics of forests and to produce indicators about their diverse dimensions. See FDES topic 1.2.3. These indicators were previously part of the theme "D. Biodiversity" and are listed in table 6.

Table 6
Indicator of the topic "forests"

ID	Name of indicator	Priority indicator	Comments
D-3.1	Forest area as a proportion of total land area (SDG indicator 15.1.1)*	Yes	PEEA uses "Total area of forest and other wooded land"
D-3.2	Share of other wooded land in country area*		PEEA uses "Total area of forest and other wooded land"
D-3.8	Forest fires (area burnt by forest fires)	Yes	
D-3.9	Deadwood in forests (volume of deadwood per forest area)		

3. Subcomponent "environmental quality"

37. This subcomponent organizes indicators on the concentration of pollutants in the air, freshwater and marine water, and on soil pollution and noise levels. Measurements of concentrations of substances in the environmental media reflect the combined and cumulative impact of human and natural processes. This pollution impacts both the human subsystem and ecosystems. See FDES subcomponent 1.3.

A. *Topic "air quality" (list of indicators)*

38. This topic includes indicators on the ambient concentration of the most important air pollutants, including suspended solid particles, gases and other relevant pollutants that can have a negative effect on human and ecosystem health. See FDES topic 1.3.1. These indicators were previously part of group "A. Air pollution and ozone depletion" and are listed in table 7.

Table 7
Indicators of the topic "air quality"

ID	Name of indicator	Priority indicator	Comments
A-2.10	PM_{10}: Annual mean concentration in cities*	Yes	
A-2.8	Annual mean level of PM_{10} in cities (population weighted) (SDG indicator 11.6.2)*	Yes	
A-2.1	PM_{10}: Number of days with exceeded daily limit value		
A-2.9	$PM_{2.5}$: Annual mean concentration in cities*	Yes	
A-2.7	Annual mean level of $PM_{2.5}$ in cities (population weighted) (SDG indicator 11.6.2)*	Yes	
A-2.5	$PM_{2.5}$: Number of days with exceeded daily limit value		
A-2.11	SO_x: Annual mean concentration in cities*	Yes	Proposed by experts after document approval: change to SO_2
A-2.2	SO_2: Number of days with exceeded daily limit value		
A-2.3	O_3: Number of days with exceeded daily limit value		
A-2.12	NO_x: Annual mean concentration in cities*	Yes	Proposed by experts after document approval: change to NO_2
A-2.4	NO_2: Number of days with exceeded daily limit value		

Note: PM – particulate matter; $PM_{2.5}$ – particles less than 2.5 micrometres in diameter; PM_{10} – particles less than 10 micrometres in diameter; SO_x – sulfur oxides; NO_x – nitrogen oxides, O_3 - ozone.

B.   *Topic "freshwater quality" (list of indicators)*

39.   Without sufficient quantities of good quality freshwater, ecosystems and humans cannot survive. Precipitation, aquifers, lakes, rivers, coastal zones and oceans are all interconnected in the water cycle, so the choice of where to measure or monitor pollutants and which pollutants to monitor will depend on local and national priorities, ecosystem characteristics and resources available. Identification of the pollutants that are most relevant for monitoring depends on several factors. These include the immediate and subsequent water uses that are important to humans and the nature of the pollutants found in water bodies and watersheds that affect the country's biocapacities and local ecological equilibriums. See FDES topic 1.3.2. These indicators were previously part of the theme "C. Water" and are listed in table 8.

Table 8
Indicators of the topic "freshwater quality"

ID	Name of indicator	Priority indicator	Comments
C-10.1	BOD in rivers		
C-10.2	Ammonium (NH_4) in rivers		
C-11.1	Phosphates in freshwater (rivers, lakes, groundwater)		
C-11.2	Nitrates in freshwater (rivers, lakes, groundwater)		
C-17.2	Proportion of bodies of water with good ambient water quality (SDG indicator 6.3.2)*	Yes	

Note: BOD – biochemical oxygen demand.

C. *Topic "marine water quality"*

40.   Oceans cover about 70 per cent of the earth's surface. They play a critical role in regulating weather and atmospheric processes, absorb 30 per cent of emitted CO_2, are a fundamental part of the water cycle and are home to species and varied ecosystems worldwide. Oceans also provide important ecosystem services for humans, with food at the forefront. Oceans are under tremendous anthropogenic pressure, including both chemical and physical contamination and over-exploitation. Marine water and ecosystems have been increasingly polluted in the last century, with critical impacts on biodiversity. Degradation is accompanied by depletion of aquatic resources based on human exploitation.

41.   Relevant indicators about marine and coastal water quality and pollutant concentrations may include, but are not limited to, nutrients and chlorophyll, organic matter, pathogens, metals, organic contaminants, physical and chemical characteristics, and coral bleaching. See FDES topic 1.3.3. These indicators were previously part of the theme "C. Water" and are listed in table 9.

Table 9
Indicators of the topic "marine water quality"

ID	Name of indicator	Priority indicator	Comments
C-12.1	Chlorophyll in transitional, coastal and marine waters (trends in chlorophyll-a concentrations)		
C-12.2	Phosphates in transitional, coastal and marine waters		
C-12.3	Nitrates in transitional, coastal and marine waters		
C-18.1	Number of items on beach per 100 m of shoreline*		PEEA recommendation: Governments should increase their efforts to complement inventories of the number of items of beach and marine litter with information on composition and sources of litter

ID	Name of indicator	Priority indicator	Comments
C-18.2	Average marine acidity (pH) measured at agreed suite of sampling stations (SDG indicator 14.3.1)*		
C-18.3	Average sea surface temperature anomaly*		
C-12.4	Index of coastal eutrophication potential		CBD headline indicator 7.1

Note: CBD headline indicators are the headline indicators of the Monitoring framework for the Kunming-Montreal Global Biodiversity Framework as adopted by the Conference of the Parties to the Convention on Biological Diversity at the fifteenth meeting (CBD/COP/DEC/15/5).

B. Component "environmental resources and their use"

42. In alignment with FDES component 2, this component includes indicators on environmental resources and their use, with a focus on measuring stocks and changes in stocks of these resources and their use for production and consumption.

43. Changes in the stocks of environmental resources include additions and reductions, from both anthropogenic and natural activities. In the case of non-renewable resources, continued extraction usually leads eventually to the depletion of the resource. For renewable resources, if extraction (e.g., abstraction, removal and harvesting) exceeds natural regeneration and humanmade replenishment, the resource is depleted. Depletion, in physical terms, is the decrease in the quantity of the stock of a natural resource over an accounting period that is due to the extraction of the natural resource by economic units occurring at a level greater than that of regeneration. See FDES component 2.

44. Material footprint and domestic material consumption are two important composite indicators that integrate information on extraction and use of different environmental resources. Therefore, they cannot be assigned to a specific FDES topic, even if they belong to the component "environmental resources and their use". See table 10.

Table 10
Composite indicators of the component "environmental resources and their use"

ID	Name of indicator	Priority indicator	Comments
I-1.4	Material footprint, material footprint per capita, and material footprint per GDP (SDG indicator 12.2.1)*	Yes	PEEA uses "Material footprint, tons per capita"
I-1.5	Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP (SDG indicator 12.2.2))*	Yes	PEEA uses "Material footprint, tons per capita"

1. Subcomponent "energy resources"

45. Energy can be produced from non-renewable or renewable sources. Non-renewable energy resources are the minerals used for energy production. These environmental resources cannot be renewed in any human timescale, so their extraction and use in the economy depletes the resource, limiting its availability for future generations. Indicators on the

magnitude of their stocks through time are required to assist in the sustainable management of these resources. See FDES subcomponent 2.2.

A.   Topic "production, trade and consumption of energy" (list of indicators)

46.   Energy production refers to the capture, extraction or manufacture of fuels or other energy products in forms which are ready for general consumption. Energy products are produced in a number of ways, depending on the energy source. Energy production, transformation, distribution and consumption are processes characterized by different efficiency rates, which cause distinct environmental impacts (including land use change, air pollution, GHG emissions and waste). Therefore, producing indicators to describe these activities is key to informing environmental sustainability policy. Total energy production originates from sources that can be classified as non-renewable or renewable. Energy production includes the production of primary and secondary energy. See FDES topic 2.2.2. These indicators were previously part of the theme "G. Energy" and are listed in table 11.

Table 11
Indicators of the topic "production, trade and consumption of energy"

ID	Name of indicator	Priority indicator	Comments
G-1.1	Total final consumption (TFC) of energy		
G-1.2	Final energy consumption		
G-1.3	Total energy use by the national economy	Yes	
G-1.4	Energy use by resident households per capita	Yes	
G-2.1	Total primary energy supply (TPES)*	Yes	In PEEA disaggregated by energy source
G-3.1	Energy intensity measured in terms of primary energy and GDP (SDG indicator 7.3.1)		
G-3.2	Energy intensity measured in terms of final energy consumption and GDP	Yes	
G-4.1	Renewable energy share in the total primary energy supply	Yes	
G-4.2	Renewable energy share in the total final energy consumption within the national territory (SDG indicator 7.2.1)*		
G-4.3	Share of fossil fuels in total primary energy supply (TPES)		
G-4.4	Use of renewable energy for transport (share of energy from renewable sources used in transport)		

2.   Subcomponent "land"

47.   Land is a unique environmental resource that delineates the space in which economic activities and environmental processes take place and within which environmental resources and economic assets are located. The two primary aspects are land cover and land use. They are closely related; while land cover describes the biophysical aspects of land, land use refers

to the functional aspects of land. Changes in land cover can be the result of natural processes and of land use changes. Generally, the total area of a country remains unchanged from one period to the next. Hence, changes in the stocks of land comprise changes within and between stocks in different classes of land cover and land use (land restructuring). See FDES subcomponent 2.3.

A.   *Topic "land use" (list of indicators)*

48.   Land use reflects both the activities undertaken and the institutional arrangements put in place for a given area for the purposes of economic production, or the maintenance and restoration of environmental functions. Land being "used" means the existence of some kind of human activity or management. Consequently, there are areas of land that are "not in use" by human activities. These areas are important from an ecological point of view. Land use indicators cover both land in use and land not in use. Indicators on land use are usually obtained through the combination of field surveys and remote sensing (mostly satellite images). Land use data may also be obtained from administrative land registers where available.

49.   This topic also includes indicators on land use pertaining to specific agricultural and forest management methods, in particular, land under organic farming, irrigation, agroforestry, sustainable forest management and different ownership categories. These indicators are important because they describe how the use and management of land and biological resources impact the environment. See FDES topic 2.3.1. Table 12 presents two new indicators not included in the first version of the Guidelines.

Table 12
Indicators of the topic "land use"

ID	Name of indicator	Priority indicator	Comments
D-7.1	Landscape fragmentation pressure and trends (density of unfragmented landscape elements ("meshes") per unit area)		
E-1.2	Total land uptake*	Yes	

B. *Topic "use of forest land" (list of indicators)*

50.   Changes in forest area in the different categories result from economic activities (afforestation or deforestation), reclassifications among the categories, or natural processes (expansion or regression). FAO defines afforestation as the establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest. It implies a transformation from non-forest to forest. FAO defines deforestation, in turn, as the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 per cent threshold. Reforestation, which is the re-establishment of forest through planting and/or deliberate seeding on land classified as forest, is also included here.

51.   Not all forest land is used primarily to produce wood. The primary designated functions of forests are production, protection of soil and water, conservation of biodiversity, social services, multiple use and other. To better understand the uses of forest land, indicators on forest land should be broken down according to its primary designated function. See FDES topic 2.3.2. These indicators were previously part of the theme "D. Biodiversity" and are listed in table 13.

Table 13
Indicators of the topic "use of forest land"

ID	Name of indicator	Priority indicator	Comments
D-3.3	Share of natural forest of total forest area*	Yes	PEEA calls this indicator "share of primary forest area"
D-3.4	Share of planted forest of total forest area*		
D-3.6	Share of forest area designated for protection of soil, water and ecosystem services of total forest area*		PEEA refers to "soil and water protection"
D-3.7	Share of forest area protected and designated for the conservation of biodiversity*		
D-3.10	Forest: growing stock, increment and fellings	Yes	
D-3.11	Forest carbon stock		
D-3.12	Progress towards sustainable forest management (SDG indicator 12.5.1)	Yes	CBD headline indicator 10.2

Note: CBD headline indicators are the headline indicators of the Monitoring framework for the Kunming-Montreal Global Biodiversity Framework as adopted by the Conference of the

Parties to the Convention on Biological Diversity at the fifteenth meeting (CBD/COP/DEC/15/5).

3. Subcomponent "soil resources"

52. Soil resources comprise the top layers (horizons) of soil that form a biological system. Accounting for soil resources can provide information on the area and volume of soil resources lost due to erosion or degradation, or made unavailable by changes in land cover and other sources. Accounting for soil resources in terms of their type, nutrient content, carbon content and other characteristics is relevant for a more detailed examination of the health of soil systems and of the connections between soil resources and production in agriculture and forestry. See FDES subcomponent 2.4.

A. Topic "soil resources" (list of indicators)

53. This topic covers stocks of soil resources and their changes (additions and reductions) in terms of area and volume, by soil type. See FDES topic 2.4.1. Table 14 presents indicators that were used in the pan-European environmental assessment, and consequently added to the ECE environmental indicators list.

Table 14
Indicators of the topic "soil resources"

ID	Name of indicator	Priority indicator	Comments
E-3.1	Proportion of area with improving or degrading soil organic carbon content)*		
E-3.2	Soil organic carbon content*		

4. Subcomponent "water resources"

54. Management of water resources, in terms of quantities, distribution and quality, is one of the world's most important priorities today. Policymakers need indicators on water resources, their abstraction, use and returns for many reasons, including to estimate the amount of available water resources; monitor abstraction from key water bodies to prevent overutilization; ensure equitable usage of abstracted water; and track the volume of water returned to the environment. See FDES subcomponent 2.6.

A. Topic "water resources" (list of indicators)

55. Water resources consist of freshwater and brackish water, regardless of their quality, in inland water bodies, including surface water, groundwater and soil water. Inland water stocks are the volume of water contained in surface water and groundwater bodies and in the soil at a point in time. Water resources are also measured in terms of flows to and out of the inland water resources during a period of time. Surface water comprises all water that flows over or is stored on the ground's surface, regardless of its salinity levels. Surface water includes water in artificial reservoirs, lakes, rivers and streams, snow, ice and glaciers. Groundwater comprises water that collects in porous layers of underground formations known as aquifers. A country's renewable water resources are generated by precipitation and inflows of water from neighbouring territories and reduced by evapotranspiration. See FDES topic 2.6.1. These indicators were previously part of the theme "C. Water" and are listed in table 15.

Table 15
Indicators of the topic "water resources"

ID	Name of indicator	Priority indicator	Comments

ID	Name of indicator	Priority indicator	Comments
C-1.1	Renewable freshwater resources	Yes	

56.   Abstraction, use and returns of water are the flows of water between the environment and the human subsystem and within the human subsystem. Water abstraction is the amount of water that is removed from any source, either permanently or temporarily, in a given period of time. Water is abstracted from surface water and groundwater resources by economic activities and households. It can be abstracted for own use or for distribution to other users. Indicators on water abstraction should be disaggregated according to the source of the water (surface or groundwater) and by abstractor (economic activity or households). Water abstraction usually refers to the off-stream use of water. The most important off-stream uses for which water is abstracted are (i) water supply to human settlements, (ii) water for agriculture, (iii) water for industries and (iv) water for cooling in thermoelectricity generation. See FDES topic 2.6.2. These indicators were previously part of the theme "C. Water" and are listed in table 16.

Table 16
Indicators of the topic "abstraction, use and returns of water"

ID	Name of indicator	Priority indicator	Comments
C-2.1	Total freshwater abstracted by source	Yes	Disaggregation by economic activities recommended
C-2.3	Water exploitation index (WEI)	Yes	
C-2.4	Level of Water Stress: freshwater withdrawal as a proportion of available freshwater resources (SDG indicator 6.4.2)	Yes	
C-3.1	Total freshwater available for use		
C-3.2	Total freshwater use	Yes	
C-3.4	Freshwater use per unit GDP		
C-3.6	Change in water use efficiency over time (SDG indicator 6.4.1)	Yes	
C-4.1	Households water use per capita of population connected to public water supply		
C-4.2	Total household water use per capita	Yes	
C-7.2	Percentage of water lost during transportation		
C-7.3	Share of water losses by different reasons (leakages, evaporation, burst mains and meter errors)		

ID	Name of indicator	Priority indicator	Comments
C-8.1	Share of reused water in total freshwater use		
C-8.3	Percentage of reused water by economic activity		

C. Component "residuals"

57.   In alignment with FDES component 3, this component is closely related to the physical flow accounts (flows from the economy to the environment) of the SEEA-CF on which the terms and definitions are based, where relevant. It contains indicators on the amount and characteristics of residuals generated by human production and consumption processes, their management, and their final release to the environment. Residuals are flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation. Residuals may be discarded, discharged or emitted directly to the environment or be captured, collected, treated, recycled or reused. It covers the main groups of residuals that are emissions of substances to air, water or soil, wastewater and waste, and the release of residuals from the application of chemical substances.

1. Subcomponent "emissions to air"

58.   Air pollution can be caused by natural as well as anthropogenic factors. This subcomponent focuses on the emission of pollutants from anthropogenic factors that are socioeconomic processes. Emissions to air are gaseous and particulate substances released to the atmosphere by establishments and households as a result of production, consumption and accumulation processes. The statistical description of such emissions covers their sources and the quantities emitted by substance. See FDES subcomponent 3.1.

A.   Topic "emissions of greenhouse gases (GHGs)" (list of indicators)

59.   GHG emissions constitute a special category of air emissions. GHG emission inventories are compiled based on the guidelines developed by the Intergovernmental Panel on Climate Change, under the auspices of the United Nations Framework Convention on Climate Change. The source categories of GHG emissions are based on processes. The categories of sinks for GHG emissions are also included. GHGs include both direct and indirect GHGs. The most important direct GHGs are carbon dioxide, methane and nitrous oxide, and the most important indirect GHGs are sulphur dioxide, nitrogen oxides and non-methane volatile organic compounds. See FDES topic 3.1.1.

60.   These indicators were previously part of the themes "A. Air pollution and ozone depletion" and "B. Climate change" and are listed in table 17.

Table 17
Indicators of the topic "emissions of greenhouse gases (GHGs)"

ID	Name of indicator	Priority indictor	Comments
B-3.1	Total GHG emissions per capita	Yes	
B-3.2	Total GHG emissions per square kilometre	Yes	.
B-3.3	Total GHG emissions per unit of GDP	Yes	
B-3.4	Total GHG emissions by sectors (energy, transport,	Yes	

ID	Name of indicator	Priority indictor	Comments
	industrial processes, solvent and other product use, agriculture, land use and forestry, waste)		
B-3.5	Total GHG emissions (excluding land use, land-use change and forestry (LULUCF)) from the national territory*	Yes	
B-3.16	Greenhouse gas emissions (without LULUCF) per capita*		
B-3.7	CO_2 emission per unit of value added (SDG indicator 9.4.1)	Yes	
B-3.8	Total greenhouse gas emissions from the national economy		
B-3.10	Greenhouse gas emissions from land use, land use change and forestry (LULUCF)	Yes	
B-3.11	CO_2 emissions from fuel combustion within the national territory*	Yes	PEEA uses "territorial fossil CO_2 emissions", therefore disaggregation fossil versus non-fossil necessary
B-3.12	Total greenhouse gas emissions from production activities	Yes	
B-3.13	Greenhouse gas emission intensity of production activities	Yes	
B-3.14	Direct greenhouse gas emissions from households		
B-3.15	Net emissions/removals of carbon dioxide by forest land		
A-1.19	Total emissions of sulfur oxides (SO_x)*	Yes	
A-1.1	Emissions of sulfur oxides (SO_x) per capita*	Yes	PEEA uses "emissions of SO_2, kg per annum per capita"; EEA refers to SO_x
A-1.2	Emissions of sulfur oxides per square kilometre		
A-1.3	Emissions of sulfur oxides per unit of GDP		
A-1.20	Total emissions of nitrogen oxides (NO_x)*	Yes	

ID	Name of indicator	Priority indictor	Comments
A-1.4	Emissions of nitrogen oxides (NO$_x$) per capita*		
A-1.5	Emissions of nitrogen oxides (NO$_x$) per square kilometre		
A-1.6	Emissions of nitrogen oxides (NO$_x$) per unit of GDP		
A-1.22	Total emissions of non-methane volatile organic compounds (NMVOC)		
A-1.7	Emissions of non-methane volatile organic compounds (NMVOC) per capita	Yes	
A-1.8	Emissions of non-methane volatile organic compounds (NMVOC) per square kilometre	Yes	
A-1.9	Emissions of non-methane volatile organic compounds (NMVOC) per unit of GDP		
A-1.10	Share of sulphur dioxide emissions from stationary or mobile sources		
A-1.11	Share of nitrogen oxides emissions from stationary or mobile sources		
A-1.12	Share of emissions of non-methane volatile organic compounds (NMVOC) from stationary or mobile sources	Yes	.
A-1.13	Share of ammonia emissions from stationary or mobile sources		
A-1.14	Share of carbon monoxide emissions from stationary or mobile sources		
A-1.15	Share of hydrocarbons emissions from stationary or mobile sources	Yes	
A-3.2	Hydrofluorocarbon phase-down		
B-3.17	Average CO$_2$ emissions from newly registered motor vehicles		

B. Topic "consumption of ozone depleting substances (ODSs)" (list of indicators)

61.   ODS is another important category of emissions that is actively monitored by the Montreal Protocol. Reported statistics worldwide have shown this protocol to be very effective in phasing out the use of these substances. Examples of ODSs include chlorofluorocarbons, hydrochlorofluorocarbons, halons, methyl chloroform, carbon tetrachloride and methyl bromide. However, as emissions of these substances are difficult to measure directly, countries report on the apparent consumption of ODSs. See FDES topic 3.1.2.

62.   These indicators were previously part of the theme "A. Air pollution and ozone depletion" and are listed in table 18.

Table 18
Indicators of the topic "consumption of ozone depleting substances (ODSs)"

ID	Name of indicator	Priority indicator	Comments
A-3.1	Total consumption of ozone-depleting substances (ODS)	Yes	Total and breakdowns into groups of substances
A-3.9	Consumption of hydrochlorofluorocarbons (ozone depleting potential per capita)*		

C. Topic "emissions of other substances to air" (list of indicators)

63.   Other environmentally important polluting substances are emitted to air beyond GHGs and ODSs. The most important are the different fractions of PM, which is an air pollutant consisting of mixed solid (i.e., dust) and liquid particles suspended in the air. PM eventually concentrates in the air and is measured to establish pollution levels (for instance as $PM_{2.5}$ and PM_{10}, see Topic "Air Quality"). Furthermore, the particulate material contains different chemical elements and compounds that can be harmful beyond the potential impact of dust. Other potentially harmful emissions include heavy metals (such as cadmium, lead and mercury) and other substances that are linked to environmental and health problems. See FDES topic 3.1.3.

64.   These indicators were previously part of group "A. Air pollution and ozone depletion" and are listed in table 19.

Table 19
Indicators of the topic "emissions of other substances to air"

ID	Name of indicator	Priority indicator	Comments
A-1.28	Emissions of ammonia per capita	Yes	
A-1.30	Emissions of ammonia per square kilometre	Yes	
A-1.29	Emissions of ammonia per unit of GDP		
A-1.31	Emissions of PM_{10} per capita		
A-1.23	Emissions of PM_{10} per square kilometre		
A-1.24	Emissions of PM_{10} per unit of GDP		

ID	Name of indicator	Priority indicator	Comments
A-1.21	Total emissions of PM$_{2.5}$*	Yes	
A-1.25	Emissions of PM$_{2.5}$ per capita*		
A-1.26	Emissions of PM$_{2.5}$ per square kilometre		
A-1.27	Emissions of PM$_{2.5}$ per unit of GDP		
A-1.16	Share of total suspended particles (TSP) emissions from stationary or mobile sources	Yes	
A-1.17	Share of PM$_{10}$ emissions from stationary or mobile sources	Yes	
A-1.18	Share of PM$_{2.5}$ emissions from stationary or mobile sources	Yes	

Note: PM – particulate matter; PM$_{2.5}$ – particles less than 2.5 micrometres in diameter; PM$_{10}$ – particles less than 2.5 micrometres in diameter.

2. Subcomponent "generation and management of wastewater"

65. This subcomponent contains indicators on the generation, management and discharge of wastewater, as well as the pollutant content of wastewater (emissions of substances to water). Policymakers, analysts and civil society need indicators on wastewater to properly manage this potentially harmful by-product of the human subsystem. See FDES subcomponent 3.2.

A. Topic "generation and pollutant content of wastewater" (list of indicators)

66. This topic includes indicators on the volume of water that is no longer required and is thus discarded by the user and statistics on the amount of pollutants contained in wastewater (emissions to water) before any collection or treatment. Indicators on the generation of wastewater and emissions to water should be broken down by the economic activity and households that generate them. See FDES topic 3.2.1.

67. These indicators were previously part of the theme "C. Water" and the set has yet to be developed.

B. Topic "collection and treatment of wastewater" (list of indicators)

68. Wastewater may be discharged directly to the environment by the generator or may be collected in sewerage systems and treated in wastewater treatment plants (urban, industrial or other). This topic can include indicators describing (i) volumes of wastewater collected and transported to its final place of discharge or treatment facilities, (ii) volume of wastewater treated by type of treatment (primary, secondary and tertiary), (iii) physical infrastructure related to wastewater collection and treatment (e.g. number of treatment plants and capacities of plants), (iv) pollutant content extracted in the treatment facilities and (v) other relevant information. See FDES topic 3.2.2.

69. These indicators were previously part of the theme "C. Water" and are listed in table 20.

Table 20
Indicators of the topic "collection and treatment of wastewater"

ID	Name of indicator	Priority indicator	Comments
C-15.1	Treatment capacity of urban wastewater treatment plants in terms of population equivalents (p.e.)	Yes	Total and per treatment type (primary, secondary, tertiary)
C-15.2	Treatment capacity of urban wastewater treatment plants in terms of hydraulic capacity (1000 m^3/day)		Total and per treatment type (primary, secondary, tertiary)
C-15.3	Treatment capacity of individual wastewater treatment facilities in terms of population equivalent (p.e.)	Yes	
C-15.4	Treatment capacity of individual wastewater treatment facilities in terms of hydraulic capacity (1000 m^3/day)		
C-15.5	Percentage of BOD$_5$ removed from generated wastewater before discharge into the environment	Yes	
C-15.6	Percentage of total phosphorus removed from generated wastewater before discharge into the environment		
C-15.7	Percentage of total nitrogen removed from generated wastewater before discharge into the environment		

Note: BOD$_5$ – biochemical oxygen demand measured in a water sample during five days of incubation at 20°C.

C.   *Topic "discharge of wastewater to the environment" (list of indicators)*

70.   This topic captures information at the stage of final discharge of wastewater to the environment. It includes (i) volume of wastewater discharged to the environment without treatment; (ii) volume of wastewater discharged to the environment after treatment, by type of treatment (primary, secondary and tertiary) and type of treatment facility (public, private, municipal, industrial); and (iii) effluent quality. See FDES topic 3.2.3,

71.   These indicators were previously part of the theme "C. Water" and are listed in table 21.

Table 21
Indicators of the topic "discharge of wastewater to the environment"

ID	Name of indicator	Priority indicator	Comments
C-16.1	Share of total wastewater discharged to the environment after treatment	Yes	Total and per treatment category
C-16.2	Proportion of domestic and industrial wastewater flows safely treated (SDG indicator 6.3.1)	Yes	

3. Subcomponent "generation and management of waste"

72. This subcomponent includes indicators on the amount and characteristics of waste, defined as discarded material for which the owner or user has no further use, generated by human activities in the course of production and consumption processes. To reduce the amount of waste generated and increase the share of waste that is recycled and reused as material or energy source are central to sustainable consumption and production and natural resource management. The final disposal of waste in the environment, even if in a controlled manner, creates pollution and occupies considerable land areas. See FDES subcomponent 3.3.

A. Topic "generation of waste" (list of indicators)

73. This topic includes indicators describing the amount of waste generated before any collection or treatment, by waste type, and by generator (by economic activity (by the International Standard Industrial Classification of All Economic Activities) and households). The waste lists that countries and international organizations use for waste statistics are usually based either on the generating process or the material content of the waste, or on the combination of the two. In many cases, the origin of the waste (the economic activity) generally determines the material content of the waste. See FDES topic 3.3.1.

74. These indicators were previously part of the theme "I. Waste" and are listed in table 22.

Table 22
Indicators of the topic "generation of waste"

ID	Name of indicator	Priority indicator	Comments
I-1.1	Households waste generation intensity per capita	Yes	
I-1.2	Annual total waste generation	Yes	
I-1.3	Waste generation intensity per unit of GDP	Yes	
I-2.1	Hazardous waste generated per capita (SDG indicator 12.4.2)*	Yes	Includes breakdown of hazardous waste generated by key type of waste, including e-waste. PEEA uses indicator "domestic e-waste generation per capita"
I-1.8	Total waste generation per capita*		

B. Topic "management of waste" (list of indicators)

75. This topic includes indicators on:

(a) The amount of waste collected and transported to treatment facilities or final disposal;

(b) The amount of waste treated and disposed of by type of treatment and disposal (e.g., reuse, recycling, composting, incineration, landfilling, other);

(c)   The physical infrastructure for waste treatment and disposal, including the number and capacity of treatment and disposal plants;

(d)   Other relevant information. See FDES topic 3.3.2.

76.   These indicators were previously part of the theme "I. Waste" and are listed in table 23.

Table 23
Indicators of the topic "management of waste"

ID	Name of indicator	Priority indicator	Comments
I-3.2	National recycling rate, tons of material recycled (SDG indicator 12.5.1)*	Yes	Breakdown by waste stream similar to related European Environment Agency indicators; PEEA uses "Recycling rate of municipal solid waste, including composting and anaerobic digestion"
I-3.3	Recovery rate of construction and demolition waste*		
I-2.2	Proportion of hazardous waste treated, by type of treatment (SDG indicator 12.4.2)	Yes	
I-2.3	Stock of hazardous waste at the end of the year		
I-4.3	Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban waste generated, by cities. (SDG indicator 11.6.1)		
I-4.2	Diversion of waste from landfill (amounts of waste deposited in landfills, by type of waste category)		

4.   Subcomponent "release of chemical substances"

77.   See FDES subcomponent 3.4.

A.   Topic "release of chemical substances" (list of indicators)

78.   This topic deals with chemical fertilizers to enrich soils and pesticide use in protecting plants and animals from disease. Other chemicals accelerate the growth of biota and preserve and enhance the quality, size and appearance of biological products. Environmental effects are generated by the diffusion of chemicals through cycling systems and build-up of contaminants in water, land and living organisms (through the food chain). Indicators under this topic include the amount of natural and chemical fertilizers, pesticides and other chemicals (hormones and pellets) used by type of active ingredients (see also Subcomponent "Biological Resources"), the area under application and the method employed. See FDES topic 3.4.1.

79.   These indicators were previously part of the theme "F. Agriculture" and are listed in table 24.

Table 24
Indicators of the topic "release of chemical substances"

ID	Name of indicator	Priority indicator	Comments
F-2.1	Consumption of mineral fertilizers per unit of agricultural area	Yes	
F-2.2	Share of area treated with mineral fertilizers in total agricultural area		
F-2.3	Consumption of organic fertilizers per unit of agricultural area	Yes	
F-2.4	Share of area treated with organic fertilizers in total agricultural area		
F-2.5	Share of area under crop treated with fertilizers in total area	Yes	
F-2.6	Consumption of fertilizers per unit of area under crop	Yes	
F-4.1	Consumption of pesticides per unit of agricultural area		
F-4.2	Consumption of insecticides per unit of agricultural area		
F-4.3	Consumption of herbicides and desiccants per unit of agricultural area		
F-4.4	Consumption of fungicides and bactericides per unit of agricultural area		
F-4.5	Consumption of plant regulators per unit of agricultural area		
F-4.6	Consumption of rodenticides per unit of agricultural area		
F-4.7	Consumption of other pesticides (e.g. mineral oils) per unit of agricultural area		

D. Component "extreme events and disasters"

80.   In alignment with FDES component 4, this component includes indicators on the occurrence of extreme events and disasters and their impacts on human well-being and the infrastructure of the human subsystem.

1. Subcomponent "natural extreme events and disasters"

81.   This subcomponent organizes indicators on the frequency and intensity of extreme events and disasters deriving from natural phenomena, as well as their impact on human lives and habitats and the environment as a whole. Indicators on natural extreme events and disasters are important to policymakers, analysts and civil society not only to assess the impact of an ongoing disaster, but also to monitor the frequency, intensity and impact of disasters over time.

82.   The types of indicators included in this topic may be, but are not limited to, the type of natural disaster, location, magnitude, date of occurrence and duration.

83.   The recommended indicators are listed in table 25.

Table 25
Indicators of topic "occurrence of natural extreme events and disasters"

ID	Name of indicator	Priority indicator	Comments
K-1.4	Number of hazardous events per year (per type of hazard)		
K-1.5	Proportion of hazardous events with deaths per year (per type of hazard)		

B. *Topic "Impact of natural extreme events and disasters" (list of indicators)*

84.   This topic includes information on the impact of a natural extreme event or disaster. Impact can be measured in a number of ways. Common dimensions include the number of people killed, injured, homeless and affected, as well as economic loss. Economic loss may refer to damage to buildings and other economic assets, number of transportation networks affected, economic disruption or loss of revenue to commercial services, and utility disruption. Physical loss or damage refers to the magnitude of the impact of the event or disaster on the quantity and quality of land, crops, livestock, aquaculture and biomass. The specific impact of each natural disaster on the integrity of the local ecosystem may also be reported on, where statistics exist. In addition, the external assistance received for disaster relief may also be measured.

85.   The recommended indicators are listed in table 26.

Table 26
Indicators of topic "impact of natural extreme events and disasters"

ID	Name of indicator	Priority indicator	Comments
K-1.6	Direct economic loss attributed to disasters in relation to global gross domestic product (GDP) (SDG 1.5.2, Sendai Framework C-1))	Yes	
K-1.7	Number of deaths attributed to disasters, per 100,000 population (Sendai Framework A-2)	Yes	
K-1.8	Direct agricultural loss attributed to disasters (Sendai Framework C-2)		

E.   Component "human settlements and environmental health"

86.   This component contains indicators on the environment in which humans live and work, particularly with regard to living conditions and environmental health. These indicators are important for the management and improvement of conditions related to human settlements, shelter conditions, safe water, sanitation and health, particularly in the context of rapid urbanization, increasing pollution, environmental degradation, disasters, extreme events and climate change. See FDES component 5.

1.   **Subcomponent "human settlements"**

87.   This subcomponent includes relevant indicators on basic services and infrastructure of human settlements. Human settlements refer to the totality of the human community, whether people live in large cities, towns or villages. They encompass the human population that resides in a settlement, the physical elements (e.g., shelter and infrastructure), services (e.g., water, sanitation, waste removal, energy and transport), and the exposure of humans to potentially deleterious environmental conditions. See FDES subcomponent 5.1.

A.   *Topic "access to selected basic services" (list of indicators)*

88.   This topic includes information about access to water, sanitation, waste removal services and energy in urban and rural areas. Access to these basic services can have a positive effect on human health and well-being, thereby contributing to improved environmental quality. See FDES topic 5.1.2.

89.   These indicators were previously part of the themes "C. Water" and "I. Waste" and are listed in table 27.

Table 27
Indicators of the topic "access to selected basic services"

ID	Name of indicator	Priority indicator	Comments
C-6.1	Share of total population (urban and rural) connected to the water supply industry	Yes	
C-6.2	Proportion of population using safely managed drinking water services (SDG indicator 6.1.1)*	Yes	
C-6.3	Percentage of population using basic drinking water services by location*		
C-6.1	Share of total population (urban and rural) connected to the water supply industry	Yes	
C-9.7	Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (SDG indicator 3.9.2)		
C-14.1	Percentage of total population connected to a wastewater collecting system	Yes	
C-14.2	Percentage of total population connected to wastewater treatment facilities*		Total and per treatment type; PEEA uses "Population connected to wastewater treatment"
C-14.3	Proportion of population using safely managed sanitation services (SDG indicator 6.2.1)*		
C-14.4	Percentage of population using basic sanitation services by location**		
I-4.1	Total population served by municipal waste collection	Yes	
G-5.1	Percentage of population with access to electricity by location*		

B. Topic 'exposure to ambient pollution' (list of indicators)

90. This topic (table 28) includes spatially described indicators on human populations exposed to different levels of air and noise pollution. This topic overlays pollutant emission and exposure data onto geographic and demographic data to create a more detailed understanding of the location of populations currently exposed to pollutants and those most at risk of future exposure. Location-specific geospatial information on ambient pollutant levels is extremely important for environmental protection and environmental health policies, particularly in larger cities. See FDES topic 5.1.4.

Table 28
Indicators of the topic "exposure to ambient pollution"

ID	Name of indicator	Priority indicator	Comments
A-2.6	Mortality rate attributed to household and ambient air pollution (SDG indicator 3.9.1)		Proposed indicator; cannot currently be calculated by countries themselves
K-1.9	Number of people exposed to unhealthy noise levels		EEA uses indicator "Estimated number of people exposed to unhealthy noise levels, based on END thresholds"

C. Topic "environmental concerns specific to urban settlements" (list of indicators)

91. A growing proportion of the world's population, currently more than half, live in urban areas. This topic is intended to organize issues of specific relevance to this part of the population. Depending on national and local conditions and priorities, additional environmentally relevant urban concerns should be included here. Such issues may include, but are not limited to, the extent of urban sprawl, the availability of green spaces for urban residents, the prevailing types of transportation in and between urban areas, and the existence and effectiveness of urban planning and zoning.

92. With regard to transportation, indicators may include the number of private, public and commercial vehicles by engine type, as well as the extent of roadway infrastructure. Most importantly, from the environmental perspective, additional indicators should include the number of passengers transported by public transportation systems and the number of passengers transported annually by hybrid and electric modes of transportation. See FDES topic 5.1.5.

93. These indicators were previously part of the themes "H. Transport" and are listed in table 29.

Table 29
Indicators of the topic "environmental concerns specific to urban settlements"

ID	Name of indicator	Priority indicator	Comments
H-1.1	Passenger and freight volumes, by mode of transport (SDG indicator 9.1.2)	Yes	
H-1.2	Total passenger transport demand per capita	Yes	
H-1.4	Share of road transport demand in total passenger transport		

ID	Name of indicator	Priority indicator	Comments
H-1.5	Share of railway transport demand in total passenger transport*		PEEA uses "railway passenger traffic, national and international"
H-1.6	Share of inland waterways demand in total passenger transport		
H-1.7	Share of maritime transport demand in total passenger transport		
H-1.8	Share of domestic aviation demand in total passenger transport		
H-1.9	Share of underground demand in total passenger transport		
H-2.1	Total Freight transport demand per unit of GDP		
H-2.3	Share of road transport in total freight transport demand		
H-2.4	Share of railway transport in total freight transport demand		
H-2.5	Share of inland waterways transport in total freight transport demand		
H-2.6	Share of maritime transport in total freight transport demand		
H-2.7	Share of domestic aviation in total freight transport demand		
H-3.1	Road vehicle fleet in the country by vehicle category (passenger cars, motor coaches and buses, trucks, trolleybuses, road tractors)	Yes	
H-3.2	Road vehicle fleet in the country by fuel type (gasoline, diesel, gas, electricity, biofuels, other)	Yes	
H-4.1	Share of road vehicle fleet in the country less/equal to 2 years old (passenger cars, motor coaches and buses, trucks, trolleybuses, road tractors)		
H-4.2	Share of road vehicle fleet in the country with the age from 2 years to 5 years (passenger cars, motor coaches and buses, trucks, trolleybuses, road tractors)		
H-4.3	Share of road vehicle fleet in the country with the age from 5 years to 10 years (passenger cars, motor coaches and buses, trucks, trolleybuses, road tractors)		
H-4.4	Share of road vehicle fleet in the country more than 10 years old (passenger cars, motor coaches and buses, trucks, trolleybuses, road tractors)		

ID	Name of indicator	Priority indicator	Comments
H-3.3	New registrations of electric vehicles		
H-5.1	Motorway length*		
H-5.2	Motor vehicle movements on national territory by vehicle-kilometres (millions)*		

E. Component "environmental protection, management and engagement"

94.   This component organizes information on environmental protection and resource management expenditure to improve the environment and maintain ecosystem health. Indicators on environmental governance, institutional strength, enforcement of regulations and extreme event preparedness are also considered. This component also includes information on a wide variety of programmes and actions to increase awareness, including environmental information and education, as well as private and community activities aimed at diminishing environmental impacts and improving the quality of local environments. See FDES component 6.

1. Subcomponent "environmental protection and resource management expenditure" (list of indicators)

95.   This subcomponent is closely related to the environmental activity accounts of the SEEA-CF and is based on the CEA. Expenditure on environmental protection and resource management may be used as one measure of public and private engagement in protecting, restoring and managing the environment towards more sustainable use. Monitoring and tracking the level of environmental protection and resource management expenditure is important for policymakers, analysts and civil society in order to determine the current and desired levels of engagement and commitment from both government and the private sector. See FDES subcomponent 6.1.

96.   These indicators (placeholders) were previously part of the theme "J. Environmental financing" and are listed in table 30.

Table 30
Indicators of the subcomponent "environmental protection and resource management expenditure"

ID	Name of indicator	Priority indicator	Comments
J-1.1	National expenditure on environmental protection as percentage of GDP*	Yes	PEEA uses indicator "government environmental protection expenditures as proportion of GDP"
J-1.5	Contribution to the international $100 billion commitment on climate-related expenditure*		
J-1.7	Domestic public funding on conservation and sustainable use of biodiversity and ecosystems		CBD headline indicator D.2

Note: CBD headline indicators are the headline indicators of the Monitoring framework for the Kunming-Montreal Global Biodiversity Framework as adopted by the Conference of the

Parties to the Convention on Biological Diversity at the fifteenth meeting (CBD/COP/DEC/15/5).

2. Subcomponent "environmental governance and regulation"

97. To provide a holistic view of a country's efforts towards sustaining and protecting the environment, policymakers, analysts and civil society require indicators on environmental governance and regulation at the national level. The magnitude of these activities can inform about the extent of institutional development, availability of resources, and the existence and enforcement of regulatory and market instruments whose primary purpose is to protect, regulate and manage the changing environment. See FDES subcomponent 6.2.

A. Topic "environmental regulation and instruments" (list of indicators)

98. This topic refers to policy responses to regulate and establish acceptable limits for protecting the environment and human health. It entails both direct regulatory and economic instruments. Direct regulatory instruments include environmental and related laws, standards, limits and their enforcement capacities. These can be described using indicators on regulated pollutants, licensing systems, applications for licences, quotas for biological resource extraction, and budget and number of staff dedicated to enforcement of environmental regulations. Economic instruments may comprise the existence and number of green/environmental taxes, environmental subsidies, eco-labelling and certification and emission permits. See FDES topic 6.2.2.

99. These indicators (placeholders) were previously part of the theme "J. Environmental financing" and are listed in table 31.

Table 31
Indicators of the topic "environmental regulation and instruments"

ID	Name of indicator	Priority indicator	Comments
J-1.2	Environmentally related taxes, % GDP	Yes	In PEEA: "Environmental tax revenues as a proportion of GDP"
J-1.3	Environmentally related taxes, % total tax revenue		
J-1.4	Share of energy and transport related taxes in total taxes and social contributions		
J-1.5	Amount of fossil-fuel subsidies (production and consumption) per unit of GDP (SDG indicator 12.c.1)*	Yes	
J-1.8	Payments for use of natural resources		

B. Topic "participation in multilateral environmental agreements and environmental conventions" (list of indicators)

100. This topic includes information on a given country's participation in multilateral environmental agreements and other global environmental conventions. The information to be produced on this topic is mainly descriptive, although comparable time series can also be derived from these statistics. See FDES topic 6.2.3.

1011. SDG indicator 6.5.2 "proportion of transboundary basin area with an operational arrangement for water cooperation" was added because it is also used in the pan-European environmental assessment (see table 32).

Table 32
Indicators of the topic "participation in multilateral environmental agreements and environmental conventions"

ID	Name of indicator	Priority indicator	Comments
C-17.1	Proportion of transboundary basin area with an operational arrangement for water cooperation (SDG indicator 6.5.2)*		

3.   Subcomponent "extreme event preparedness and disaster management"

102.   These indicators and statistics include the existence and strength of the disaster management agency's facilities and infrastructure, including indicators and statistics on extreme event preparedness and disaster management expenditure. See FDES subcomponent 6.3.

A.   Topic "preparedness for natural extreme events and disasters" (list of indicators)

103.   Disaster preparedness measures vary according to a given community and location's characteristics and historical profile for natural extreme events and disasters. Relevant information may include the existence and description of national disaster plans; the type and number of shelters in place; the type and number of internationally certified emergency and recovery management specialists; the number of volunteers; and the quantity of first aid and emergency supplies and equipment stockpiles. The existence of early warning systems for all major hazards, and expenditure on disaster prevention, preparedness, clean-up and rehabilitation are also important data requirements. See FDES topic 6.3.1 and table 33 below.

Table 33
Indicators of the topic "preparedness for natural extreme events and disasters"

ID	Name of indicator	Priority indicator	Comments
K-1.1	Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms (Sendai Framework indicator G-3)*		PEEA uses "estimated proportion of population covered by local disaster risk reduction strategies"

4.   Subcomponent "environmental information and awareness"

114.   This subcomponent covers statistics about environmental information and diverse processes that contribute to increasing social awareness of environmental issues, thus promoting pro-environmental engagement and actions by the public and decision-makers at both the local and national levels. See FDES subcomponent 6.4.

A. *Topic "environmental information" (list of indicators)*

115. Environmental information includes quantitative and qualitative facts describing the state of the environment and its changes as described in the components of FDES. See FDES topic 6.4.1 and table 34 below.

Table 34
Indicators of the topic "environmental information"

ID	Name of indicator	Priority indicator	Comments
K-1.2	Number of companies publishing sustainability reports (SDG indicator 12.6.1)*		

B. *Topic "environmental education" (list of indicators)*

116. Environmental education refers to the process of sharing and constructing environmental information and knowledge, as well as information on how humans interact with the environment. Environmental education is carried out through a variety of programmes, including formal and informal education and training, directed towards different audiences. It may be curriculum- and classroom-based or experiential and may be provided on-site or in community settings by government agencies or non-governmental organizations (NGOs). See FDES topic 6.4.2 and table 35 below.

Table 35
Indicators of the topic "environmental education"

ID	Name of indicator	Priority indicator	Comments
K-1.3	Proportion of students in lower secondary education showing adequate understanding of issues relating to global citizenship and sustainability, by sex*		

IV. Data and statistics needed for compiling the list of indicators

117. This chapter will list data and statistics needed for the compilation of the indicators. It will be structured according to FDES.

118. For each data item it will be indicated how it relates to FDES and for the production of which indicators it is needed.