Rosenström Ulla & Lyytimäki Jari (2006). The Role of Indicators in Improving Timeliness of International Environmental Reports. *European Environment* 16(1): 32–44. https://doi.org/10.1002/eet.403

**The Role of Indicators in Improving Timeliness of International Environmental Reports**

Ulla Rosenström & Jari Lyytimäki

Environmental indicators were developed mainly to improve information flows from scientists to policy-makers. This article discusses the importance of timely environmental data and investigates the influence of indicator-based reporting on the data timeliness of environmental reports by international organizations. Timeliness of information contributes to the quality and appeal of the reports, and to their role as early warning tools, and increases their usability by decision-makers in short-term decision cycles. The results of an analysis of 11 international reports by the European Environmental Agency (EEA) and the Organization for Economic Co-Operation and Development (OECD) show a considerable time lag of three years on average, with only minor development towards more timely reporting. The results suggest that the introduction of environmental indicators has not improved the timeliness of reporting. In order to overcome these problems, the article recommends some methods for improving timeliness. These include better choice of indicators in smaller sets, use of preliminary data and outlooks, development of new indicators, publishing on the internet and more effective use of internet databases to avoid intermediate levels in data collection.

**Keywords:** environmental reporting; state of the environment reports; indicators; timeliness; EEA; OECD

**Introduction**

International state of the environment reporting (SOER) faces many challenges: for example, gathering and harmonizing the data from different countries, making the desired impact on the selected target group and evaluating the effectiveness of the reporting process. Reporting is difficult due to the complexity and scope of environmental issues. In addition, recent demands to integrate wide range of economic, social and cultural aspects to address sustainable development have emerged (Sheate et al., 2003). Nevertheless, as the state of the environment has deteriorated and awareness of the problems increased, needs to produce reports providing decision-makers and the public with adequate information have increased considerably.

The history of SOER dates back to 1969 to the United States with the enactment of a National Environmental Policy Act. The Stockholm Conference on the Human Environment of 1972 brought the reporting to a global level. Consequently, various reports and yearbooks of environmental statistics were compiled and published in the 1970s (e.g. UNEP, 1973; OECD, 1979; EPA 1980) but it took two decades before environmental reporting began on a more regular basis and could provide coherent and accessible information on international level. For example, the Worldwatch Institute began to publish a series State of the World in 1984 and a yearbook Vital Signs in 1992. The Organisation for Economic Co-Operation and Development (OECD) published an influential environmental indicator report in 1994 (OECD, 1994) and the European Environment Agency (EEA) reviewed the state of the European environment for the first time in 1995 (Stanners and Bordeau, 1995).

As SOER became a more regular practice for the environmental authorities, a new problem called information overload was identified. The amount of environmental data available has grown to be so vast as to impair effective selection and use of the most relevant information for decision-making. To tackle the problem, the use of indicators was introduced to the environmental field in the early 1990s (Hammond et al., 1995) and currently environmental indicators are widely used to highlight information about phenomena that are regarded as typical for and/or critical to the state of the environment. The roles of indicators vary according to their users (Moldan et al., 1997). Initially, indicators were developed to measure progress and to inform decision-makers as well as the public about current trends in a timely and policy-relevant manner (Atkinson and Hamilton, 1996). Another important task for indicators is to provide early warnings about the future. Indicators can also be used as tools for providing the common language needed when dealing with emerging or complex issues, to raise discussion and to set targets by decision-makers. The important role of indicators in political debate is to support discussion and to convince others; i.e., they are tools for discussion (Rosenström, 2002). In a nutshell, three main purposes for the indicators can be identified: to gather and synthesize information from various sources, to increase public awareness about the environmental problems, and third to provide decision-makers with adequate, reliable and timely information for decision-making.

The 1990s can be characterized as mainly a period for developing the indicators (Rydin et al., 2003) and many comprehensive sets were developed in the area of environment and sustainable development on both international and national levels (e.g. UN, 1996; Department of the Environment, 1996). Developing indicator-based reporting led to more focus on the indicators themselves and their frameworks, at the expense of the needs of the user groups, such as policy-makers, civil servants or the public. Consequently, after ten years of indicator hype, many have noted the limited extent to which indicators are actually being used (e.g. Bell and Morse, 2001; Gudmundsson, 2003).

These problems have been confronted by efforts to increase the policy relevance and data availability of the indicators. For example, the OECD Key Environmental Indicators (OECD, 2004) and EEA Core Set of Environmental Indicators (EEA, 2004b) have recently been introduced. However, as discussed in the next section, the issue of timeliness has not been seriously addressed, although it is potentially a significant determinant of data usability in policy-making.

Providing up-to-date information can be considered as one of the main challenges for SOER. For example, the Global Reporting Initiative defines timeliness as follows: 'Reports should provide information on a regular schedule that meets user needs and comports with the nature of the information itself ' (GRI, 2002). This definition may be problematic when the information is characterized by unforeseeable developments; the regular schedule may leave sudden changes unnoticed for too long a time. Bishop (2003) identifies timeliness as one of the ten key principles of what she calls 'authentic communication'. She defines timeliness as follows: 'Information is provided when it is known and is communicated early enough that the audience has time to provide input before actions are taken or major decisions are made'. This definition includes two aspects, namely the timely data and the timely communication procedure. Our main focus here is on the timeliness of the data within indicator reports and SOERs. It must be noted, however, that the these aspects are intertwined; it makes little sense to build an indicator set with timely data if the publication of the report is to be delayed by a slow editing process. On the other hand, it is possible to communicate the information too early, before the indicators are found to be reliable enough by the scientific community. One important point is also that the target groups for an indicator report may be very different and the needs with the timeliness may vary accordingly.

In this paper we will examine selected SOERs and indicator reports to identify the time lags within the indicators used. Comparison of SOERs and indicator-based reports will show whether the increasing use of indicators has actually resulted in more timely data. Discussion and recommendations will follow on the implications of time lags and potential ways to overcome them. These recommendations are based to a great extent on our own experiences of producing

national state of the environment and indicator reports and participating in international working groups that deal with these issues (e.g. Heinonen et al., 2005; Lyytimäki, 2004; Rosenström, 2003, 2002; Välimäki, 2002a, 2002b; Rosenström and Palosaari, 2000; Rosenström et al., 1996).

**The Importance of Timeliness**

International environmental reporting has improved in many fields over the past 25 years, including harmonization of data, international comparability and coverage of new issues. However, according to the OECD (2000) the timeliness of reporting has generally not improved since the early 1980s. Instead, there seems to be a tendency to provide less timely information, albeit better documented. More emphasis may have been given to the presentation of the indicators, which has hindered their timely publication. Furthermore, environmental data still lag behind economic data, limiting their use in policy performance evaluation and public information (OECD, 2000).

In the European policy field, indicators are actively developed to monitor key strategies such as the Lisbon Strategy and the Cardiff Process that led to the EU sustainable development strategy (European Commission, 2001). The Lisbon Strategy is monitored by structural indicators that contain mainly economic and social indicators that are updated regularly. The EU sustainable development indicators, however, contain more environmental data, which is more difficult to obtain from all 25 member countries. The 2005 revision used the indicators to monitor, assess and review the old strategy (European Commission, 2005). Unfortunately most of the data available was not more recent than 2002 and thus progress since 2001 was difficult to assess (Eurostat, 2005).

Several studies on the communication success factors confirm the importance of timeliness. Based on a survey conducted on the water utilities in the United States, Bishop (2003) reports that the most frequent answer to the question on what the water utility would do differently next time was 'communicate earlier'. Interviews with Finnish politicians and senior civil servants showed that one of the key criteria for useful information is its timeliness (Rosenström, 2002). In some cases, prompt reporting also permits early detection of emerging problems and thus the attention of decision-makers can be obtained in time to act (Munn et al., 2000). Timeliness also relates to the quality of the information (Dwyer and Wilson, 1989). A message that contains recent information seems more accurate and correct than a figure that relates to four years back in time. The ability to produce up-to-date information signals the competence of the providers.

The changes in the state of the environment are often slow from the temporal perspective of human action. If the changes are happening on a timescale of hundreds or thousands of years, it may not matter very much that the most recent data are five years old. However, the most changes are not linear and easy to predict, but non-linear, characterized with a broad range of time lags, rhythms that are very short or extremely long and different embedded times of organisms, ecosystems, economic systems etc. (Held, 2001). As the thresholds are exceeded, the changes may accelerate exponentially and unexpectedly (Hukkinen, 2003). If these changes are not identified early enough, they may have serious effects on human well-being and ecosystem health. When the diversity of temporal perspectives and unforeseeable nature of changes are taken seriously, timely information becomes a valuable asset for environmental policy.

The importance attached to timeliness of reporting varies among the reporting institutes. The significance of up-to-date information is reflected in several reports such as the EEA indicator report of 2002 (EEA, 2002). This is also clearly stated in the Global Reporting Initiative Guidelines (GRI, 2002), intended mainly to harmonize the corporate sustainability reporting. The OECD (2000) names availability, timeliness and accuracy as the three main aspects that define useful information. Information cannot be used if it is not available and it has to be available on time. Information also has to be accurate, otherwise it cannot be used correctly.

However, timeliness is not mentioned in the so-called Bellagio Principles, serving as guidelines for sustainable development reporting (Hardi and Zdan, 1997). In the EEA guidelines for SOER, timeliness is referred to as 'Time series, whenever possible, should be extended to accommodate the most recent data, and can be supplemented with projections' (Kristensen et al., 1999). The criteria for the new EEA core set of environmental indicators (EEA, 2004b) list timeliness as tenth criterion for its indicators. The detailed criteria state that an indicator should 'be produced in reasonable and useful time'. However, these formulations are rather vague, leaving open what is 'useful time', or what is meant by accommodating the most recent data 'whenever possible'. These examples suggest that timeliness is understood as a secondary criterion for selecting environmental indicators and overshadowed by more important criteria, such as data availability and reliability.

We argue that timeliness is an issue to be treated more seriously, not only as a secondary criterion. The discussion about the criteria of sustainability indicators has been dominated by the 'production side' of the information, putting most of the attention on issues such as harmonizing the data, selecting and building the indicators and developing frameworks for indicator systems (e.g. Kuik and Verbruggen, 1991; Moldan et al., 1997; Dale and Beyerler, 2001; Heinonen et al., 2005). As McCool and Stankey (2004) point out, the search for indicators has been dominated by technical exploration by scientific elites. However, timeliness is a more serious issue from the 'consumption side' of the information (EEA,

1999). For example, Cash et al. (2003) emphasize that the information produced by science must be salient, as well as credible and legitimate. Timeliness can be seen as one key feature of the saliency of the information.

**Approach and Description of the Material**

The main purpose of the study was to investigate the extent to which time lags exist within environmental information provided by international organizations. The fact that indicator reports have gained popularity in comparison to traditional SOERs raises the question of whether the indicators used in them are more up to date.

The empirical part of the article is based on international environmental reports published by the European Environment Agency (EEA) and the Organisation for Economic Co-Operation and Development (OECD). The analysis was carried out using 11 reports. These reports were identified as important key reports, prepared with substantial resources and aimed to influence national and international policymaking.

Five of these reports were described as indicator reports. The assumption is that the indicators in indicator reports are more carefully selected and fewer in number than in the conventional environmental reports. These EEA indicator reports were used as a reference to define what were indicators in the other reports.

Besides written text, the reports make use of time series, maps, tables and photographs to convey environmental information. An indicator may comprise any of these forms of information (e.g. Meadows, 1998; Bossel, 1999). Often an indicator is a combination of visual and textual information. In this analysis, the indicator was defined to be a visually distinctive (graph, map or table), quantitative presentation of information. Photographs were not included, even though they can also function as powerful visual indicators, addressing certain problems and suggesting a certain approach and interpretation (Seppänen and Väliverronen, 2003).

The key inclusion criterion for indicators in the analysis was a clear indication of the latest year of information. Indicators lacking this information or expressing the time vaguely, such as 'late 1980s' were not included. Some country comparison indicators stated various different 'latest years'. These were included if one year was clearly prominent. Applying this definition of an indicator and selection criterion allowed us to reach an extensive and diverse picture about the timeliness of different indicators, while keeping the amount of indicators manageable and the selection process transparent and unambiguous.

The average and median time lags were calculated by subtracting the latest data year from the year of publication. The timing of the publication was identified for EEA reports that had been published since 1996. Both the EEA SOERs and indicator reports (Signals series) were published in May–June and thus the timing of the publication did not affect the comparability of these reports. Maximum and minimum values for time lags were identified as well to show the variation in the data used. The use of scenarios was recorded for the EEA indicator series.

***OECD Environmental Reports***

The OECD reports included in this study were published in 1979, 1985, 1991 and 2001. They are all relatively concise publications of some 200 pages each. The first three are called 'environmental reports' and the last one is called 'OECD Environmental Indicators'. The SOERs cover traditional environmental issues with references to economic sectors. The reports were divided into three sections foreshadowing the OECD 'pressure–state–response' framework. From 1991 onwards the OECD published five environmental indicator reports, of which we studied the publications for 2001 and 2004. As the OECD Key Environmental Indicators of 2004 (OECD, 2004) contains only 10 indicators and the latest year of data is unclear for many variables, it was not considered comparable with the other reports studied and was therefore excluded.

The first SOER (OECD, 1979) covers environmental challenges by economic sector, environmental conditions by environmental medium complemented by wildlife, chemicals and noise and societal responses to alleviate the pressures on the environment. The report contains 19 figures and 19 tables usually including time series for around ten years.

The second SOER (OECD, 1985) begins with the environmental conditions chapter divided by environmental medium and resources, followed by the pressures by economic sector and ending with the responses section. The number of figures has tripled from the previous SOER, the number of tables remaining almost the same.

The third SOER (OECD, 1991) includes largely the same chapters and is divided into three sections. The names of the sections are now slightly different, but the underlying state–pressure–response thinking is still clear. The number of figures has decreased slightly.

The 2001 environmental indicator report (OECD, 2001) is divided into three categories of indicators: environmental, socio-economic and key environmental indicators. The number of 'regular' indicators is 34 and there are 10 key environmental indicators. However, indicators such as 'air emissions' include sub-indicators that show sulphur dioxide and nitrogen oxide emissions separately. Furthermore, this report includes many indicators without a precise latest year

for the data; most of the key environmental indicators especially presented data either without years or with reference to 'late 1990s'.

***EEA Environmental Assessment Reports***

The first European environmental assessment was published in 1995 (Stanners and Bordeau, 1995). It contains a massive total of 676 pages with text, graphs, maps, tables and photographs. The contents are divided into five parts containing a total of 40 chapters. As this was the first attempt to describe environmental issues and problems arching over Europe, a large amount of space is devoted to an explanation of different environmental problems such as climate change. A distinctive feature is that much of the data is from international institutes and not from European sources. Instead of graphically presented time series, the use of maps is frequent.

The second environmental assessment (EEA, 1998) is much smaller in size with less than 300 pages. The book concentrates on environmental issues, and sectors such as energy and forestry are dealt with as driving forces. The number of time series is considerably smaller, but the data sources are now increasingly EEA and Eurostat.

The third assessment (EEA, 2003) is about the same size as the second one. The 14 chapters include developments in the socio-economic sectors, environmental problems as well as pervasive impacts and policy management issues. The environmental assessment has clear linkages to sustainability issues. The main emphasis is on time series and maps have been virtually omitted.

***EEA Environmental Signals***

The EEA published environmental indicator reports (Environmental Signals) for three consecutive years (EEA, 2000, 2001, 2002) and a fourth in 2004 (EEA, 2004a), which differs slightly from the others. The target readership of the reports is senior policy-makers in the EEA countries and the EU. The reports do not attempt to confine the EEA to a certain set of environmental indicators but rather to select indicators for each report depending on current issues. In 2004, however, the EEA introduced a more stable core set of indicators for its member countries to consider (EEA, 2004b).

All four Environmental Signals reports present the indicators according to main economic sectors and environmental problems. Some of the chapters change from year to year; for example, environmental taxes are not included in all reports, but issues such as climate change and eutrophication persist. The number of pages increases year by year until 2002. In the 2004 version a drastic selection has been made and the number of indicators has been reduced to 30, which is close to the number of the core set indicators (37). The issues in the fourth indicator report are presented very differently from the earlier publications: sectors and issues are mixed and links to policy and messages have been strongly emphasized.

**Results: Timeliness of the Indicators**

The analysis of the 11 environmental reports demonstrates that the average time lag of indicators is 3.4 years. The first OECD environmental report from 1979 displayed data mainly of 1975, leading to a 3.6 year time lag. The results show that timeliness has not significantly improved over the past 25 years, since the next two OECD reports of 1985 and 1991 had time lags of less than three years in the early reports (2.96 and 2.84). The EEA reports on the other hand improved since the initial 4.8 year time lag in the first SOER of 1995, with a 3.1 year time lag in its latest indicator report of 2004. The results are illustrated in Figure 1.

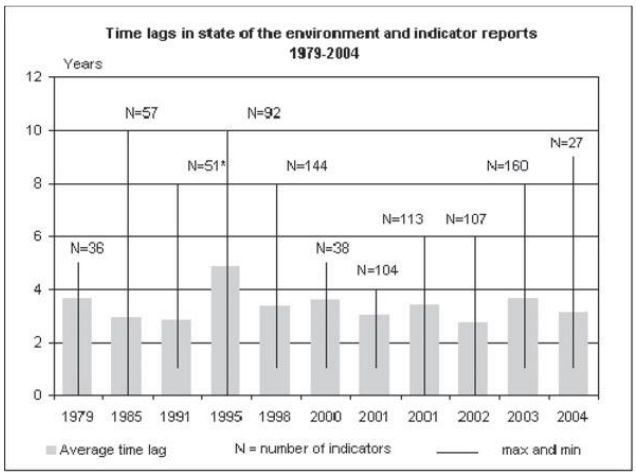



Figure 1. Time lags in state of the environment and indicator reports. *The 1991 report included several graphs with vague dates and they were not included in the study.

A possible reason for more up-to-date data on OECD SOERs could be that they contain socioeconomic data that affect the overall average. The 2001 OECD environmental indicator report makes a distinction between environmental and socio-economic indicators. The average time-lag for 20 environmental indicators is 3.4 years, and for 18 socio-economic indicators 2.6 years. The socio-economic indicators include those related to energy consumption and fertilizer use in agriculture. The same trend can be detected in the other reports as well, for example the data on the price of gasoline or the number of traffic accidents is more recent than purely environmental data. If purely economic indicators are treated separately (such as taxes and prices) in the EEA reports, it shows that the time lag is one year shorter than that for environmental indicators. However, if the EEA indicators are grouped according to the OECD 2001 division into environmental and socio-economic indicators, there is no statistical difference in the timeliness of the data (Table 1). The number of each type of indicator is roughly the same in all the EEA reports. The reason for this could be that the OECD receives socio-economic data faster than an environmental agency and hence the difference in timeliness is so marked within the OECD reports.

| Year of publication | Average time lag for environmental data | Average time lag for socio-economic data |
|---|---|---|
| 2001(OECD) | 3.4 | 2.6 |
| 2000 (EEA) | 3.5 | 3.7 |
| 2002 (EEA) | 2.8 | 2.7 |
| 2004 (EEA) | 3.0 | 3.1 |

Table 1. Average time lags for OECD 2001 environmental indicators and EEA Environmental Signals indicator reports.

The first EEA assessment contained the oldest data with regard to the date of publication. Most of the time series end at 1990, which means that there was a five-year time lag. Apparently new issues such as climate change were lagging more behind than already established issues such as freshwater pollution, where the average time lag was slightly shorter, at 4.5 years. The number of time series was quite small overall, and no indicators at all appeared in some chapters, such as the one on chemicals.

All the reports are able to show some very recent data (0–1 year old), but the oldest data are alarmingly old. In the last indicator report of 2004, the indicator 'observed changes in growing season length' gives a longer term perspective on climate change from 1960 to 1995, which means that users are offered status information almost ten years old.

The fact that the 2001 OECD indicator report gives imprecise information about the latest year of data is probably due to differences in data availability in different countries. The attempt is to include the latest year available and thereby serve decision-makers' needs for up-to-date information. It could be a sign of either little concern for giving the precise dates or an attempt to hide the apparent time lags by stating 'late 1990s'. Tables comparing different countries with data from different years (i.e. the latest year available) can also be misleading. For example, in the Nordic countries the household energy consumption is heavily dependent on climate conditions and thus the same year's data should be used for purposes of comparison.

Moving towards indicator-based reporting has not obviously improved the timeliness of environmental data. In the case of EEA the change is more noticeable: the average time lag for 2000 and 2004 is 2.4 and 3.1 years respectively, whereas for the 2003 SOER it is 3.6 years. The median, however, is 3 years for all. For the OECD reports the development seems to be the opposite. The average time lag for the 1991 SOER is 2.8 years and 3.0 years for the 2001 indicator report.

**Possible Methods to Improve Timeliness**

There are various reasons why some data can be provided quickly and others are alarmingly old, including the level of integration of different policy-fields and sectors of society, geographical coverage, difficulties related to the multi-disciplinary scientific work typical of sustainability issues, the limited capacity to use mathematical models and build scenarios and the level of co-operation between data providers, indicator builders and people communicating the indicators to target group (Moldan et al., 1997; Meadows, 1998; Bossel, 1999). In what follows we propose some possible methods to improve the timeliness.

***Shorter Reports with Carefully Selected Indicators***

In the light of our results, the use of indicators has not significantly served to condense the environmental information presented in the reports studied. Neither has data quality improved with regard to timeliness. Especially for the EEA reports, the overall size of the reports clearly diminished with the shift to indicator reporting, but as the indicator reports evolved they started to grow again until 2004.

In the early years of environmental indicators, the national sets were quite large, including more than 100 indicators (see, e.g., Department of the Environment, 1996; Rosenström et al., 1996). The updating of such collections soon

proved a tremendous effort, and consequently discussion on headline indicators was initiated (e.g. DETR, 1998). The rationale behind a small number of headline indicators was to show policy-makers the most important and policy relevant, appealing indicators. What has not been so clearly articulated is that due to the smaller number of indicators and more frequent updates, headline indicators can provide more timely data. The drastic cut in the number of indicators in the EEA 2004 report follows developments in other institutions and countries.

A similar activity to British headline indicators is the use of thematic indicators that can relate the information more closely to policy-making. The Finnish National Commission for Sustainable Development experimented with the use of theme indicators supporting the main issue at hand in the meetings. The small leaflets of eight indicators accompanied by clear policy messages are intended to serve as background material, concretization of the theme and initiators for discussion (Finnish Environment Institute, 2004). Simple leaflets are also cost-effective to produce and contain the most recent data available. Together these frequently published indicator leaflets can provide a comprehensive and updated picture of the sustainability trends in Finland.

The current EEA plans to keep the 2005 SOER to less than 100 pages and supplement it with other short reports similar to the solutions described above. By keeping the environmental reports concise, the publishing times can be shortened considerably, thereby ensuring the timeliness of the information.

***Streamlining of Data Collection***

Unfortunately, neither tight publishing schedules nor concise reports can help if the data collection and storage takes very long. Environmental information is currently collected and stored by various international organizations. This entails numerous questionnaires for countries to complete. Recent efforts to decrease the reporting obligations of the countries has been taken up and networks such as the EIONET of EEA have been founded to ensure smoother data flows, but these efforts have not really aimed at limiting the actual data submission. What has happened is that data collection has been centralized in the countries, but they are still collected manually by a few people who then forward the data. Currently this practice amounts to three-year time lags on the international level, whereas most of the national level data are already available the following year, i.e. data for 2003 are available in 2004.

There is also some evidence that the length of the manuscript publishing process has become shorter. This may be due to improved technologies in both layout and printing. Signals 2000 was published in May 2000, yet the forewords by the EEA director were dated November 1999 and the report does not use data from 1999 with the exception of ozone concentrations from the RIVM for April 1999. The 2002 edition of Signals was also published in May. However, this time the editors were able to modify the manuscript as late as March, since the latest data on EU flower awards are from 28 February 2002. Of the four Signals reports, this 2002 version had the shortest average time lag, 2.76 years. Furthermore, in Signals 2000 motor car fuel prices date back to 1998, whereas in Signals 2002 the figures date to the January 2002 situation. Either the data flows or the efforts of the data compilers have improved significantly.

The omission of central data collection in countries could speed up the process. If the original data providers could log on directly to the international organization's database and submit the data, the time lags could be shortened by 1 to 1.5 years. However, this would require additional motivation and resources for the actors at national level.

***Developing New Indicators***

Developing new indicators is one obvious method to improve the timeliness of the information. However, based on our results, it seems that when timeliness is not taken as a key criterion for indicator development the time lags are not substantially shortened. On the contrary, it seems that the new indicators are more complex than older ones and therefore more time consuming to produce. The total material requirement (Adriaanse et al., 1997) and the ecological footprint (Wackernagel and Rees, 1996) serve as two examples of popular recently introduced indicators that involve a great many variables and are time consuming to produce.

One example of a promising new indicator is presented by Sutton (2003), who develops an empirical environmental sustainablity index from nighttime satellite imagery and ecosystem service valuation. Compared to the ecological footprint or the environmental sustainability index sponsored by the World Economic Forum, this indicator involves far fewer variables and is simpler to produce. In particular, the use of nighttime satellite imagery is a promising tool for the development of a timely indicator of environmental pressure caused by various human activities.

***Use of Preliminary Data and Outlooks***

Due to the complexity of environmental issues, the development of environmental indicators is often more time consuming and complicated than for the economic and social sectors. Scientific uncertainties need time to be resolved and scientists and statisticians are usually reluctant to publish preliminary data. However, if environmental reporters want to compete with the 'quartal economy' that produces figures four times or more a year they need to consider new methods. Many emissions can be calculated, but this requires more resources and interest in the matter. We could, for

example, give preliminary values for greenhouse gas emissions as soon as we have economic values that include energy statistics.

The use of outlooks and scenarios may be a more powerful tool than preliminary data. Outlooks could provide the decision-makers with probable, desirable and undesirable scenarios and also highlight outcomes of optional actions. Scenarios are especially helpful in strategy planning, as actions for the future are decided. The use of projections has gradually increased in the EEA Signals reports. The first of the series in 2000 used none, but the third report in 2002 used seven and the fourth in 2004 used four scenarios or future projections.

***Internet Based Reporting***

Using the Internet for reporting is often considered to improve timeliness. Discussing corporate reporting, Scott and Jackson (2002) argue that it takes much less time to upload a website than it does to publish a hard-copy report. They also note that the reported data is more current and new information can be added to websites as soon as it is available. Internet based reporting can lead to shorter publishing times and the existing publications can be updated more easily than conventional paper reports. This could mean a move away from the old concept of the periodicity of SOER to a more flexible concept of continuous reporting or even to real time reporting.

However, there are also some pitfalls. Designing high-quality web-reports can take at least as much effort as designing hard copy reports, and on the other hand digital printing technologies enable very fast printing of hard copy reports. The new technologies used in web publications have also made the preparation of a state-of-the art webpage more time consuming than a simple page utilizing only HTML (Hyper Text Markup Language). However, once the site has been published, the updating can be efficient and quick.

The options for fast updating of the data are undoubtedly one of the advantages of the web reports. Unfortunately, publishing new numbers is only a part of the problem. Making the new data available might fulfill the information needs of some target groups, but most of the target groups need information that is more tailored according to their specific needs. Careful consideration of the meanings and implications of the new data must be included, the relevancy of the data explained and the reliability ascertained with the qualifications of the target group in mind.

**Conclusions**

Improving the timeliness of indicators is an important challenge for environmental reporting. Producing geographically wide-ranging assessments incorporating various issues and requiring in many cases a multi-disciplinary approach are time and resource consuming and the latest reports available often describe the situation several years previously. In recent decades the reports have improved considerably, both in quality and in the accuracy of the data. However, it seems that the efforts to improve the quality and quantity of the data have had only a limited impact on improving the timeliness of the data. Based on the analysis of 11 reports the average time lag is currently over three years and has not recently improved. In order to minimize the time lags timeliness needs to be recognized as an important criterion for environmental reporting.

The qualitative research on the issue is an important future research need. Qualitative interrogation could be helpful to find out more about the specific reasons for the lack of timeliness and about possible obstacles to implement the methods to improve the timeliness suggested here. For example, differences between nations or organizations are undoubtedly great, and the reasons for these differences may vary substantially. However, building more knowledge about the reasons for the lack of timeliness will have only a limited impact, unless the question of timeliness is taken seriously by the people and institutions dealing with the production of indicators and preparation of the reports. The production of indicators and their use in policy contexts are not independent of each other. Even though the production of indicators is mainly done by scientific experts, it must involve stakeholders (Chess et al., 2005; McCool and Stankey, 2004). One key challenge is how to incorporate various stakeholders into the process of producing indicators without compromising the timeliness.

**References**

Adriaanse A, Bringezu S, Hammond A, Moriguchi Y, Rodenburg E, Rogich D, Schutz H. 1997. Resource Flows: the Material Basis of Industrial Economies. World Resources Institute (USA)–Wuppertal Institute (Germany)–Netherlands Ministry of Housing, Spatial Planning and Environment–National Institute for Economic Studies (Japan). Washington, D.C.
Atkinson G, Hamilton K. 1996. Accounting for progress: indicators for sustainable development. Environment 38(7): 16–20.
Bell S, Morse S. 2001. Breaking through the glass ceiling: who really cares about sustainability indicators? Local Environment 6(3): 291–309.
Bishop B. 2003. Water utility communication practices – what contributes to success? Journal AWWA 95(1): 42–51.
Bossel H. 1999. Indicators for Sustainable Development: Theory, Method, Applications, a report to the Balaton Group. IISD: Winnipeg, Canada.
Cash DW, Clark W, Alcock F, Dickson NM, Eckley N, Guston DH, Jäger J, Mitchell RB. 2003. Knowledge systems for sustainable development. Proceedings of the National Academy of Sciences (PNAS) 100(14): 8086–8091.
Chess C, Johnson BB, Gibson G. 2005. Communicating about environmental indicators. Journal of Risk Research 8(1): 63–75.
Dale VH, Beyeler SC. 2001. Challenges in the development and use of ecological indicators. Ecological Indicators 1(1): 3–10.

Department of the Environment. 1996. Indicators of Sustainable Development for the United Kingdom. HMSO: London.
Department of the Environment, Transport and the Regions (DETR). 1998. Sustainability Counts. DETR: London.
Dwyer D, Wilson R. 1989. An empirical investigation of factors affecting the timeliness of reporting by municipalities. Journal of Accounting and Public Policy 8: 29–55.
Environmental Protection Agency (EPA). 1980. State of the Environment. Office of Public Awareness of the United States.
European Commission. 2001. A Sustainable Europe for a Better World: a European Union Strategy for Sustainable Development, COM(2001)264 final. http://europa.eu.int/eur-lex/en/com/cnc/2001/com2001_0264en01.pdf [2 September 2005].
European Commission. 2005. The 2005 Review of the EU Sustainable Development Strategy: Initial Stocktaking and Future Orientations,
COM(2005) 37 final. http://europa.eu.int/comm/sustainable/docs/COMM_PDF_COM_2005_0037_F_EN_ACTE.pdf [2 September 2005].
European Environment Agency (EEA). 1998. Europe's Environment: the Second Assessment. EEA: Copenhagen.
European Environment Agency (EEA). 1999. A New Model of Environmental Communication for Europe from Consumption to Use of Information, Environmental Issue Report 13. EEA: Copenhagen.
European Environment Agency (EEA). 2000. Environmental Signals 2000. European Environment Agency Regular Indicator Report, Environmental Assessment Report 6. EEA: Copenhagen.
European Environment Agency (EEA). 2001. Environmental Signals 2001. European Environment Agency Regular Indicator Report, Environmental Assessment Report 8. EEA: Copenhagen.
European Environment Agency (EEA). 2002. Environmental Signals 2002 – Benchmarking the Millennium, Environmental Assessment Report 9. EEA: Copenhagen.
European Environment Agency (EEA). 2003. Europe's Environment: the Third Assessment, Environmental Assessment Report 10. EEA: Copenhagen.
European Environment Agency (EEA). 2004a. EEA Signals 2004. A European Environment Agency Update on Selected Issues. EEA: Copenhagen.
European Environment Agency (EEA). 2004b. Criteria for the Selection of the EEA Core Set of Indicators. http://www.eea.eu.int/coreset/CSI-criteria.pdf [22 September 2004].
Finnish Environment Institute. 2004. Theme Indicators for the Finnish National Commission for Sustainable Development. http://www.environment.fi/default.asp?node=15132&lan=en [28 December 2004].
Global Reporting Initiative (GRI). 2002. Sustainability Reporting Guidelines 2002. http://www.globalreporting.org/guidelines/2002/contents.asp [10 August 2004].
Gudmundsson H. 2003. The policy use of environmental indicators – learning from evaluation research. The Journal of Transdisciplinary Environmental Studies 2(2): 1–12.
Hammond A, Adriaanse A, Rodenburg E, Bryant D, Woodward R. 1995. Environmental Indicators: a Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development. World Resources Institute: New York.
Hardi P, Zdan T. 1997. Assessing Sustainable Development: Principles in Practice. International Institute for Sustainable Development: Manitoba.
Heinonen S, Hietanen O, Lyytimäki J, Rosenström U. 2005. How to approach the sustainable information society? Criteria and indicators as useful tools. Progress in Industrial Ecology – an International Journal 2(3/4): 303–328.
Held M. 2001. Sustainable development from a temporal perspective. Time and Society 10(2/3): 351–366.
Hukkinen J. 2003. From groundless universalism to grounded generalism: improving ecological economic indicators of human–environmental interaction. Ecological Economics 44(1): 11–27.
Kristensen P, Anderson L, Denisov N. 1999. A Checklist for State of the Environment Reporting, Technical Report 15. European Environment Agency: Copenhagen.
Kuik O, Verbruggen H (eds). 1991. In Search of Indicators of Sustainable Development. Kluwer: Dordrecht.
Lyytimäki J. 2004. Producing multidisciplinary state of the environment reports: two tales from Finland. The Journal of Transdisciplinary Environmental Studies 3(2): 1–10.
McCool SF, Stankey GH. 2004. Indicators of sustainability: challenges and opportunities at the interface of science and policy. Environmental Management 33(3): 294–305.
Meadows D. 1998. Indicators and Information Systems for Sustainable Development, a report to the Balaton Group. The Sustainability Institute. Hartland Four Corners.
Moldan B, Billharz S, Matrevers R (eds). 1997. Sustainability Indicators. Report of the Project on Indicators of Sustainable Development. Wiley: Chichester, UK.
Munn T, Timmerman P, Whyte A. 2000. Emerging environmental issues. Bulletin of the American Meteorological Society 81(7): 1603–1609.
Organisation for Economic Co-Operation and Development (OECD). 1979. The State of the Environment in OECD Countries. OECD: Paris.
Organisation for Economic Co-Operation and Development (OECD). 1985. The State of the Environment 1985. OECD: Paris.
Organisation for Economic Co-Operation and Development (OECD). 1991. The State of the Environment. OECD: Paris.
Organisation for Economic Co-Operation and Development (OECD). 1994. Environmental Indicators: OECD Core Set. OECD: Paris.
Organisation for Economic Co-Operation and Development (OECD). 2000. Proceedings of the OECD Seminar on Public Access to Environmental Information, Athens, 2000, ENV/EPOC/GEP(2000)8. Environment Directorate, Environment Policy Committee.
Organisation for Economic Co-Operation and Development (OECD). 2001. OECD Environmental Indicators. Towards Sustainable Development. OECD: Paris.
Organisation for Economic Co-Operation and Development (OECD). 2004. OECD Key Environmental Indicators. http://www.oecd.org/dataoecd/32/20/31558547.pdf [8 March 2005].
Rosenström U. 2002. The potential for the use of sustainable development indicators in policy-making in Finland. Futura 21(2): 19–25.
Rosenström U. 2003. Final Report from ISEI Twinning Light Project in Czech Republic.
Rosenström U, Lehtonen M, Sisula H. 1996. Trends in the Finnish Environment. Indicators for the 1997 OECD Environmental Performance Review of Finland, Finnish Environment 63. Finnish Environment Institute: Helsinki.

Rosenström U, Palosaari M (eds). 2000. Signs of Sustainability. Finland's Indicators for Sustainable Development 2000, Finnish Environment 404e. Ministry of the Environment: Helsinki.
Rydin Y, Holman N, Wolff E. 2003. Local sustainability indicators. Local Environment 8(6): 581–589.
Scott P, Jackson R. 2002. Environmental, social and sustainability reporting on the web: best practices. Corporate Environmental Strategy 9(2): 193–202.
Seppänen J, Väliverronen E. 2003. Visualizing biodiversity: the role of photographs in environmental discourse. Science as Culture 12(1): 59–85.
Sheate WR, Dagg S, Richardson J, Aschemann R, Palerm J, Steen U. 2003. Integrating the environment into strategic decision-making: conceptualizing policy SEA. European Environment 13: 1–18.
Stanners D, Bourdeau P (eds). 1995. Europe's Environment. The Dobris Assessment. European Environment Agency: Copenhagen.
Sutton P. 2003. An empirical environmental sustainability index derived solely from nighttime satellite imagery and ecosystem service valuation. Population and Environment 24(4): 293–311.
United Nations (UN). 1996. Indicators of Sustainable Development Framework and Methodologies. UN: New York.
United Nations Environment Programme (UNEP). 1973. State of the Environment. UNEP.
Välimäki J. 2002a. Sustainable development reporting: frameworks. Background paper for discussion at EEA SoE expert group workshop, Copenhagen, 2002.
Välimäki J. 2002b. Tiedon mitalla kestävyyteen [Information for sustainability]. Suomen Ympäristö 556, Ympäristöpolitiikka. Ympäristöministeriö: Helsinki (in Finnish).
Wackernagel M, Rees W. 1996. Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island, BC: New Society.
Copyright