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Digest of EEA indicators 2014

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About this report

Environmental indicators are essential tools for assessing environmental trends, tracking progress against objectives and targets, evaluating the effectiveness of policies and communicating complex phenomena to non-technical audiences. The last guide to European Environment Agency (EEA) indicators, published in 2005, focused on the Core Set of Indicators (CSI) (EEA, 2005). Since then, the EEA has published a wide range of assessments based on indicators. In addition, many new indicators have been developed, and the evolving European Union (EU) policy context has created new opportunities for their use.

This report reflects these developments and provides a comprehensive yet accessible guide to EEA indicators. It acts as a reference document and provides an overview of the EEA indicators, placing them in the context of the wider landscape of European environmental indicators. The report highlights the insights that indicators can provide on progress against environmental priorities. In summary, the digest explains 'what we have, why we have it, and how it can be used'.

The report is structured in three sections. The first section describes the European landscape of environmental indicators, i.e. their definition, application and limitations, as well as the main ongoing environmental indicator initiatives in Europe. The next section focuses on EEA indicators, summarising the frameworks and tools used to support indicator developments and describing the range of thematic indicator sets under EEA management. It presents the revised EEA CSI, selected on the basis of their policy relevance and quality. The final section examines policy applications for indicators in the context of cross-cutting, systemic policy challenges, and considers the prospects for future development. This is particularly significant in the context of the EU 7th Environment Action Programme, in effect from January 2014, and the long-standing demands for indicators of environmental sustainability that can be utilised alongside macro-level socio-economic indicators such as Gross Domestic Product and the Human Development Index.

Section 1 The European indicator landscape

1 Environmental indicators: characteristics and use

1.1 Definitions

Environmental indicators summarise, simplify and communicate more complex data sets: 'an environmental indicator is a measure, generally quantitative, that can be used to illustrate and communicate complex environmental phenomena simply, including trends and progress over time — and thus helps provide insight into the state of the environment' (EEA, 2005). Published EEA indicators consist of one or more graphs and underlying data that are always accompanied by interpretation and analysis in the form of a policy-relevant assessment (see Section 3.3 and Box 3.1 for further details).

This provides information and guidance alongside the indicator, contributing to the evidence base for decision-making.

The Organisation for Economic Co-operation and Development (OECD) pioneered the development of environmental indicators at international level in the early 1990s. This work included setting the general criteria for selecting indicators; these criteria can also be used to define the characteristics of a good environmental indicator (see Box 1.1). According to the criteria, an indicator should be robust and analytically sound. While not all robust indicators are based on official statistics, following

Box 1.1 OECD criteria for selecting environmental indicators (OECD, 1993)

Policy relevance and utility for users	An environmental indicator should: • provide a representative picture of environmental conditions, pressures on the environment or society's responses; • be simple, easy to interpret and able to show trends over time; • be responsive to changes in the environment and related human activities; • provide a basis for international comparisons; • be either national in scope or applicable to regional environmental issues of national significance; • have a threshold or reference value against which it can be compared, so that users can assess the significance of the values associated with it.
Analytical soundness	An environmental indicator should: • be theoretically well-founded in technical and scientific terms; • be based on international standards and international consensus concerning its validity; • lend itself to being linked to economic models, forecasting and information systems.
Measurability	The data required to support the indicator should be: • readily available or made available at a reasonable cost/benefit ratio; • adequately documented and of known quality; • updated at regular intervals in accordance with reliable procedures.

These criteria describe the ideal indicator, and not all criteria will necessarily be fulfilled in practice.

statistical principles offers benefits, for example, in terms of providing objective information that is consistent over time and across countries.

Indicators are commonly combined to form a set, where each individual indicator provides one part of the picture. These sets are often referred to as dashboards or scoreboards, and the component indicators are presented individually. Indicators can also be combined to form indices. Indices are developed by combining individual indicators into one measure, and are often used for multidimensional concepts which cannot be captured using a single indicator. The component indicators of composite indices such as the Human Development Index (HDI) have different units which are converted or normalised prior to aggregation. Different methodological approaches to the compilation of composite indicators, including the important issue of weighting individual component indicators, are set out in the *Handbook on Constructing Composite Indicators*, published by the OECD and Joint Research Centre (JRC) (Nardo et al., 2008).

Indicators fulfil two major functions: (a) they reduce the number of measurements and parameters that would normally be required to represent a situation, and (b) and they simplify the communication process by which the results of measurement are provided to the user (OECD, 2011). In addition, indicators also provide a platform for structuring and stabilising data flows.

1.2 Applications

Policy

Environmental indicators play a crucial role for effective and coherent policymaking. They provide selected, aggregated and interpreted information with three major purposes (Stanners et al., 2007):

- to provide information on environmental problems, in order to enable policymakers to evaluate their seriousness (this is especially important for new and emerging issues);
- to support policy development and priority-setting, by highlighting key factors in the cause-and-effect chain that cause environmental pressures and that policy can target;
- to measure policy progress and evaluate the effectiveness of policy responses.

The EEA categorises the policy cycle into six stages: (1) issue identification, (2) issue framing, (3) policy measures identification (and *ex ante* Impact Assessment), (4) policy measure development, (5) policy measure implementation, and (6) policy measure effectiveness and *ex post* Impact Assessment (Stanners et al., 2007). Indicators play a role in all six stages of the cycle, but they are most commonly used to monitor progress with implementation of policy measures and assess their effectiveness in terms of relevant environmental outcomes.

Where quantitative measures such as policy targets, thresholds or reference values have been established, indicators play a particularly important role in measuring progress and performance against these. This can take the form of measuring the 'distance to target', overshoots of thresholds and changes from reference conditions. Setting environmental targets is closely linked to identifying appropriate reference points and indicators to monitor performance. It is hard to monitor the impacts of policy and management measures if these cannot be associated with corresponding indicators (EEA, 2010).

During the last decade, indicator sets have been produced to monitor progress under many different policy frameworks. The construction of such indicator sets has become a policy objective in itself, e.g. one of the objectives contained in the *Roadmap to a Resource Efficient Europe* (COM (2011) 571 final) is to develop indicators and targets to monitor progress (EC, 2011). Indicator sets have been favoured rather than development of composite indices. Aggregation of indicators must be carried out with care and transparency otherwise it may produce an indicator which is less robust than its components. Indicator sets can encompass different dimensions of an issue or policy area without losing information through aggregation, although they should not be made excessively large in size.

Assessment

In assessments, indicators are used to answer the question 'what is happening to the environment and why?' Indicators illustrate and substantiate statements made in assessments by providing information on states and trends of priority issues, on spatial patterns of change, and by analysing progress in meeting targets or reference values. The choice of indicators can structure and guide data collection for integrated environmental assessment (van Woerden et al., 2007). Chapter 3 describes how the EEA has used environmental indicators in some of its assessments.

Indicators are used to tell a story and put the data in perspective: how they are selected is therefore an important factor. Selection is often carried out on the basis of criteria such as the OECD set (see Box 1.1). However, for assessment purposes, an indicator's quality is not the only consideration: whether it fits the assessment question and how the selected indicators combine in a set to cover the different dimensions of the assessment are also important factors. While indicator quality can be evaluated using sets of criteria, selecting the most appropriate indicators for use in an assessment may be a more subjective process, shaped by individual judgement. Individuals will often choose different indicators for the same assessment question. One of the challenges is that it can be easier to select indicators based on data availability, rather than on what needs to be measured. Conceptual frameworks can be helpful in selecting indicators for use in assessments and for identifying gaps (see Section 1.3 below).

Communication and awareness-raising

Indicators should communicate complex issues in a simple way, and provide insight into an issue beyond the parameter that is being measured. For instance, the trend in the amount of carbon dioxide (CO_2) being emitted to the atmosphere may be used to illustrate the much more complex realities of climate change.

Many of the most effective indicators as regards communication and awareness-raising are those that are easy to understand and present in a visually attractive way. The use of the footprint concept has been particularly successful in recent years: footprint indicators lend themselves to a simple message that can be presented visually, making them attractive to the media and valuable in communication terms.

1.3 Limitations

'Not everything that counts can be counted and not everything that can be counted counts'. This quote, attributed to Albert Einstein, succinctly summarises some of the limitations of quantitative indicators. Indicators cannot provide a comprehensive perspective on an issue, and while they can demonstrate change, they will not necessarily provide information on the reasons why. Therefore indicators are of limited use if taken out of context, and any detailed analysis will need to supplement indicators with other quantitative and qualitative information.

Environmental indicators usually report past developments and provide historical time-series. The timeliness of indicators affects their policy relevance, and there is a growing desire for 'early estimates' and 'now-casts'. For important indicators, such as GDP and greenhouse gas (GHG) emissions, various forecasts are produced, or future scenarios are explored under various policy measures. However, the number of environmental indicators for which prospective trends are produced is still relatively low; indeed, some would argue that the scope of indicators should be focused on showing past trends.

Each individual indicator has both strengths and weaknesses, and it is important to consider these, as well as how indicators can be combined in a set to cover the different dimensions of an issue. This requires clarity concerning the question the indicator is addressing — otherwise, the indicator may provide misleading or inaccurate information about the subject being measured. An example would be the use of an indicator that reflects change over a very long time-scale, when decision-makers require knowledge about change over a short time-scale. Moreover, it may not be possible to directly measure the subject under analysis to the required level of quality; in this case, indirect or proxy indicators may be used.

A key consideration when selecting indicators is data availability e.g. length of time series or geographical coverage. However data availability alone should not drive the selection process: a highly relevant indicator for policy may have limited data availability, while a less relevant indicator may have greater data availability. The use of a conceptual framework to identify and select indicators for a policy issue or assessment can help overcome some of the limitations of individual indicators. A conceptual framework can provide a rationale for indicator selection, ensuring all important aspects of an issue are covered, as well as the relationships between them, if possible. It can also help to limit the number of indicators, an important benefit, as sets that contain too many indicators may be difficult to interpret (although too few indicators can limit the scope of understanding). A framework can also render the selection of particular indicators transparent and logical, helping to ensure that the indicator set comprises the best achievable indicators, rather than reflecting the interests of particular stakeholders. Frameworks also enable the identification of gaps for which indicators are not available, providing grounds for the use of best available or proxy indicators, and informing indicator development and data collection plans.

2 European indicators

2.1 Available indicators

More than two decades of environmental indicator efforts in Europe have been driven by a combination of policy and assessment demands. Developments include conceptual frameworks (e.g. DPSIR — see Section 3.2), integrated analytical methods (e.g. environmental accounting — see Chapter 7), regular indicator sets for policy (e.g. Streamlining European Biodiversity Indicators since 2004 — see Section 4.2) and regular indicator assessments (e.g. the Transport and Environment Reporting Mechanism since 1998 — see Section 4.5).

European environmental indicators have often developed organically, in response to different policy priorities, agendas and institutional settings. There have often been long lead times between the demands for indicators and their actual conception and production. In the meantime, however, policy priorities change, generating new demands that often differ from those made previously (e.g. putting a value on nature), and sometimes repeating earlier demands in a new context (e.g. resource efficiency, eco-efficiency). This can and has resulted in many indicators and indicator initiatives, arguably more than necessary, given resource limitations.

The EEA is only one of several EU–level bodies that produce environmental indicators. Eurostat and the Directorate-General (DG) for the Environment are also significant players in this regard, with sectoral DGs of the European Commission as well as the Joint Research Centre (JRC) making important contributions. At international level, the OECD, the United Nations Statistical Division (UNSD) and United Nations Economic Commission for Europe (UNECE) either regularly publish environmental indicators for which internationally comparable data exist, and/or use them in environmental performance reviews.

Many indicators are also generated by research projects, but these are often not replicated or produced regularly, or disseminated in a structured manner and there are far too many to address in this report. No overview of all EU indicator sets is available, although under the 'Streamlining of environmental indicators' project (see Section 2.2), a European environmental indicator metadata catalogue is currently under development. Box 2.1 presents some of the indicator sets most relevant for the environment domain at EU level.

2.2 Streamlining initiatives

Identifying inconsistencies in naming and a partial overlap between indicators and indicator sets led to an indicator streamlining exercise involving the EEA, the JRC, DG Environment and Eurostat. The project 'Streamlining of environmental indicators' is coordinated by Eurostat and the exercise has the following goals:

- to ensure that indicators based on the same data sets and/or with the same content have the same name, and that indicators based on different data sets and/or with different content have clearly different names, regardless of the indicator publisher;
- to publish online a list of available environmental indicators in thematic groups, as well as the respective metadata file for each indicator (indicator profiles);
- to define streamlining principles and apply these to the indicators; to set up a well-defined streamlining process and extend the results of the current exercise to other EU (and potentially international) sets of environment or sustainable development–related indicators.

A European Environmental Indicator Metadata Catalogue is under development; it will have a dedicated section on the Eurostat website from the second half of 2014, and will act as a portal to EEA and Eurostat environmental indicators. Other producers of environmental indicators will be able to contribute to the catalogue; it is to constitute a central information point at EU level. The ambition is to extend the catalogue, so as to include environmental indicators from non-European

Box 2.1 European indicator sets

This list provides examples for illustration purposes only and does not claim to be comprehensive.

EU Sustainable Development Indicators (SDIs)
The SDIs were approved by the European Commission in 2005. The indicator set comprises more than 100 indicators across 10 domains, with around 50 indicators covering environmental issues or providing insight into environmental pressures and policy responses in key sectors. The indicator set is maintained by Eurostat, and can be viewed at http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators/all_indicators.

Europe 2020 — headline indicators
The Europe 2020 strategy is focused on smart, sustainable and inclusive growth. It has set targets and has defined headline indicators to monitor progress towards these targets. Three headline indicators relate to the environment, namely, GHG emissions, climate change and energy; see http://epp.eurostat.ec.europa.eu/portal/page/portal/europe_2020_indicators/headline_indicators.

The *Roadmap to a Resource Efficient Europe*
The Communication *Roadmap to a Resource Efficient Europe* (COM (2011) 571 final) aims to set actions and targets to make the EU more resource efficient and reduce its environmental impact. The associated staff working paper provides a list of indicators to help follow up on objectives and actions. DG Environment and data producers (Eurostat, the EEA and JRC) have developed the Resource Efficiency Scoreboard published by Eurostat: see http://epp.eurostat.ec.europa.eu/portal/page/portal/europe_2020_indicators/ree_scoreboard.

Agri-environment indicators (AEIs)
As identified in the European Commission Communication *Development of agri-environmental indicators for monitoring the integration of environmental concerns into the common agricultural policy* (COM (2006) 508 final), 28 AEIs cover the entire DPSIR framework, with indicator responsibility shared across Eurostat, DG Agriculture, DG Environment, the JRC and the EEA. Eurostat maintain the web page at http://epp.eurostat.ec.europa.eu/portal/page/portal/agri_environmental_indicators/introduction.

Life-cycle indicators
In order to quantify and monitor progress towards sustainability in terms of environmental performance, life-cycle indicators have been developed by the JRC. These offer a quantitative understanding of the links between environmental impacts and processes related to consumption, production, resource use/depletion, resource recycling, and waste management. Three classes of indicators have been developed for this purpose: resource efficiency indicators, basket-of-products indicators, and waste management indicators. For further information, see http://sa.jrc.ec.europa.eu/?page_id=768.

organisations such as the OECD, United Nations (UN) and others, creating a well-established and reliable worldwide repository.

In parallel with discussions on streamlining European environmental indicators, the EEA has also undertaken an extensive review of its indicators. The review was prompted by three considerations that drove the demand from EEA stakeholders to have the overall environmental indicators picture clarified. These were the perceived insufficiency of current indicators to meet recent policy demands; the scope for further rationalising indicator efforts across the EU and between geographical scales; and the need for clarity on development plans for new indicators, in support of current and emerging policy priorities.

The EEA indicator review involved four distinct but interconnected activities:

- 'cleaning up' the EEA indicators, to remove redundancies and duplications and ensure improved access to them on the website;

- mapping the EEA indicators and their status as it relates to their technical, conceptual and political contexts;
- continuing the indicator-based state-of-environment reporting in member countries, as part of the European environment state and outlook 2010 (SOER 2010) follow-up process;
- reviving the annual publication of an indicator-based cross-cutting assessment.

All four activities have been successfully managed, and now form part of ongoing EEA activities. The review has delivered an improved approach to indicator management and development at the EEA, with a focus on continuous improvement of the indicator resource. This includes improved communication with stakeholders concerning indicator availability, and better presentation of indicators on the EEA website, as well as improvements in the structure and content of the EEA Indicator Management System (IMS). The outcomes of the review are presented in this report, along with the current status of EEA indicators, the revised Core Set of Indicators (CSI) and expected outcomes of ongoing and planned activities.

Section 2 Indicators at the EEA

3 General approach

3.1 Principles and structuring

The overall approach to indicators at the EEA is illustrated by the indicator eye and its three dimensions (see Figure 3.1). The inner core (or CSI) comprises a small set of indicators, selected on the basis of their policy relevance, their regular updates and the quality of established or expected on-stream data flows. The outer core comprises regular indicators that fulfil minimum criteria as regards policy relevance and regular updates, and the stability and geographical scope of underpinning data sets. The third dimension comprises indicators of an irregular or even one-off character, developed by other organisations and used by the EEA in its assessment reports.

In past decades, the primary drivers of EU environmental policies were concerns for protecting human health, and the feasibility of reducing pressures on the environment through efficiency and other measures targeted at key economic sectors. This has shaped and directed the focus of monitoring and data collection, the types of indicators developed and the resulting balance of indicators in the EEA system.

Today, the EEA maintains an extensive set of 137 indicators, grouped in 13 environmental themes (see Figure 3.2). Most of these indicators are explicitly designed to support environmental policies and are based on statistics from international organisations and EU partners as well as on national data. EEA indicators are structured into thematic sets as well as sets established for a particular purpose, as are the CSI.

Geographic coverage of EEA indicators ranges from global, EEA member and cooperating countries, EU-28, regional or local depending on the indicators context and use. For example, some climate change indicators such as temperature are global and European, whereas others relating to air and water quality have a more regional and local focus.

The EEA CSI was first established in 2004 for three main purposes, which remain the objectives today:

- to provide a manageable and stable basis for indicator-based assessments of progress against environmental policy priorities;
- to prioritise improvements in the quality and geographic coverage of data flows which will enhance comparability and certainty of information and assessments;
- to streamline EEA/ European Environment Information and Observation Network (Eionet) contributions to other European and global indicator initiatives.

The first CSI consisted of 37 indicators selected from a much larger set maintained by the EEA; it was not balanced across themes reflecting the availability of indicators and selection criteria used in 2004. Therefore, revision of the CSI aimed to establish an indicator set with a more balanced structure and with improved alignment with current policy priorities and the EEA's Multiannual Work Programme 2014–2018, which aims to support environment and climate policy implementation priorities in Europe (see Chapter 5 for further details).

Figure 3.1 The EEA indicator eye

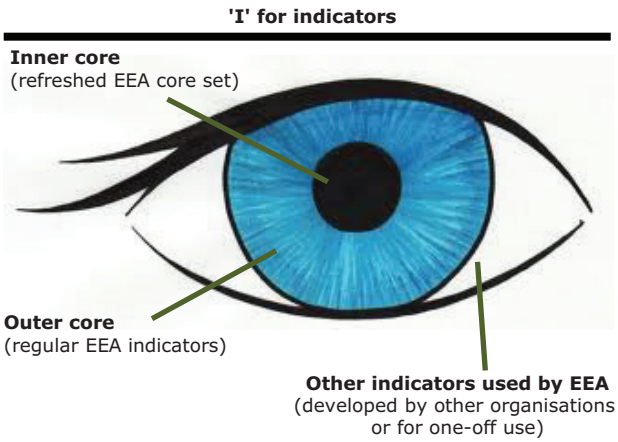


Figure 3.2 EEA indicators by theme (March 2014)

Themes	Number of indicators
Air pollution	11
Biodiversity	27
Climate change	46
Energy	11
Environmental scenarios	2
Fisheries	3
Green economy	1
Household consumption	1
Land	1
Soil	1
Transport	20
Waste	2
Water	11
Total	137

3.2 Frameworks and tools

EEA indicators are supported by a range of frameworks and tools. These focus on content framing, development, maintenance and dissemination. They constitute conceptual frameworks for environmental analyses (such as indicator typology), for production systems (such as the IMS), and for networks (such as the European environmental information and observation network (Eionet) established under EEA regulations and wider stakeholder engagement activities).

Monitoring, data, indicators, assessments, knowledge (MDIAK)

Reliable, relevant, targeted and timely environmental information is an essential element in implementing environmental policy and management processes. The development of such information can be divided into a number of phases that link the generation of information to its final use, and distinguish information according to its level of aggregation (see Figure 3.3).

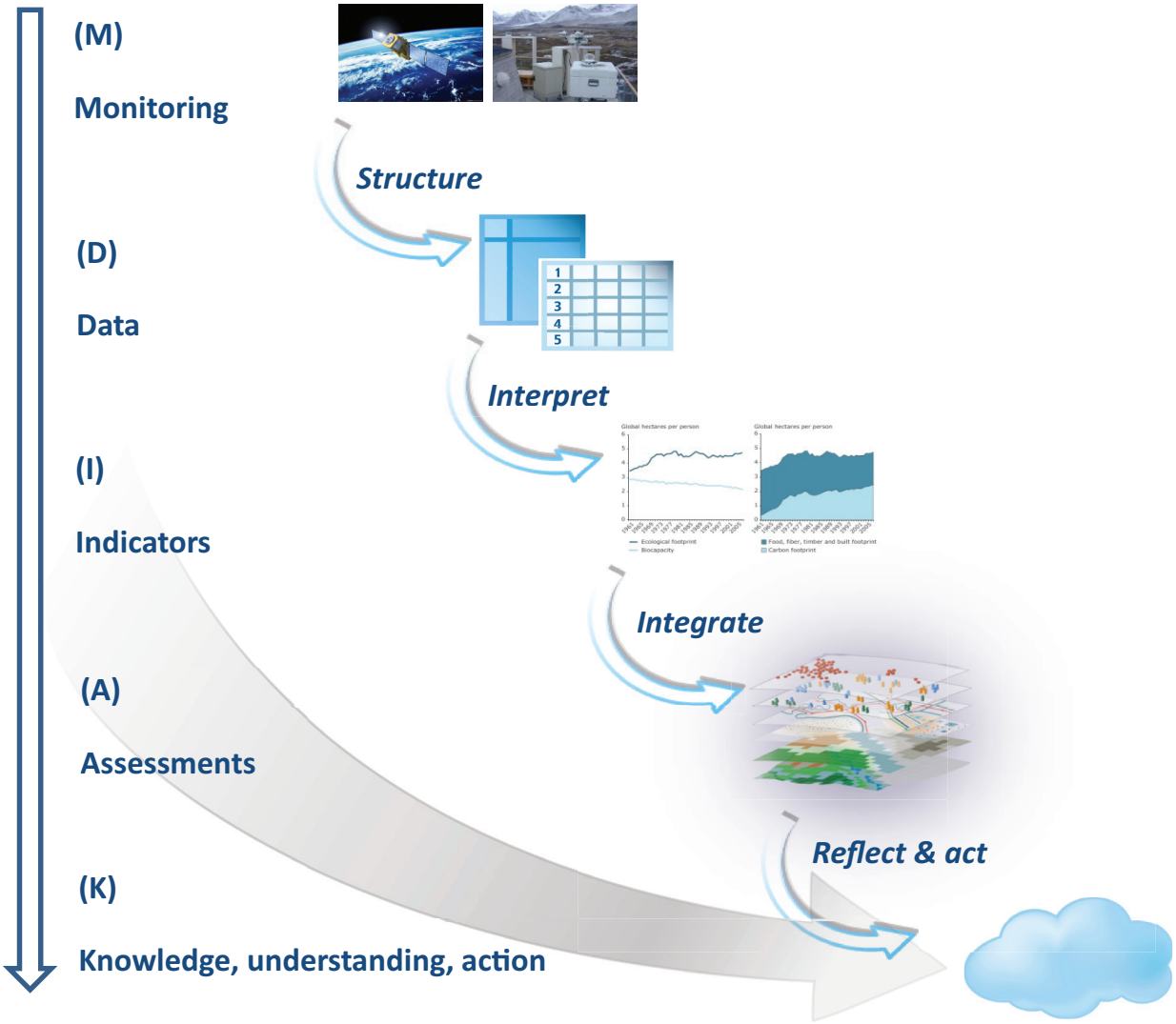
In this context, 'monitoring' provides observations or measurements of environmental parameters. 'Data' refers to combinations of measurements, structured in a manner that allows further processing and comparisons. 'Indicators' can then be derived by further selection, aggregation and interpretation of sometimes multiple data, with a view to communicating the state and trends clearly and answering specific policy or assessment questions. Indicators underpin 'assessments' and result in 'knowledge' which supports policymaking. The term 'knowledge' is understood as key insights into environmental processes, their management and options for action, to be taken on board by experts and policymakers alike.

Driving force, pressure, state, impact, and response (DPSIR)

Statistics Canada was the earliest source of comprehensive systemic frameworks and approaches to guide environmental data needs and indicator developments with the STRESS (STress Response Environmental Statistical System) framework (Stanners et al., 2007). The pressure-state-response reporting framework implemented by the OECD in the 1980s was derived from this.

To structure thinking about the interplay between the environment and socio-economic activities, the EEA developed the DPSIR (driving force, pressure, state, impact, and response) framework, an extended version of the OECD model. In the DPSIR framework, social and economic developments drive (D) changes that exert pressure (P) on the

Figure 3.3 The MDIAK reporting chain



environment. As a consequence, changes occur in the state (S) of the environment, which lead to impacts (I) on human health, ecosystem functioning and the economy. Finally, societal and political responses (R) affect earlier parts of the system, directly or indirectly.

From a policy perspective, there is a clear need for indicators on all parts of the DPSIR chain (Stanners et al., 2007; EEA, 2010), as explained below.

- Driving force indicators describe the social, demographic and economic developments in societies, and the corresponding changes in lifestyles and overall levels of consumption and production patterns. Examples include population growth and GDP.
- Pressure indicators describe developments in the release of substances (e.g. emissions to air or water), physical and biological agents, the use of resources and land. Examples include CO_2 emissions by sectors and land take.
- State indicators provide a description of the quantity and quality of physical, biological and chemical variables in a certain area. Examples include air quality, species diversity and atmospheric CO_2 concentrations.
- Impact indicators describe the relevance of changes in the state of the environment and corresponding implications for ecosystems, the economy and human well-being and health. Examples include the percentage of the

population exposed to noise above particular thresholds, or drinking water below quality standards.

- Response indicators relate to responses by society and policymakers that attempt to prevent, compensate, ameliorate, or adapt to changes in the state of the environment. Examples include environmental expenditure and recycling rates.

Indicators can also link the DPSIR elements with efficiency indicators describing the interplay between driving forces, pressures and responses (Figure 3.4). This kind of information helps to answer policy questions such as whether we are decoupling resource use and environmental pressures from economic growth and inform policy development and implementation.

The DPSIR framework is used by the EEA to help design assessments, select indicators and communicate results. It is coherent with those used by other organisations such as the OECD and the UN and international indicator-related processes such as the UN Framework for Development of Environment Statistics (UN Statistics Division, 2013).

EEA typology of indicators — ABCDE

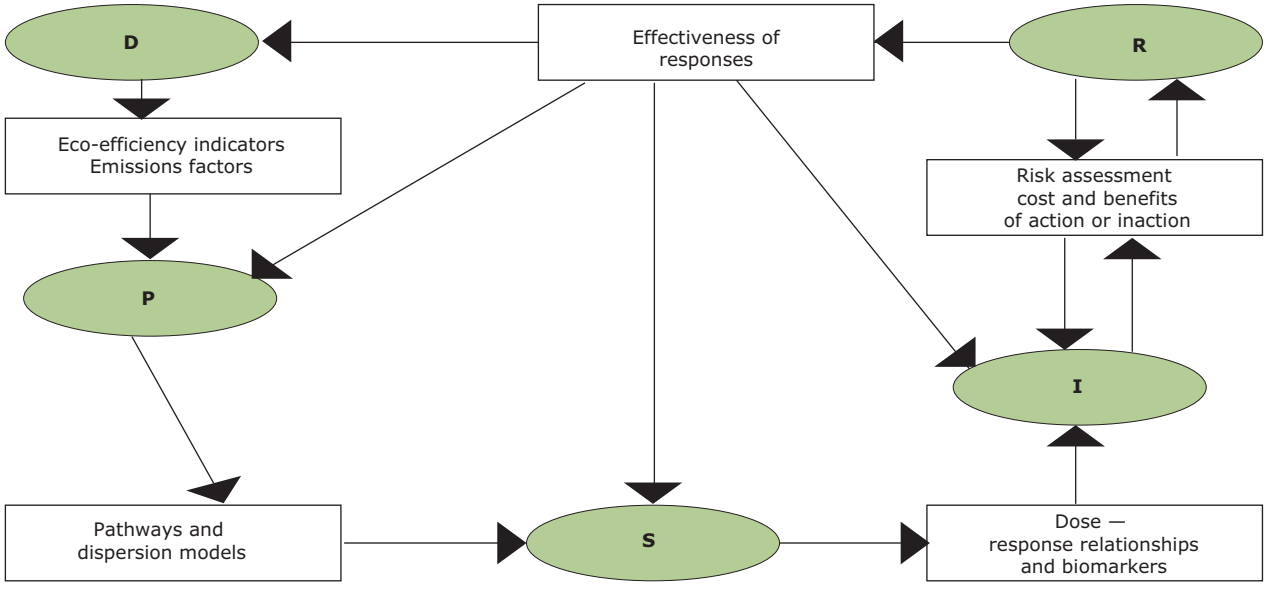
The EEA typology was developed in response to the need for an indicator classification allowing analysis of environment-society interactions in more detail.

EEA indicators are classified as descriptive (Type A), performance (Type B), efficiency (Type C), policy effectiveness (Type D) or total welfare (Type E), depending on which environmental challenge they address and which stage of the policy cycle they aim to inform.

Descriptive indicators (A) can be used for all elements of DPSIR, and they reflect the state of affairs. They describe the actual situation as concerns environmental issues, e.g. nutrient concentrations in European rivers. Performance indicators (B) may use the same variables as descriptive indicators, but are connected with targets or reference conditions. They link clearly to policy responses so as to measure progress, e.g. the ecological and chemical status of EU water bodies under the Water Framework Directive (WFD). Efficiency indicators (C) express the relationship between drivers and pressures, and are commonly expressed per capita or unit of GDP, e.g. GHG emissions per unit of GDP. Policy effectiveness indicators (D) relate the change in environmental variables to policy measures, linking responses to other elements of the DPSIR framework, e.g. production and consumption of ozone-depleting substances. Total welfare indicators (E) provide an overall measure of sustainability, integrating economic, environmental and social considerations, e.g. the Index of Sustainable Economic Welfare.

The majority of EEA indicators are descriptive, i.e. they show what is happening to the environment, and mainly comprise state, pressure

Figure 3.4 Indicators and information linking DPSIR



and impact indicators (see Table 3.1). The EEA does not have any indicators of total welfare reflecting the drivers of indicator development and perspectives on highly composite indices (see Section 1.2). Given the ongoing policy interest in C, D and E indicators, their further development is merited.

3.3 Indicator formats and maintenance

EEA indicators are mostly, but not exclusively, developed bottom-up from countries using data sets drawn from national environmental and monitoring systems, often established because of EU legislation (see Figure 3.3; MDIAK).

Each EEA indicator is based on one or more source data sets which are processed in line with the methodology outlined in the indicator specification (see Box 3.1). The data are then used to compile the tables, maps and graphs which support the assessment and key messages. A new assessment is produced whenever new data become available from the source data sets, and an updated version is then published on the EEA website.

Eionet is a partnership network of the EEA and its member and cooperating countries, involving approximately 1 400 experts and more than 400 national institutions. Eionet members contribute data for EEA indicators and through a combination of formal (consultation) and informal (voluntary contributions and country tests) involvement to support indicator development. National perspectives are very important for the development, publication and use of EEA indicators and in particular, the CSI.

The Eionet priority data flows, agreed between the EEA and Eionet, identify a set of stable, well-defined objectives to provide a focus for countries when they are putting procedures in place for regular reporting. They are a crucial mechanism for improving data quality for indicators. Two key characteristics of a priority data flow are regular frequency for data collection and regular use of the data in an EEA product such as an indicator. Every year, the EEA produces a report on these data flows to show progress in order to allow countries to identify and confirm the institutional resources they need for regular reporting procedures. The report also encourages countries to aim for better performance through friendly competition, concentrating on achievements rather than failures.

Developing data flows so that they provide an improved foundation for current and future indicators will require action in a number of areas. These include geo-referencing of data to enable analysis based on ecological units, and improving the timeliness of data so that indicators are updated regularly, and thus are more useful in informing policy debates. Improved accessibility and automated sharing of data sets will also improve the timeliness and relevance of indicators.

Together with its member countries and EU partners, the EEA is developing a range of approaches and systems that tackle the above challenges. The 'Shared European and national state of the environment' (SENSE) project, now in its third phase, allows automated online sharing of European and national indicators and assessments and their underpinning data between the EEA and Eionet. Over time, the 'Infrastructure for Spatial Information

Table 3.1 EEA indicators by focus and type

Focus/type	Driving force (D)	Pressure (P)	State (S)	Impact (I)	Response (R)	Total
Descriptive (A)	16	22	22	39	10	109
Performance (B)	0	11	2	0	3	16
Efficiency (C)	3	4	0	1	1	9
Policy effectiveness (D)	2	0	0	0	1	3
Total welfare (E)	0	0	0	0	0	0
Total	21	37	24	40	15	137

Box 3.1 Format of EEA indicator publications

1. Indicator specification (this part contains common and stable metadata for all the periodic assessments)
1. Identification (title; code) and classification (DPSIR; typology; EEA themes)
2. Rationale — justification for indicator selection; scientific references
3. Indicator definition — definition; units
4. Policy context and targets — context description; targets; related policy documents
5. Policy questions — key policy questions; specific policy questions (optional)
6. Methodology — methodology for indicator calculation; methodology for gap filling; methodology references
7. Data specifications — EEA data references; external data references; data sources in latest figures
8. Uncertainties — methodology uncertainty; data set uncertainty; rationale uncertainty
9. Responsibility and ownership (EEA indicator manager; ownership)
10. Further work (short-term work; long-term work)
11. Common Content Management System (CMS) metadata
2. Indicator assessment (this part is the actual assessment created at a certain frequency)
12. Key messages
13. Relation to which 'Key policy question' from the specification it tries to answer
14. Key assessment text
15. Relations to one or more figures supporting the assessment
16. Common CMS metadata
17. Specific assessment + figure (optional; conditional on 5)

in the European Community (INSPIRE) process will result in enhanced availability of geospatial reference data. The combination of remote sensing and in situ observations, available from the Copernicus integrated monitoring services, will strengthen capacities for handling near real-time (NRT) data flows.

The EEA is also investing in improving the presentation of indicators on the website (and therefore their communication potential, too) (see Box 3.2).

3.4 Building capacities in EEA co-operating countries and the European Neighbourhood

The West Balkan countries are cooperating countries of the EEA and the long-term objective

Box 3.2 Data visualisation

The EEA's data visualisation tool, DaViz, has been used from 2013 to convert EEA indicator charts and tables into an interactive presentation format. DaViz enables users to explore EEA indicators on the Web by creating interactive charts that allow users to select particular variables and countries for comparison, display trends using motion charts and create charts and group them into one dashboard. DaViz makes it easy to share and reuse data, as charts can also be easily embedded into any site and can be used on any device. This improves the communication value of EEA indicators. For further information, see http://www.eea.europa.eu/data-and-maps/daviz.

is to fully include all West Balkan partners into the regular EEA reports and assessments. The EEA has supported development of 37 EEA CSIs at regional and local/national level and the West Balkan Core Set of Indicators was published in 2012 (Zoi Environment Network, 2012). The countries involved included Albania, Bosnia and Herzegovina, Croatia (became member of the EU on 1 July 2013), the former Yugoslav Republic of Macedonia, Kosovo (UN Security Council resolution 1244/99), Montenegro and Serbia.

The EEA supports cooperating countries in developing or extending their national environmental information systems in line with the Eionet approach and SEIS principles (e.g. institutional cooperation, technical infrastructure and content).

Indicators are also an important part of the EEA's work in the European Neighbourhood, where the objective is to build capacities in countries and regions bordering those with EEA membership. The project 'Towards a Shared Environmental Information System (SEIS) in the European Neighbourhood' is being implemented over the period from 2010 to 2014. The overall objective is to help protect the environment in the European Neighbourhood region by improving capacities of relevant authorities in environmental monitoring, data collection and management, assessment and indicator-based reporting on the environment.

Participating countries in the European Neighbourhood Policy (ENP) East region include Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine; the ENP South region's participating countries include Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia.

The main expected outcomes of the project are the further development and strengthening of national capacities for handling environmental data and information, and the facilitation of open access to available environmental data and information, through compatible and freely available tools for data exchange. One of the key objectives of the ENPI-SEIS process is the establishment of regular data and information flows aiming to ensure the production of selected indicators, and to assist partner countries in fulfilling their related national and international reporting obligations.

The ENPI East countries identified the production of selected environmental indicators as one of their main cross-cutting activities. The project builds on the work of the UNECE Joint Task Force on Environmental Indicators and on a feasibility study conducted in 2012: it aims to establish regular data flows for the production of eight pilot indicators, covering 11 national data sets (see Table 3.2). The 11 selected data sets are regularly assembled at national level, based on national or international reporting requirements.

For the ENP South region, cooperation resulted in the selection of six Horizon 2020 (H2020) indicators, the set-up of a reporting tool, and the preparation of the first draft H2020 report, which will be presented at the Union for the Mediterranean Ministerial Conference in May 2014.

Table 3.2 ENPI environmental indicators

Indicator from UNECE guidelines	Data set
1. Emissions of pollutants into the atmospheric air	(1) Emissions of SO_2
	(2) Emissions of NO_X
2. Ambient air quality in urban areas	(3) Mean concentration of NO_2
3. Consumption of ozone-depleting substances (ODS)	(4) Consumption of ODS
4. Greenhouse gas (GHG) emissions	(5) GHG emissions
5. Waste generation	(6) Annual municipal waste generation
6. BOD_5 and concentration of ammonium in rivers	(7) BOD_5 concentration in the rivers
	(8) Ammonium concentration in the rivers
7. Nutrients in freshwater	(9) Nitrates concentration in the major water bodies
	(10) Total phosphorus concentration in the major water bodies
8. Protected areas	(11) Areas under protection in total and broken down by regimes of protection

The six priority indicators targeted for the region are as follows:

- municipal waste generation per capita;
- amount of collected and treated municipal waste, including collection rate and type of treatment;
- share of population with access to an improved sanitation system (total, urban and rural);
- volume of wastewater collected, of which volume of wastewater treated;
- nutrient concentrations in transitional, coastal and marine waters of the Mediterranean Sea;
- release of toxic substances and nutrients from industrial sectors.

The first reporting exercise for the H2020 mid-term assessment confirmed that setting up a regular reporting mechanism remains a long-term process. Important challenges have been identified relating to division of responsibilities of national authorities managing environmental data, data quality and data accessibility; the need for further institutional arrangements to support data flows and preparation of thematic assessments; and limited human and sometimes financial resources to support the process.

4 Thematic indicators

4.1 Air pollution indicators

The EEA currently publishes 11 air pollution indicators (see Table 4.1). These indicators have mainly been developed to provide information on performance in reducing emissions to air, as regulated by the Gothenburg Protocol under the Convention on Long-range Transboundary Air Pollution (LRTAP Convention), Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants, known as the National Emission Ceilings (NECD) and the EU Greenhouse Gas Monitoring Mechanism/ UN Framework Convention on Climate Change (UNFCC). The indicators provide information on emissions by country and sector, and some assess distance to target. In addition to providing information on these environmental pressures, the EEA publishes indicators on the exposure of humans and ecosystems to these pollutants.

The EEA regularly publishes assessments of progress being made in reducing emissions, and uses the indicators in annual reports on air quality in Europe. These annual reports provide a regularly updated account of air quality, in support of policy development and implementation at both European and national levels.

4.2 Biodiversity indicators

The EEA hosts the indicator set developed under the Streamlining European Biodiversity Indicators (SEBI) process (see Table 4.2). Development of the SEBI set began in 2005, with the aim of providing a streamlined set of biodiversity indicators for Europe to measure progress towards the target of halting biodiversity loss by 2010. The set was developed by a wide range of stakeholders, and an agreed list of indicators was published in 2007. The SEBI set has provided the basis for indicator-based assessments of Europe's progress towards the 2010 target of halting biodiversity loss. Individual assessments were undertaken for each of the 26 SEBI 2010 indicators; these then formed the basis for the overall assessment of progress (EEA, 2009).

Table 4.1 Air pollution indicators

Indicator name	Indicator focus	Indicator type
Emission of acidifying substances	P	B
Emissions of ozone precursors	P	B
Emissions of primary particulate matter and secondary particulate matter precursors	P	B
Exceedance of air quality limit values in urban areas	S	A
Exposure of ecosystems to acidification, eutrophication and ozone	S	B
Sulphur dioxide (SO_2) emissions	P	B
Nitrogen oxides (NO_x) emissions	P	B
Ammonia (NH_3) emissions	P	B
Non-methane volatile organic compounds (NMVOC) emissions	P	B
Heavy metal (HM) emissions	P	B
Persistent organic pollutant (POP) emissions	P	B

Table 4.2 Biodiversity indicators

CBD focal area	Indicator name	Indicator focus	Indicator type
Status and trends of the components of biological diversity	Species of European interest	S	A
	Designated areas	R	A
	Species diversity	S	A
	Abundance and distribution of selected species	S	A
	Red List Index for European species	S	A
	Ecosystem coverage	S	A
	Habitats of European interest	S	A
	Livestock genetic diversity	S	A
	Nationally designated protected areas	R	A
	Sites designated under the EU Habitats and Birds directives	R	A
Threats to biodiversity	Critical load exceedance for nitrogen	P	B
	Invasive alien species in Europe	P	A
	Impact of climate change on bird population	P	A
Ecosystem integrity and ecosystem goods and services	Marine trophic index of European seas	S	A
	Fragmentation of natural and semi-natural areas	P	A
	Nutrients in transitional, coastal and marine waters	P	A
	Freshwater quality	P	A
Sustainable use	Forest: growing stock, increment and fellings	P	A
	Forest: deadwood	S	A
	Agriculture: nitrogen balance	P	A
	Agriculture: area under management practices potentially supporting biodiversity	S	A
	Fisheries: European commercial fish stocks	P	A
	Aquaculture: effluent water quality from finfish farms	P	A
	Ecological Footprint of European countries	P	A
Status of access and benefits sharing	Patent applications based on genetic resources	R	A
Status of resource transfers	Financing biodiversity management	R	A
Public opinion (additional EU focal area)	Public awareness	R	A

In 2010, a new Strategic Plan for Biodiversity 2011–2020 was adopted at the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity in Nagoya, Japan. It was clear that the global 2010 target had not been met, and that in fact biodiversity loss had been continuing. The strategy includes the development of a coherent indicator-based framework for monitoring, assessing and reporting on progress in implementing actions and meeting targets.

In line with global developments, a new EU Biodiversity strategy titled *Our life insurance, our natural capital: an EU biodiversity strategy to 2020* was adopted by the European Commission in May 2011. This provided a framework under which the EU could meet its own biodiversity objectives and its global commitments as a party to the Convention on Biological Diversity (CBD). The Biodiversity strategy sets out a long-term 2050 vision and 2020 headline target. The SEBI set was reviewed and the indicators mapped to the new targets, both at global and EU level, informing development plans for the set in the following years (EEA, 2012c).

4.3 Climate indicators

The EEA currently publishes 46 climate indicators (see Table 4.3). Development of these indicators has been driven by both policy demands and assessment needs. Some indicators have been developed to provide information on performance in reducing emissions reported under the EU Greenhouse Gas Monitoring Mechanism/UNFCC. These indicators provide information on past and projected GHG emissions by country as well as a sectoral breakdown and assessment of distance to target.

Other indicators focus on related impacts, and in 2012, the EEA published an indicator-based assessment of climate change, impacts and vulnerability in Europe (EEA, 2012a). The report used indicators to provide information on past and projected climate change and related impacts in Europe, assess the vulnerability of society, human health and ecosystems, and identify those regions most at risk from climate change. The principle sources of uncertainty for the indicators used in the report were also presented.

Table 4.3 Climate indicators

Indicator name	Indicator focus	Indicator type
Production and consumption of ozone depleting substances	D	D
Greenhouse gas emission trends	P	B
Progress to greenhouse gas emission targets	P	A
Global and European temperature	S	B
Atmospheric greenhouse gas concentrations	S	A
Mean precipitation	I	A
Precipitation extremes	I	A
Storms	I	A
Air pollution by ozone and health	I	A
Glaciers	I	A
Snow cover	I	A
Greenland ice sheet	I	A
Arctic and Baltic Sea ice	I	A
Permafrost	I	A
Global and European sea-level rise	I	A
Sea surface temperature	I	A
Phenology of marine species	I	A
Distribution of marine species	I	A
River flow	I	A
River floods	I	A
River flow drought	I	A
Water temperature	I	A
Lake and river ice cover	I	A
Distribution of plant species	I	A
Plant and fungi phenology	I	A
Distribution of animal species	I	A
Animal phenology	I	A
Species interaction	I	A
Soil organic carbon	I	A

Table 4.3 Climate indicators (cont.)

Indicator name	Indicator focus	Indicator type
Soil erosion	I	A
Soil moisture	I	A
Growing season for agricultural crops	I	A
Agrophenology	I	A
Water-limited crop productivity	I	A
Irrigation water requirement	I	A
Forest growth	I	A
Forest fires	I	A
Extreme temperatures and health	I	A
Vector-borne disease	I	A
Damages from weather and climate-related events	I	A
Ocean acidification	S	A
Ocean heat content	S	A
Storm surges	I	A
Floods and health	I	A
Heating degree days	I	A
Production, sales and emissions of fluorinated GHGs (F-gases)	D	D

4.4 Energy indicators

The EEA currently publishes 11 energy indicators (see Table 4.4) which provide information on trends in energy use and the integration of environmental considerations in the energy sector. The indicators are organised around policy questions, and inform regular energy and environment reporting as well as assessments of the expected environmental benefits and pressures from different shares of renewable energy.

Table 4.4 Energy indicators

Indicator name	Indicator focus	Indicator type
Final energy consumption by sector	D	A
Total primary energy intensity	R	B
Primary energy consumption by fuel	D	A
Renewable primary energy consumption	R	B
Renewable electricity consumption	R	B
Efficiency of conventional thermal electricity generation	D	C
Final energy consumption intensity	D	A
Share of renewable energy in final energy consumption	I	C
Overview of the European energy system	D	C
Progress on energy efficiency in Europe	R	C
Overview of the electricity production and use in Europe	D	C

4.5 Transport indicators

The EEA's annual Transport and Environment Reporting Mechanism (TERM) report aims to provide policymakers, as well as a broader audience, with a clear overview of current transport demand, the pressures from the transport sector on the environment and related impacts and responses. TERM reports have been published since 2000, based on an indicator set that covers the most important aspects of the transport and environment system (see Table 4.5). The TERM indicator set has enabled a range of different assessments to be developed from the same indicator base. In recent years, the annual report has explored different aspects in greater detail: air pollution, greener transport, urban transport and resource efficiency.

The TERM process is steered jointly by the European Commission (Eurostat, DG Environment, DG Mobility and Transport and DG Climate Action) and the EEA. EEA member countries and other international organisations provide input and are consulted on a regular basis. In order to sharpen the focus on targets, a core set of indicators for transport (TERM CSIs) was developed in the 2013 report. These indicators cover issues such as energy consumption, emissions, transport demand, price developments and fleet monitoring (EEA, 2013a). They are intended to provide an overview of what is happening in the transport sector and why.

4.6 Water indicators

The EEA currently publishes 11 indicators providing information on the status of and pressures on freshwater, transitional, coastal and marine waters (see Table 4.6). This thematic area is a focus of indicator development with relevant directives, including the WFD and Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive), generating new indicators, along with the *Roadmap to a Resource Efficient Europe*. These new indicators are at various stages of development and will be published in future on the EEA website.

Table 4.5 Transport indicators

Indicator name	Indicator focus	Indicator type
Passenger transport demand	D	A
Freight transport demand	D	A
Use of cleaner and alternative fuels	R	D
Transport final energy consumption by mode	P	A
Transport emissions of greenhouse gases	P	A
Transport emissions of air pollutants	P	A
Exceedances of air quality objectives due to traffic	S	A
Traffic noise: exposure and annoyance	I	A
Fragmentation of land and ecosystems	S	A
Capacity of infrastructure network	D	A
Transport infrastructure investments	D	A
Real change in transport prices by mode	D	A
Fuel prices	D	A
Energy efficiency and specific CO2 emissions	P	A
Specific air pollutant emissions	P	A
Occupancy rates of passenger vehicles	D	A
Load factors for freight transport	D	A
Size of the vehicle fleet	P	C
Average age of the vehicle fleet	D	A
Proportion of vehicle fleet meeting certain emission standards	D	A

Table 4.6 Water indicators

Indicator name	Indicator focus	Indicator type
Use of freshwater resources	P	A
Oxygen consuming substances in rivers	S	A
Nutrients in freshwater	S	A
Nutrients in transitional, coastal and marine waters	S	A
Bathing water quality	S	A
Chlorophyll in transitional, coastal and marine waters	S	A
Urban waste water treatment	R	A
Hazardous substances in marine organisms	P	A
Emission intensity of agriculture in Europe	P	C
Emission intensity of domestic sector in Europe	P	C
Emission intensity of manufacturing industry in Europe	P	C

4.7 Other thematic indicators

The EEA also publishes indicators on a range of other thematic areas: waste, land, soil, household consumption, green economy, fisheries and environmental scenarios (see Table 4.7). These are used in various EEA assessments and publications, such as the 'European environment — state and outlook' reports (SOER).

Table 4.7 Fisheries, land, soil, waste, household consumption and green economy

Thematic area	Indicator name	Indicator focus	Indicator type
Waste	Municipal waste generation	P	A
	Waste electrical and electronic equipment	R	A
Land	Land take	P	A
Soil	Progress in management of contaminated sites	R	A
Household consumption	Household expenditure on consumption categories with differing environmental pressure intensities	D	A
Green economy	Number of organisations with registered environmental management systems according to EMAS and ISO 14001	R	A
Fisheries	Status of marine fish stocks	S	A
	Aquaculture production	P	A
	Fishing fleet capacity	P	A
Environmental scenarios	GDP — Outlook from OECD	D	A
	Total population – Outlook from UNSTAT	D	A

5 Core Set of Indicators (CSI)

The revision of the EEA CSI, the first since its establishment in 2004, aimed to produce an indicator set with a more balanced structure and improved alignment with current policy priorities and the EEA's work programme in the coming years.

The revised CSI comprises 42 indicators structured into 6 thematic areas which correspond to priority themes for stronger environmental policy implementation (see Table 5.1). The thematic areas also integrate the sectors agriculture and forests, fisheries (and maritime), energy, and transport. These are considered to be the main sources of environmental pressures from economic sectors. The choice of themes and sectors reflects policy priorities, EEA investments over the past decade and the diversity of EEA indicators, and enables indicator-based assessments of progress against key environmental policy priorities.

The EEA CSI only comprises those indicators regularly produced by the EEA; it does not comprehensively cover all environmental issues. Indicators produced by Eurostat and the JRC amongst others complement the CSI. The revision aimed to keep the CSI stable, but not static, by retaining existing CSI indicators where they were of sufficient relevance and quality. New indicators were also chosen, primarily from existing EEA indicator sets. The revision has resulted in seven indicators that were part of the previous core set being removed. There are several reasons for this: selection of alternative indicators which better relate to current policy priorities, and removal of indicators no longer maintained by EEA (such as the two agri-environment indicators now published by Eurostat). Balancing the CSI across themes has led to a reduction in the number of energy indicators, although these indicators are still published by EEA as thematic indicators.

The need to adjust the CSI to new policy demands has led to the integration of a longer term perspective and the inclusion of indicators under development that will become operational during the 2014-to-2018 period. This provides scope for innovation and should enable the CSI to better reflect new policy demands. The data implications arising from these proposals are expected to be minimal for countries. Data flows for the CSI will either come from established processes or from recent policy initiatives e.g. the Marine Strategy Framework Directive.

Table 5.1 EEA Core Set of Indicators

Thematic area and topic	Indicator name	Notes	Indicator focus
A. Air pollution, transport and noise			
Air pollution	Emissions of main air pollutants	New indicator under development (based on merging indicators 'emissions of acidifying substances', 'emissions of ozone precursors' and 'emissions of primary particulate matter and secondary particulate matter precursors')	P
	Exceedance of air quality limit values in urban areas	Indicator is retained unchanged	S
	Exposure of ecosystems to acidification, eutrophication and ozone	Indicator is retained unchanged	S
Transport	Passenger and freight transport demand	New indicator under development (based on merging indicators 'passenger transport demand' and 'freight transport demand')	D
	Use of cleaner and alternative fuels	Indicator is retained unchanged	R
Industry	Pollutant releases to air, water and waste from industrial facilities	New indicator under development	P
Noise	Population exceeding ambient noise limit values (for road traffic)	New indicator under development	S
B. Climate change and energy			
Climate change mitigation	EU and national total greenhouse gas emission trends and projections	New indicator under development (based on merging indicators 'greenhouse gas emission trends' and 'progress to greenhouse gas emission targets')	P
	Atmospheric greenhouse gas concentrations	Indicator is retained unchanged	S
	Production, consumption and emissions of fluorinated gases	New indicator under development (based on 'production, sales and emissions of fluorinated GHG's (F-gases)). 'Production and consumption of ozone depleting substances' moved to the outer core	P
Climate change impacts	Global and European temperature	Indicator is retained unchanged	S
	Cryosphere trends for European glaciers and sea ice	New indicator under development (based on indicators 'glaciers', 'Greenland ice sheet' and 'Arctic and Baltic sea ice')	I
Energy	Overview of European energy system	New CSI indicator is introduced and three indicators ('primary energy consumption by fuel', 'renewable primary energy consumption' and 'renewable electricity consumption') moved to the outer core	D
	Share of renewable energy in final energy consumption	New CSI indicator previously published by EEA	I
C. Freshwater resources			
Water resources/ water scarcity and drought	Use of freshwater resources	Indicator is retained and revised	P
Freshwater ecosystems	Trends in ecological status	New indicator under development	S

Table 5.1 EEA Core Set of Indicators (cont.)

Thematic area and topic	Indicator name	Notes	Indicator focus
Water pollution and quality	Oxygen consuming substances in rivers	Indicator is retained unchanged	S
	Nutrients in freshwater	Indicator is retained unchanged	S
Water and health	Bathing water quality	Indicator is retained unchanged and 'urban waste water treatment' moved to the outer core.	S
Climate change impacts on water	Climate change impacts on water	New indicator under development (based on indicators 'river floods' and 'damages from weather and climate-related events')	I
Pressures on water	Pressures on water	New indicator under development (based on indicators 'river flow drought', 'lake and river ice cover', 'agriculture: nitrogen balance' and 'pesticide risk')	P
D. Marine and maritime			
Transitional, coastal and marine water quality	Nutrients in transitional, coastal and marine waters	Indicator is retained and revised	S
	Chlorophyll in transitional, coastal and marine waters	Indicator is retained unchanged	S
	Hazardous substances in marine organisms	New CSI indicator previously published by EEA	P
Fisheries	Status of marine fish stocks	Indicator is retained and revised	S
	Fishing fleet capacity	Indicator is retained and revised. 'Aquaculture production' moved to the outer core	P
Climate change	Sea surface temperature	New CSI indicator previously published by EEA	I
	Global and European sea level rise	New CSI indicator under development (based on merging indicators 'global and European temperature' and 'storm surges')	I
E. Biodiversity and ecosystems			
Status and trends of the components of biological diversity	Species and habitats of European interest	New indicator under development (based on indicators 'species of European interest' and 'habitats of European interest' with additional information from Birds Directive reporting. Marine component will be added when available)	S
	Designated areas	Indicator is retained unchanged	R
	Abundance and distribution of selected species	New CSI indicator previously published by EEA	S
Threats to biodiversity: Habitat loss and degradation	Land take	Indicator is retained unchanged	P
	Fragmentation of habitats and ecosystems	New indicator under development	I
Sectors – agriculture and forests	Agricultural areas under Natura 2000	New indicator under development. Two agriculture indicators 'Gross Nutrient Balance' and 'Areas under organic farming' have been removed from the CSI as they are now published by Eurostat	R
	Forest: growing stock, increment and fellings and deadwood	New indicator under development (based on indicators 'forest: growing stock and deadwood' and 'forest: deadwood')	S

Table 5.1 EEA Core Set of Indicators (cont.)

Thematic area and topic	Indicator name	Notes	Indicator focus
F. Waste and resources			
Waste generation	Waste generation	New indicator under development and 'municipal waste generation' retained until new indicator is published	P
Waste recycling	Waste recycling	New indicator under development	R
Waste diversion from landfill/ disposal	Diversion of waste from landfill	New indicator under development	R
Household consumption	Household environmental pressure intensity	New CSI indicator previously published by EEA	D
Energy efficiency	Total primary energy intensity	Indicator is retained unchanged	R
Decoupling of environmental pressures	Decoupling of resource use from environmental pressures	New indicator under development	D
Decoupling of environmental impacts	Decoupling of resource use from environmental impacts	New indicator under development	D

Section 3 Policy applications and further development

6 Indicators for cross-cutting analyses

6.1 Evolving policy needs

Current environmental indicators reflect environmental policy concerns over the last decades. Well-established indicators tend to relate to policy challenges of the 1980s and early 1990s such as air and water pollution, waste generation and nature conservation, in terms of protection of endangered species and habitats. Since the late 1990s, recognition of more diffuse policy challenges resulted in the development of indicators focused on the integration of environmental considerations into sectoral domains with the greatest environmental impacts, e.g. energy, transport, agriculture and industry.

The SOER 2010 (EEA, 2010) highlighted how our understanding of environmental challenges and their underlying causes has evolved over time (see Table 6.1). More complex, systemic challenges (such as climate change impacts and adaptation, biodiversity loss, ecosystem resilience, resource scarcities and synergistic effects on human health) have created demands for more integrated indicators across the DPSIR chain. However, the time period involved in developing new indicators, establishing their use in policy and decision-making, and current resource constraints have resulted in existing indicators being revisited and reused, and assessed in terms of how they can meet these new demands. The revival of the annual publication of an indicator-based cross-cutting assessment has taken this approach.

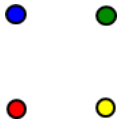
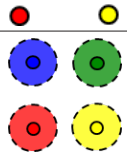
6.2 Measuring progress towards a green economy — the annual indicator report series

The Environmental indicator report series has focused on measuring progress towards a green economy. A green economy can be understood as one in which environmental, economic and social policies and innovations enable societies to use resources efficiently — enhancing human well-being in an inclusive manner, while maintaining the natural systems that sustain us (EEA, 2012b).

Ecosystem resilience and resource efficiency in a green economy

In the 2012 Environmental indicator report (EEA, 2012b), the focus was on key aspects of the

Table 6.1 Reflecting on environmental challenges

Characterisation of the type of challenge		Key feature	In the spotlight in	Policy approach example
Specific		Linear cause-effect large (point) sources often local	1970s/1980s (continuing today)	Targeted policies and single-issue instruments
Diffuse		Cumulative causes multiple sources often regional	1980s/1990s (continuing today)	Policy integration and raising public awareness
Systemic		Systemic causes interlinked sources often global	1990s/2000s (continuing today)	Policy coherence and systemic approaches

transition to a green economy: resource efficiency and ecosystem resilience. Six indicators were used to assess resource efficiency, and six to address ecosystem resilience. The findings indicate a mixed performance, although they suggest that Europe has made more progress in improving resource efficiency than in preserving ecosystem resilience (see Table 6.2).

Table 6.2 Indicative summary table of progress towards meeting environmental targets or objectives (extract from EEA, 2012b)

Selected 'state' indicators (related to ecosystem resilience)			
Environmental issue	**EU-27 target or objective**	**EU-27 on track?**	**EU-27 and EEA32 10-year trend?**
Focus: loss of biodiversity			
Conservation status (safeguard EU's most important habitats and species)	To achieve favourable conservation status, set up Natura 2000 network	☐	→
Focus: climate change			
Global mean temperature change	To limit increases to below 2 °C globally	☒ (a)	(↗)
Focus: air quality			
Air quality in urban areas (particulate matter and ozone)	To attain levels of air quality that do not give rise to negative health impacts	☒	→
Focus: marine environment			
Biodiversity loss (marine species and habitats)	To reverse negative species abundance trends	☒	(↘)
Focus: water stress			
Water stress (water exploitation)	To achieve good quantitative status of waterbodies	☐ (b)	→ (c)
Focus: material resource use			
Ecological footprint (footprint versus biocapacity)	n/a	n/a	→
Selected 'pressure' indicators (related to ecosystem resilience)			
Environmental issue	**EU-27 target or objective**	**EU-27 on track?**	**EU-27 and EEA32 10-year trend?**
Focus: nitrogen emissions			
Transboundary air pollution (NO_x, NMVOC, SO_2, NH_3)	To limit emissions of acidifying, and eutrophying pollutants	☐	↘
Focus: carbon emissions			
GHG emissions	To reduce GHG emissions by 20 % by 2020	☑	↘
Focus: air pollution			
Air pollution	To limit emissions of ozone precursor pollutants	☐	↘

Table 6.2 Indicative summary table of progress towards meeting environmental targets or objectives (extract from EEA, 2012b) (cont.)

Selected 'state' indicators (related to ecosystem resilience)			
Environmental issue	**EU-27 target or objective**	**EU-27 on track?**	**EU-27 and EEA32 10-year trend?**
Focus: maritime use			
Maritime transport emissions	To reduce GHG emissions	☐	→
Focus: water use			
Water use	n/a	n/a	↘
Focus: material resource			
Decoupling and recycling (decouple resource use from economic growth)	To decouple resource use from economic growth; to move towards a recycling society	☐	↗

Legend:		
Positive developments	Neutral developments	Negative developments
↘ Decreasing trend	→ Stable	(↘) Decreasing trend
↗ Increasing trend		(↗) Increasing trend
☑ EU on track (some countries may not meet target)	☐ Mixed progress (but overall problem remains)	☒ EU not on track (some countries may meet target)

Note: (a) The aim is to limit the global mean temperature increase to below 2 °C above preindustrial levels. This depends critically also on GHG emissions originating outside Europe.

(b) The targets set out in the WFD have to be reached by 2015. Initial assessments by Member States show that a large percentage of waterbodies will not attain good ecological and chemical status.

(c) Note that the trend regarding water abstractions in Europe is decreasing. This does not necessarily translate to a decrease in water stress, however; water availability may continue to be low in regions with water stress due to variations in seasonal water demand and climatic factors.

The report primarily used pressure and state indicators as proxies to quantify resource efficiency and resilience aspects. Indicators that depict environmental pressures can indicate progress in improving resource efficiency, as they can be related to their key driving forces and measure whether the environmental pressure per production unit or per economic activity is increasing or decreasing. Indicators that describe the state of or impacts on the environment help illustrate threats to ecosystem resilience based on the assumption that that an environmental system under stress will have less ability to adapt to environmental pressures, and will thus display low levels of resilience. Therefore, almost all the indicators used had been established for some time and for a primary purpose different to that specified in the report. The use of proxy or best available indicators was necessary in the absence of established indicators for monitoring progress towards a green economy.

Natural resources and human well-being in a green economy

The 2013 Environmental indicator report (EEA, 2013b) extended the analysis of the green economy to focus on the environmental pressures associated with resource use patterns and their impacts on human health and the environment. Although the causal relationships between individual resource use and health parameters are often obscure and complex, exposure to environmental pressures can be used as a useful proxy for well-being outcomes. The report interprets the available indicators per resource use category in terms of multiple

Table 6.3 Indicative summary table of progress relating to resource use (extract from EEA, 2013b)

Selected 'pressure' indicators (related to resource use)			
Aspect	**Indicator**	**Trend**	**Rationale (efficiency)**
Food			
Food demand	Meat consumption per capita	→	Higher values imply greater resource needs
Agricultural productivity	Cereal yield	↗	Higher values imply smaller land footprint
Chemical inputs	Pesticide/fertiliser use	→	Higher values indicate increased environmental pressure
Water			
Water demand	Water use	↘	Lower values imply decoupling from population/GDP
Exploitation intensity of river basins	Water exploitation index	□	Lower values imply more sustainable water use/greater regional differentiation indicates local water stress
Ecological status of waterbodies	Concentration of selected pollutants in water	↘	Lower values imply increased ecological quality of waterbodies
Energy			
Energy demand	Total consumption/energy intensity	↘	Higher values imply increased pressure on air quality
Sustainability of supply	Renewable energy share	↗	Higher values imply greater sustainability
Air emissions	Greenhouse gas emissions	↘	Higher values indicate increased pressure on the environment
Housing			
Housing demand	Average household size	↘	Lower values indicate increased pressure on the environment
Material use	Recycling rate construction material	↗	Higher values indicate reduced resource needs
Land take	Urban land take	↗	Higher values indicate habitat loss/ landscape fragmentation
Selected 'impact' indicators (related to exposure/human health and well-being)			
Aspect	**Indicator (exposure)**	**Trend**	**Rationale (health and well-being impacts)**
Food			
Nutritional quality	Obesity incidence	↗	Higher values indicate health risks
Biodiversity/amenity value of the farmed landscape	HNV farmland conservation status	↘	Lower values Indicate decreasing biodiversity/amenity value
Water			
Water availability	Breaches in drinking water supply	*No data, risk increasing due to climate change*	—
Water safety	Bathing water compliance	↗	Higher values indicate lower human exposure

Table 6.3 Indicative summary table of progress relating to resource use (extract from EEA, 2013b) (cont.)

Selected 'impact' indicators (related to exposure/human health and well-being)			
Aspect	**Indicator (exposure)**	**Trend**	**Rationale (health and well-being impacts)**
Energy			
Air quality	Exposure exceedance for selected pollutants	↘	Higher values indicate greater human exposure
Climate change	Heat waves/flooding risk	↗	Higher values indicate greater human exposure
Housing			
Housing quality	Floor space per person	↗	Higher values indicate more comfort
Living environment	Access to green spaces	*No trend data*	—

Legend:		
Positive developments	Neutral developments	Negative developments
↘ Decreasing trend	→ Stable	↘ Decreasing trend
↗ Increasing trend		↗ Increasing trend
	☐ Mixed progress (but overall problem remains)	

environmental pressures and related impacts on human health and well-being. The findings suggest that overall, environmental pressures from resource use in Europe are declining (most notably for water and energy); however, these overall trends do mask large regional differences (see Table 6.3).

The report used pressure indicators to analyse resource use patterns and associated pressures on the environment and also included impact indicators, drawing on both EEA indicator resources and those published by external sources such as Eurostat. However, while the indicators used are classified as impact under the DPSIR, they often provide information on exposure patterns without giving information on effects.

One of the challenges was the lack of available indicators in areas such as food, where indicators for specific impacts of the European food system on human health and well-being are scarce. There was better availability of indicators for areas such as energy, where indicators were available to illustrate different dimensions: past consumption trends, resource use required to meet energy demands, environmental pressures resulting from energy use and resulting impacts on humans from air pollutant exposure.

Environmental impacts from production and consumption systems in Europe

The forthcoming 2014 Environmental indicator report extends the analysis of the green economy, developing an integrated perspective that embraces some global dimensions of the challenge. The focus of the analysis is on production–consumption systems, which link environmental, social and economic systems across the world and support livelihoods across the value chain, but which also account for much of humanity's burden on the environment.

The logic underpinning this assessment is that production and consumption need to be addressed together: they are systemically interdependent. Focusing on consumption or production in isolation provides only a partial understanding of the issues. Only by adopting an integrated perspective is it possible to gain a full understanding of these systems, the incentives that structure them, the functions they perform, the ways in which system elements interact, the impacts they generate and the opportunities available for reconfiguring them.

This report addresses the production–consumption systems that meet European demand for three

product types: electric and electronic equipment, clothing, and food. These categories were selected because imported goods and resources play an important role in meeting European demand in each area. The associated impacts (both positive and negative) are thus dispersed across global supply chains, creating a complex governance challenge. As with the 2012 and 2013 indicator reports, most of the indicators being used for the 2014 report are proxies for addressing the integrated, systemic dimensions of the impacts of production and consumption systems and their transformation in a green economy.

7 Future prospects

The growing gaps discussed in Chapter 6 between available, established indicators and those required to meet policy demands call for reflection on what indicator resources are needed to support systemic and cross-cutting areas of European environmental and climate policies in the coming years. Some of the prospects and opportunities are discussed in this chapter.

Several recent developments provide a platform on which to build and make progress through the lifetime of the existing EU policy cycle to 2020. These include the 2013 revision of the EEA CSI, the 2013 EU resource efficiency scoreboard, the trialling of environmental composite and aggregate indicators under the 'Beyond GDP' process, regular reporting by countries under EU Regulation No 691/2011 on European environmental economic accounts, and experimentation by the EU and countries on natural capital accounting, JRC's life-cycle indicators and consumption-based environmental economic accounts.

At the same time, given increasing resource constraints, political decisions are urgently needed on how to best distribute efforts between established indicator initiatives and development efforts to close long-existing gaps. Currently, it may be argued that the balance of efforts excessively favours established initiatives at the expense of new developments.

7.1 The 7th Environment Action Programme

The long-term, comprehensive scope of the 7th Environment Action Programme (7EAP) and its nine priority objectives provides a useful overall framework within which to consider policy demands for indicators and means to meet them up to 2020 and beyond. The first three priority objectives are thematic and interrelated, and should be pursued in parallel, as action taken under one objective is likely to contribute to the achievement of other objectives.

These three objectives are:

1. to protect, conserve and enhance the Union's natural capital;
2. to turn the Union into a resource-efficient, green and competitive low-carbon economy;
3. to safeguard the Union's citizens from environment-related pressures and risks to health and well-being.

Achieving the above objectives requires an enabling framework which supports effective action, so they are complemented by four related priority objectives:

4. to maximise the benefits of Union environment legislation by improving implementation;
5. to improve the knowledge and evidence base for Union environmental policy;
6. to secure investment for environment and climate policy and address environmental externalities;
7. to improve environmental integration and policy coherence.

Two additional priority objectives focus on meeting local, regional and global challenges:

8. to enhance the sustainability of the Union's cities;
9. to increase the Union's effectiveness in addressing international environmental and climate-related challenges.

By and large, established EEA indicators and the revised CSI focus primarily on informing policy implementation, including risks to health and well-being, and to a lesser extent, on informing progress with sectoral integration. Several existing indicators also contribute to elements of

the objectives for natural capital and a resource-efficient economy. However, gaps still remain across these priorities, as is evident in the EEA 2012-14 Environmental indicator report series (see Section 6.2) especially indicators that capture the trends in the systemic nature of the first three priority objectives.

There is room for improvement in indicators across all thematic policy areas, even in those with regular monitoring and reporting regimes. The timeliness of indicators can be improved through developments relating to real-time data, 'early estimates' and 'now-casting', such as the early estimates of GHG emissions for the EU-15 and EU-27 by the EEA and the EU-27 CO_2 emissions estimates from energy use by Eurostat (EC, 2013b). An additional challenge for more established policy areas is that of providing better analysis of cross-linkages between indicators, so as to help identify synergies and trade-offs between policy options and their management, and contribute to enhanced policy coherence.

In terms of priority objectives 2 and 6, there is still a need to translate the resource-efficient, low-carbon, green economy concept into a small set of indicators that can be used to measure progress and inform policymaking and decision-making. Identifying such a set of indicators is a particular challenge, given the large range of relevant environment and climate policy objectives and targets underlying such objectives, and the conceptual difficulties of measuring and monitoring externalities. The EEA report *Towards a green economy in Europe EU environmental policy targets and objectives 2010–2050* provides an overview of the key environmental objectives and targets in EU environmental legislation and policy for the period from 2010 through 2050 (EEA, 2013c). A total of 63 legally binding targets and 68 non-legally binding objectives are identified across 9 policy areas; analysing these against green economy objectives and indicators would be a pragmatic first step towards identifying usable indicators and gaps to be filled.

Different challenges are posed by the management of natural capital and ecosystem services and links to human well-being. There are two principal ways that indicators could capture the relationship between human well-being and ecosystem services. The first is through an explicit link between resource efficiency and how people meet their needs for food, water, energy and material resources. The second addresses the spatial dimension and the links between natural capital and where people live, and enables a better understanding of access to nature or vulnerability to environmental change. Developments in satellite observations, *in situ* monitoring and spatially resolved statistics for population and land use aspects offer promising prospects for making progress. The Mapping and Assessment of Ecosystems and their Services (MAES) process under the EU Biodiversity strategy 2020 provides a chapeau for doing so in the most policy-relevant way.

While more attention has been paid to integrating environmental and economic indicators and accounts, less progress has been made on integrating social factors and environmental information. One way of linking environmental and social issues is to focus on aspects linked to the environment of existing social indicators. Another is to integrate social aspects into existing environmental indicators. In the latter approach, the rationale is one of providing information on relationships between population categories such as socio-economic status or age and contribution to environmental pressures, vulnerability and access to ecosystem services. The increasing focus in Europe on societal inequalities provides a platform for greater focus on socio-environmental considerations and indicators.

For issues such as the green economy and management of natural capital and ecosystem services, indicators are needed that not only provide information on decoupling of resource use from economic growth and environmental impacts within Europe, but also integrate a global perspective. Europe's success in reducing pressures has sometimes resulted from the delocalisation of polluting industries to less industrialised countries. The scramble globally for natural resources has highlighted that the flows of nature embedded into traded goods need to be recorded, in order to keep track of the various leakages (biological, social and economic).

Such footprint indicators and accounting for indirect flows/embodied impacts have been developed mainly through research. The JRC, for example, has estimated the land, material, water, acid emissions, GHG and ozone precursor footprints of the EU-27 and individual European countries (Arto et al., 2012). Eurostat have also developed a model for the aggregated EU-27 to estimate raw material consumption, in order to provide an additional perspective to resource efficiency indicators. However, while development of footprint indicators is a long-standing policy

demand, and progress has been made in this regard, their regular production as well as their use within the policy process remains far from being realised.

7.2 Looking beyond GDP

Moreover, there is considerable political demand for a single indicator, from an environmental perspective, that can be considered alongside economic and social equivalents such as GDP, unemployment, inflation and income inequalities. This could offer policymakers a more pluralistic view of macro-level developments and a better idea of the synergies and trade-offs that steer decision-making at that level. This demand has been on the table for many decades, and has driven many methodological developments and trials, e.g. the Index of Sustainable Economic Welfare, Adjusted Net Savings, and the Ecological Footprint. Across the indicators managed by the EEA and other EU partners, there are currently no established indicators addressing this political demand and there is unlikely to be one in the near future given the complexities of condensing different essential aspects into a single number.

In recent years, the EU has focused more on measuring progress in society and sustainable well-being. This has resulted in several political initiatives: examples are *GDP and beyond* (EC, 2009) and the Stiglitz-Fitoussi-Sen Commission (CMEPSP, 2009). These initiatives have brought together a range of international, national and regional organisations to discuss the need to adjust the current information available for measuring progress in society, sustainability, well-being and quality of life. They have also supported experimentation with composite and aggregate indicators that might be considered alongside GDP.

The European Commission's report on progress on 'GDP and beyond' actions sets out what has been achieved, and discusses additional actions (EC, 2013b). In practical terms, going beyond GDP means creating measures that convey not just what we have produced and consumed in the latest year, but also the state of natural capital that determines what we can sustainably produce and consume in Europe and globally (EEA, 2010).

The integration of accounting approaches with indicator developments can bring substance and coherence to these challenges. Accounting approaches enable the production of a time series of consistent, comparable and coherent statistics and indicators. Integration across accounting modules, though complex, can deliver additional benefits by furthering the understanding of environment and economic interactions through linked key phenomena such as carbon in the atmosphere, and soils and oceans with economic activities and their externalities.

The 7EAP highlights the need to consider the interplay between social, economic and environmental factors in the transition to an inclusive green economy, with environmental accounting playing a key role (see Box 7.1). Similar objectives and approaches lie at the heart of the development of Sustainable Development Goals and indicators in the follow-up to the Rio 2012 conference (EC, 2013a).

Box 7.1 Excerpt from 7th Environment Action Programme (7EAP)

The 7EAP states that 'the transition to an inclusive green economy requires giving proper consideration to the interplay between socio-economic and environmental factors', and that 'work to develop indicators for monitoring economic progress and which complement and go beyond GDP should continue. Securing transparent, sustainable investment depends on the proper valuation of environmental goods. Further efforts to measure the value of ecosystems and the cost of their depletion, together with corresponding incentives, will be needed to inform policy and investment decisions. Work to develop a system of environmental accounts, including physical and monetary accounts for natural capital and ecosystem services, will need to be stepped up. This supports the outcome of Rio+20, which recognises the need for broader measures of progress to measure well-being and sustainability to complement GDP. […] This requires in particular (vii) developing and applying alternative indicators that complement and go beyond GDP to monitor the sustainability of progress and continuing work to integrate economic indicators with environmental and social indicators, including by means of natural capital accounting.'

7.3 Conclusion

The EEA indicator review and revision of the CSI has established the framework for indicator production and further development at the EEA over the next 5 years (2014–2018).

The next phase of indicator development in Europe requires further reflection on how bodies like the EEA can continue to meet established and new thematic and sectoral demands as well as respond to more recent systemic demands.

This will involve many considerations, including:

- being conceptually clear on what the policy priorities and their interrelations mean for the production of indicators, and how existing indicators and data sets can contribute;
- being clear on the scale (from European to local) at which indicators are needed, and for which purpose, since this will have substantial implications for data flow sources and modelling demands;
- applying data modelling techniques to fill data gaps to enable the assimilation of data from different sources into integrated indicators, and applying methods and approaches that deliver policy-relevant and credible composite and/or aggregate indicators.

Pursuant to Article 4 of the 7EAP, the EEA will support the monitoring of that programme through its Environmental indicator report series from 2016 onwards, and in doing so will continue cooperation with Eurostat, the JRC and others on streamlining and improving European environmental indicators.

These and other developments will be reflected in future versions of this eeport, which will be updated regularly on the EEA website, so as to provide an accessible overview of its status and progress to stakeholders.

Acronyms

CBD	Convention on Biological Diversity
CSI	Core Set of Indicators
DG	Directorate-General
DPSIR	Driving force, pressure, state, impact, and response
EAP	Environment Action Programme
EEA	European Environment Agency
ENP	European Neighbourhood Policy
EU	European Union
GDP	Gross domestic product
GHG	Greenhouse gas
HDI	Human development index
IMS	Indicator Management System
JRC	Joint Research Centre
LRTAP	Long-range transboundary air pollution
MAES	Mapping and Assessment of Ecosystems and their Services
MDIAK	Monitoring, data, indicators, assessments, knowledge
MSFD	Marine Strategy Framework Directive (Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy)
NECD	National Emission Ceilings Directive (Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants)
NMVOC	Non-methane volatile organic compound
NRT	Near real-time
OECD	Organisation for Economic Co-operation and Development
POP	Persistent organic pollutant
SDIs	Sustainable Development Indicators
SEBI	Streamlining European Biodiversity Indicators
SEIS	Shared Environmental Information System
SENSE	Shared European and national state of the environment
SOER	European environment state and outlook reports
TERM	Transport and Environment Reporting Mechanism
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNFCC	UN Framework Convention on Climate Change
WFD	Water Framework Directive (Directive 2000/60/EC establishing a framework for Community action in the field of water policy)

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