"Capacity Building and Strengthening Institutional Arrangement / Data Yearbook"

Workshop: "Environmental Indicators and their use for indicator-based reporting activities"

Environmental Reporting

Typology of Indicators

Ms. Cristina Frizza

APAT

Agency for Environmental Protection and Technical Services

Tools to build/write a Report

- Informative base
- Classification and management of informative elements
- Elaboration and Representation
- Related Indicators

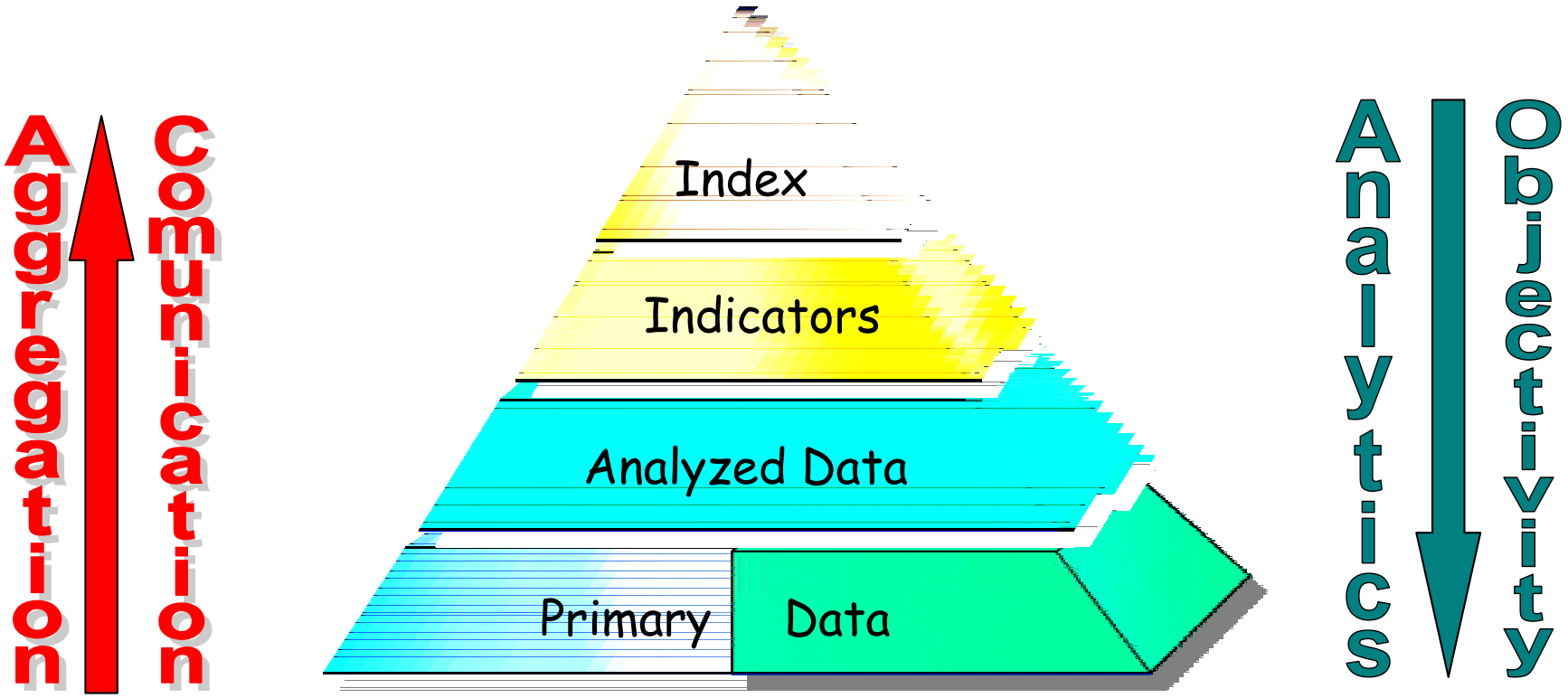
Informative base
Elements

Parameter: Objective measure of property

Indicator: In a very general way, an indicator can be defined as a parameter or a value derived from parameters, which provides information about a phenomenon. The indicator has significance that extends beyond the properties directly associated with the parameter value Indicators possess a synthetic meaning and are developed for a specific purpose

Index: Aggregation of two or more indicators to monitor or represent a complex phenomena

The Information Pyramid



Indicators

We use indicators in everyday life to reflect the state of the things We have grown to accept these measures, or indicators, and make decision based on them That is their purpose They condense a lot of information into one or two well understood measures that can be acted upon

The Sahara and Sahel Observatory (1997)

Why indicators?

- Community sustainability indicators can help in measuring progress and they can help in identifying problems, achievements and areas for action
- For local government and community groups, indicators are an important component of planning and setting goals They also underpin evidenced-based decision making

Why indicators?

- Because indicators can form the basis of community planning and decision making, they are important part of bringing local citizens together, enhancing their sense of belonging and galvanizing action or working together to make a difference
- Ultimately indicators have to shift the emphasis from money and consumption to factors that relate to the quality of our lives socially, economically and environmentally with the ultimate aim of building better lives

Aim of indicators

In general

- Reduce the number of measure and of parameters, that should be necessary to do an exact representation of situation
- Simplify the communication processes of results of measure to stakeholders

In relation to policy making

- Supply information on environmental problems, in order to enable policy-makers to value their seriousness
- Support policy development and priority setting, by identifying key factors that cause pressure on the environment
  - Monitor the effects of policy responses

Every indicators should be:

Relevant

Accurate

Accessible and clear

Complete

Comparable

Coherent

Timely and punctual

The EEA Typology of indicators

Indicators can be classified into 3 simple groups which address the following questions:

1. What is happening to the environment and to humans?
   (Descriptive Indicators)
2. Does it matter?
   (Performance Indicators)
3. Are we improving?
   (Efficiency Indicators)

Descriptive Indicators

Descriptive indicators show the development of a variable, but are not connected with a concrete policy target They describe the actual situation with regard to the main environmental issues, such as climate change, desertification, toxic contamination and wastes in relation to geographical levels at which these issues manifest themselves

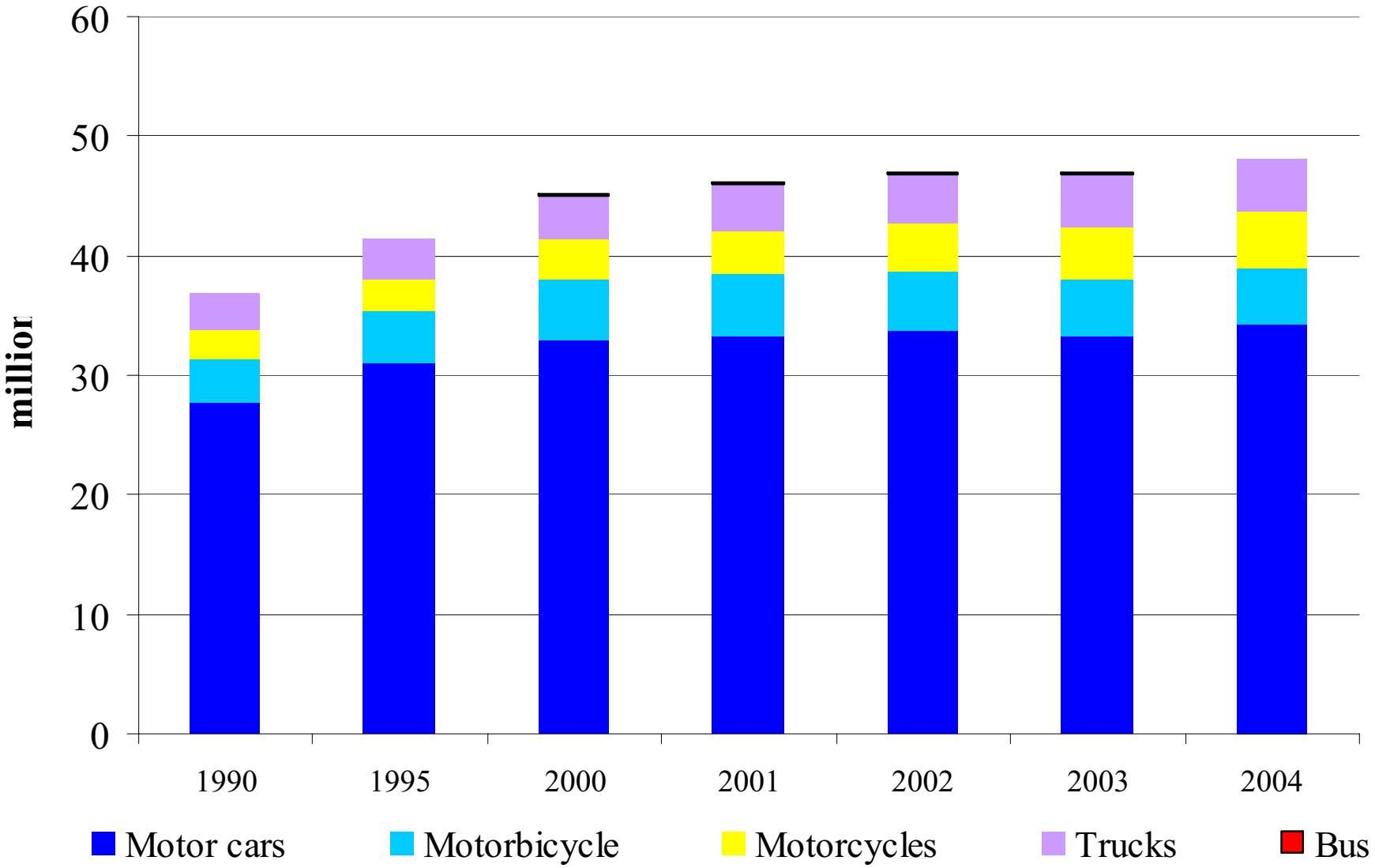
This kind of indicators usually are based on the DPSIR framework or a subset of it

Descriptive Indicators

Indicators for driving forces describe the social, demographic and economic developments in societies and the corresponding changes in life styles, overall levels of consumption and production patterns Primary driving forces are population growth and developments in the needs and activities of individuals These cause changes in production and consumption Through these changes the driving forces exert pressure on the environment

An example of Descriptive driving forces indicator is the “Proportion of vehicle fleet”

Vehicle fleet

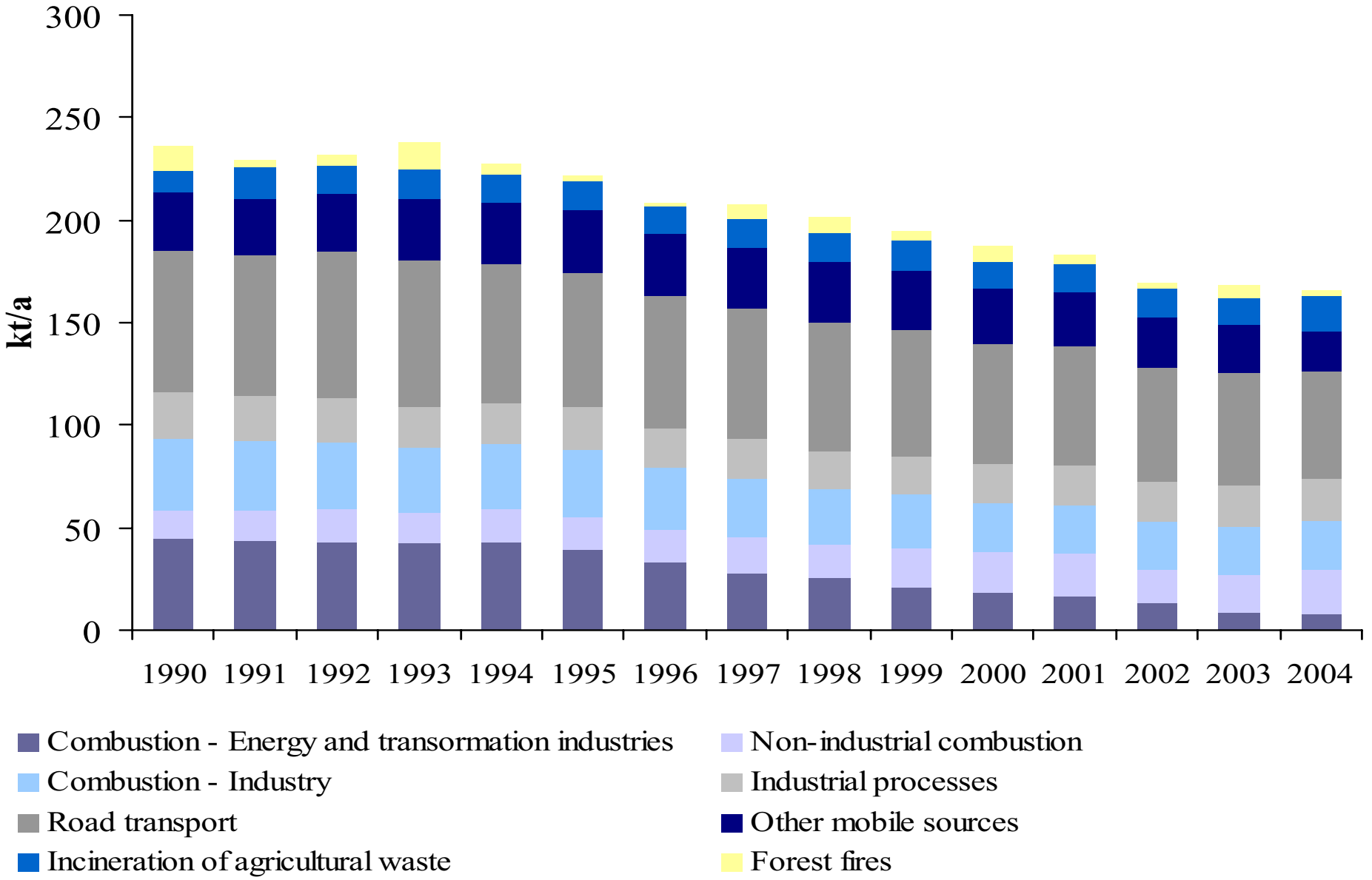


Descriptive Indicators

Pressure indicators describe developments in release of substances (emissions), physical and biological agents, the use of resources and the use of land The pressures exerted by society are transformed in a variety of natural processes to manifest themselves in changes in environmental conditions

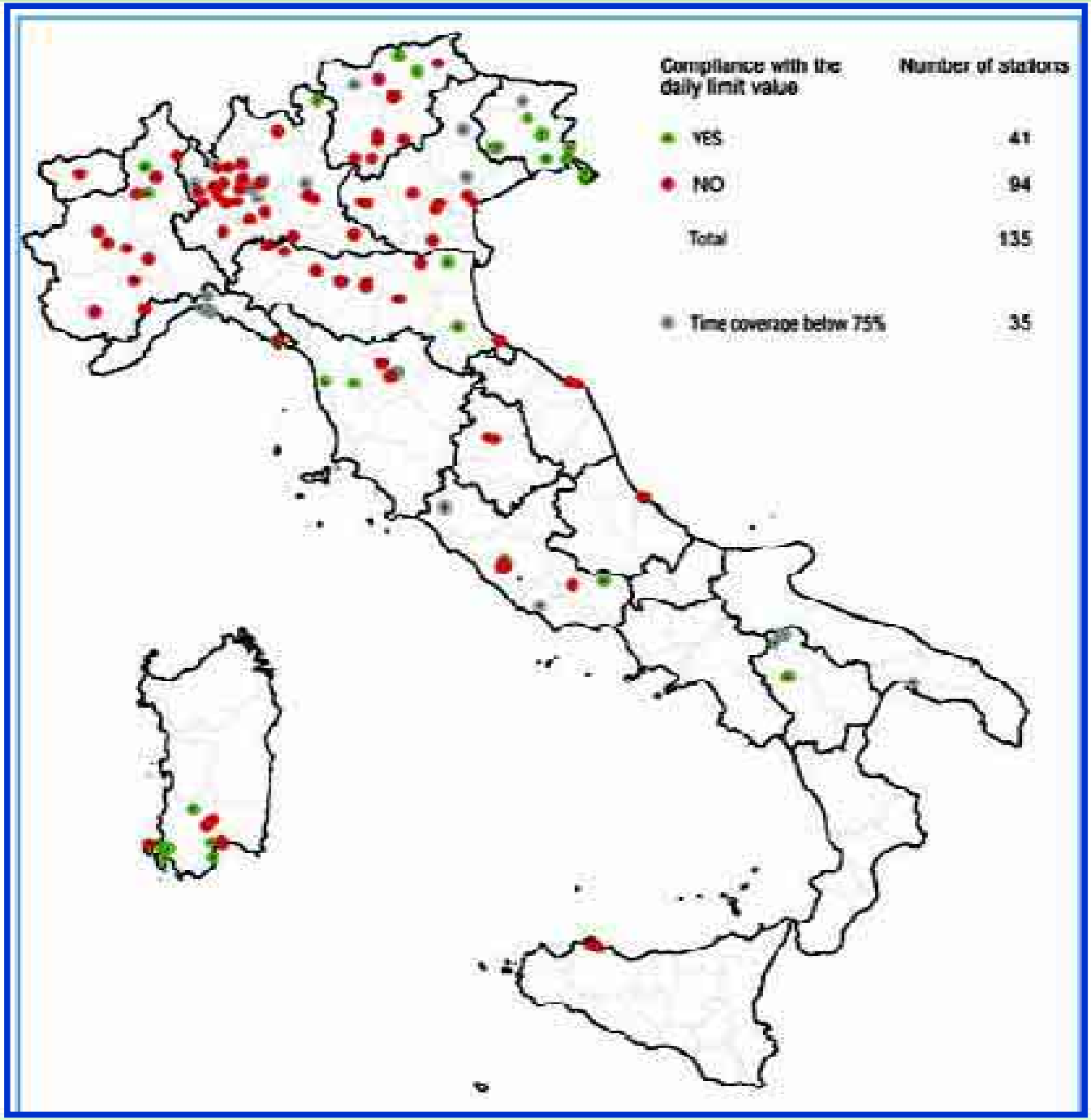
Examples of pressures descriptive indicators are PM_{10} emissions per sector, the use of rock, gravel and sand for construction and the amount of land used for roads

Particulate matter (PM10) emissions per sector



Descriptive Indicators

State indicators give a description of the quantity and quality of physical phenomena (such as temperature), biological phenomena (such as fish stocks) and chemical phenomena (such as air quality PM_{10} concentrations) in a certain area State descriptive indicators may, for instance, describe the forest and wildlife resources present, the concentration of phosphorous and sulphur in lakes, or the level of noise in the neighbourhood of airports

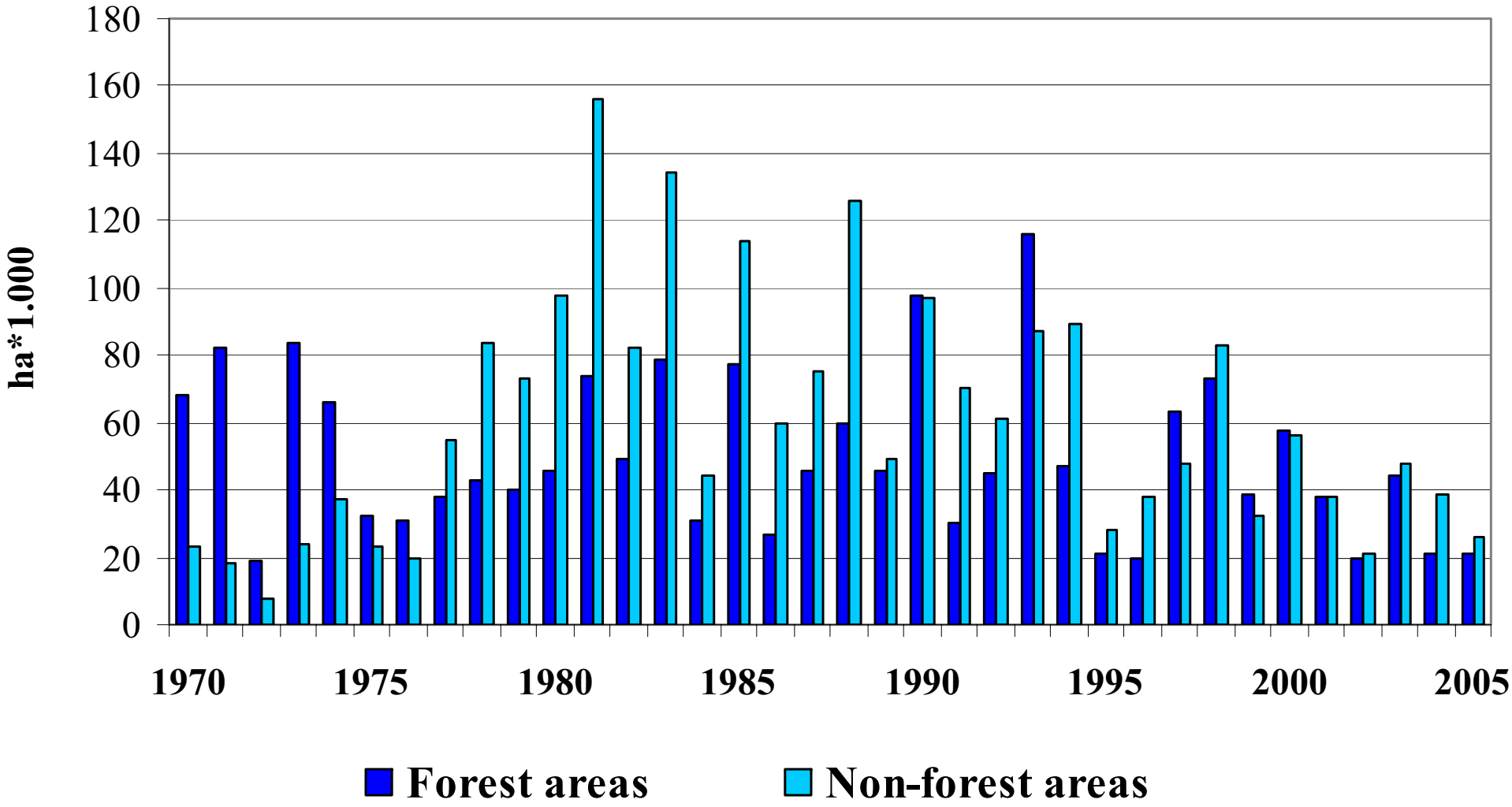

Compliance with the daily limit value
Number of stations
YES 41
NO 94
Total 135
Time coverage below 75% 35

Descriptive Indicators

Due to pressure on the environment, the state of the environment changes These changes then have impacts on the social and economic functions on the environment, such as the provision of adequate conditions for health, resources availability and biodiversity Impact indicators are used to describe these impacts

Impacts occur in a certain sequence: air pollution may cause global warming (primary effect), which may in turn cause an increase in temperature (secondary effect), which may provoke a rise of sea level (tertiary impact), which could result in the loss of biodiversity

Forest and non-forest areas hit by fires



Descriptive Indicators

Response indicators refer to responses by groups (and individuals) in society, as well as government attempts to prevent, compensate, ameliorate or adapt to changes in the state of the environment

Some societal responses may be regarded as negative driving forces, since they aim at redirecting prevailing trend in consumption and production patterns

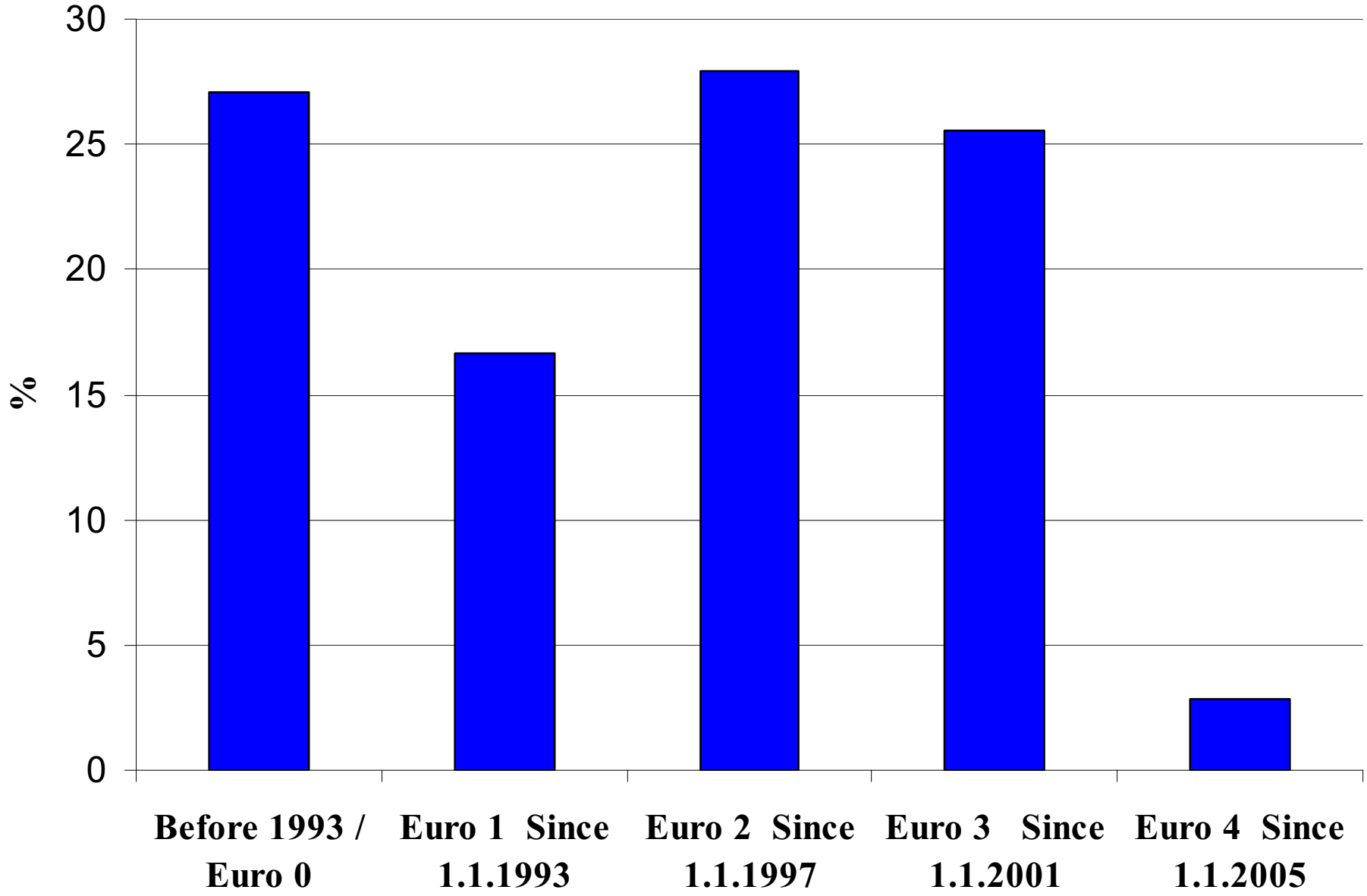
Other responses aim at raising the efficiency of products and processes, through stimulating the development and penetration of clean technologies

Examples of response indicators:

Percentage of cars meeting certain emission standards

Recycling rate of domestic waste

Percentage of cars meeting certain emission standards



Performance Indicators

The descriptive indicators reflect the situation as it is, without reference to how the situation should be In contrast, Performance Indicators compare actual conditions whit a specific set of reference conditions

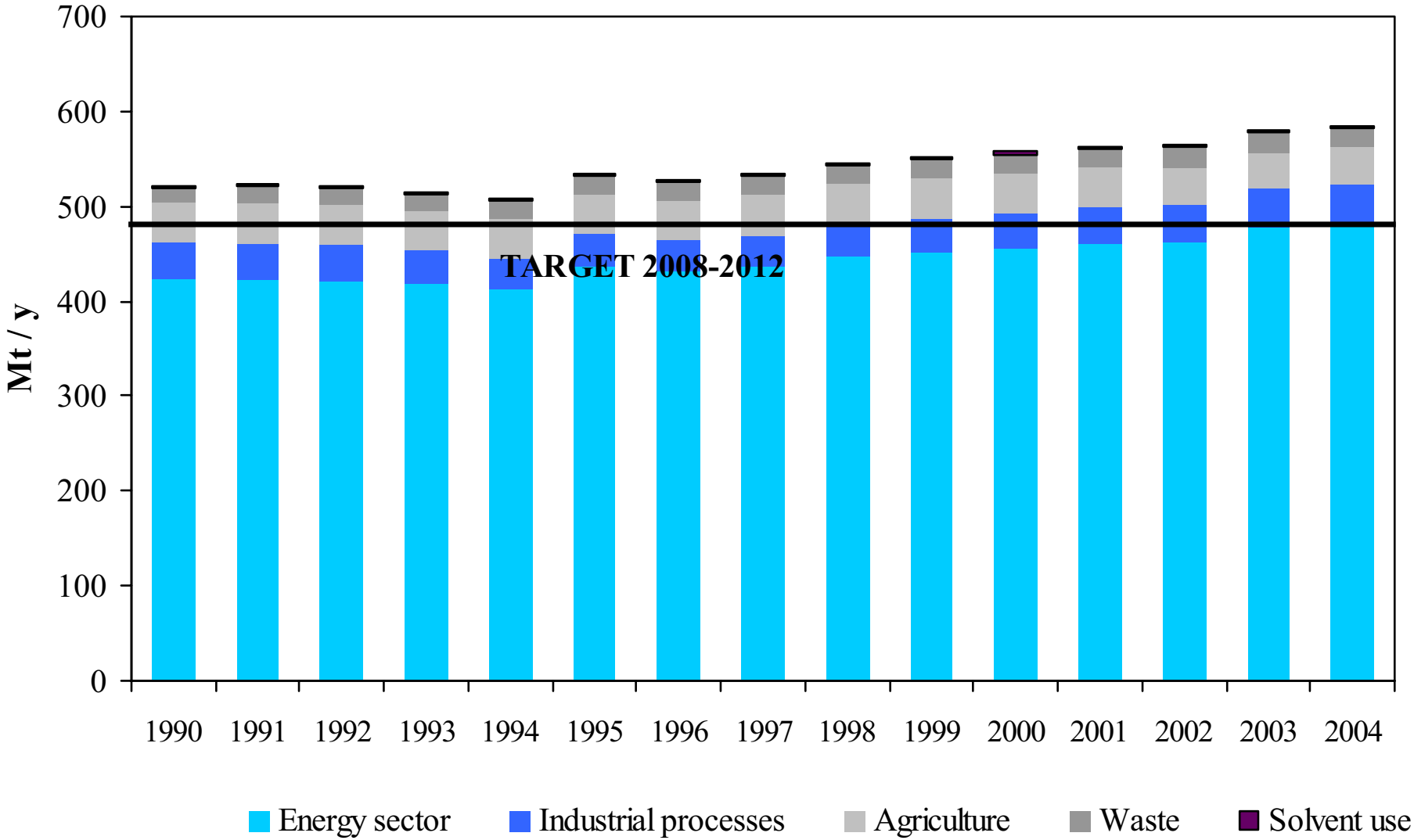
They measure the distance between the environmental situation and the desired situation (target)

These indicators are relevant if specific groups or institutions may be held accountable for changes in environmental pressures or states

Most countries and international bodies develop performance indicators for monitoring their progress towards environmental targets:

- National policy targets
- International policy targets, accepted by governments
  - Tentative approximations of sustainability levels

GHG EMISSIONS (CO2, CH4, N2O, HFCS, PFCS, SF6)



Efficiency Indicators

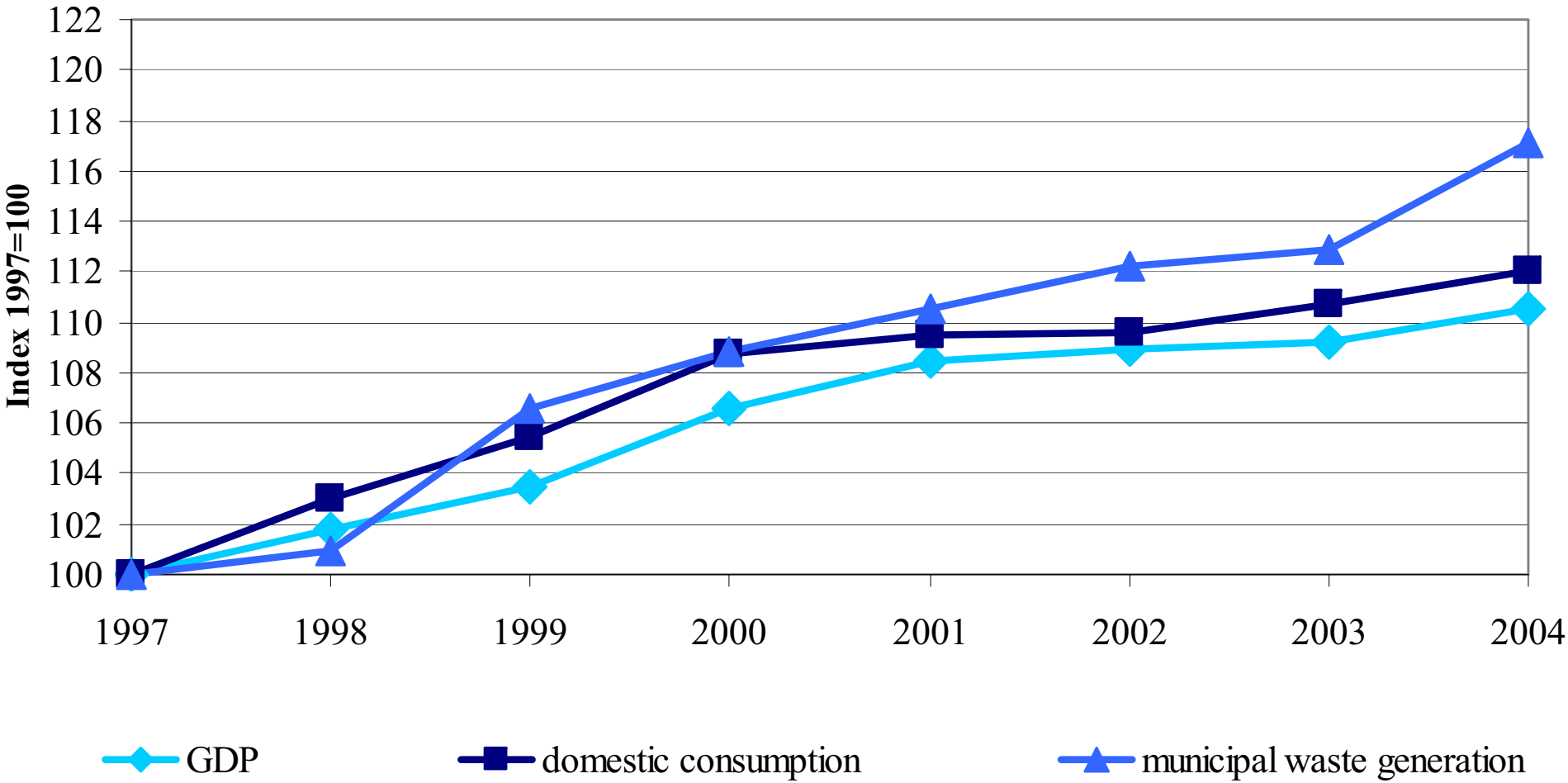
It is important to note that some indicators express the relation between separate elements of the causal chain. Most relevant for policy-making are the indicators that relate environmental pressures to human activities, their name is Efficiency Indicators.

These indicators provide insight in the efficiency of products and processes. Efficiency in terms of the resources used, the emissions and waste generated per unit of desired output.

The energy efficiency of cars may be described as the volume of fuel used per person per mile travelled.

The environmental efficiency of a nation may be described in terms of the level of emissions and waste generated per unit of GDP.

Trend of the Municipal waste generation and social-economic indicators



Efficiency Indicators

Apart from efficiency indicators dealing with one variable only, also aggregated efficiency indicators have been constructed

The best-known aggregated efficiency indicator is the MIPS-indicator It is used to express the Material Intensity Per Service unit and is very useful to compare the efficiency of the various ways of performing a similar function

Efficiency Indicators

Example:

MIPS may be used to compare the amounts of energy and resources used for transporting one person 100 miles by means of the present day car, by aeroplane and by light rail

The relevance of these and other efficiency indicators is that they reflect whether or not society is improving the quality of its products and processes in terms of resources, emissions and waste per unit output

New Indicators developing

- **Sustainable development indicators**
- **Ecological Footprint**
- **Biocapacity**
- **EF/BC Accounts**

Sustainable development indicators

Sustainable development indicators are indicators that measure progress made in sustainable growth and development

They can provide an early warning, sounding the alarm in time to prevent economic, social and environmental damage

They are also important tools to communicate ideas of sustainable development

Indicators for monitoring progress towards sustainable development are needed in order to assist decision-makers and policy-makers at all levels and to increase focus on sustainable development

History

The 1992 Earth Summit recognized the important role that indicators can play in helping countries to make informed decisions concerning sustainable development

This recognition is articulated in Chapter 40 of Agenda 21 which calls on countries at the national level, as well as international, governmental and non-governmental organizations to develop and identify indicators of sustainable development that can provide a solid basis for decision- making at all levels

Moreover, Agenda 21 specifically calls for the harmonization of efforts to develop sustainable development indicators at the national, regional and global levels, including the incorporation of a suitable set of these indicators in common, regularly updated and widely accessible reports and databases

History

In response to this call, the Commission on Sustainable Development approved in 1995, the Programme of Work on Indicators of Sustainable Development

The main objective of the CSD Work Programme was to make indicators of sustainable development accessible to decision- makers at the national level, by defining them, elucidating their methodologies and providing training and other capacity building activities

The Nineteenth Special Session of the General Assembly held in 1997 for the five year review of UNCED affirmed the importance of the work programme on indicators of sustainable development in coming up with a practical and agreed set of indicators that are suited to country-specific conditions and can be used in monitoring progress towards sustainable development at the national level

Assessing progress towards sustainable development

The CSD work programme comprised the following key elements:

- Enhancement of information exchange
- Development of methodology sheets (1995-1996)
- Training and capacity building (1995-1996)
- Testing of an appropriate combination of indicators and monitoring of experiences (1996-1999)
- Evaluation of the indicators and adjustment as necessary (2000)
- Identification and assessment of linkages among the economic, social, institutional and environmental elements of sustainable development to further facilitate decision making at all levels (2000)
    - Development of highly aggregated indicators

Main Phases And Approaches to Implementation

1. Development of the Indicator Methodology Sheets (May 1995 - August 1996)
2. Training and Capacity-Building
   National Testing
   (May 1996 – January 1998)
3. Evaluation of the Testing Results and Indicator Set
   The working list of Indicators
   Revising the framework and Indicator List
   Linkages and Aggregation
   (January 1999 – December 2000)

Phase 1
Development of the Indicator Methodology Sheets

One of the significant tasks of the first phase was the preparation of the methodology sheets for each indicator.

Building on existing work, a cooperative, consultative, and collaborative approach was used to produce the methodology sheets.

More than thirty organizations of the United Nations system, other intergovernmental, non-governmental and major group organizations supported this work, assuming lead roles in the drafting of methodology sheets appropriate to their mandate and experience.

Phase 1
Development of the Indicator Methodology Sheets

An Expert Group, consisting of forty-five (45) members from non-governmental organizations and United Nations agencies, guided the overall process of developing the methodology sheets.

In February 1996, an international Expert Workshop on Methodologies for Indicators of Sustainable Development was held in Glen Cove, New York to review the preliminary methodology sheets.

The collection of methodology sheets was published by the United Nations in August 1996 under the title of "*Indicators of Sustainable Development: Framework and Methodologies*".

Phase 1
Content of the Methodology Sheets

Basic information on the indicator, including its definition and unit of measurement

Purpose and usefulness of the indicator for sustainable development decision-making (i e, policy relevance); international targets where these are available; and the relevant international conventions, if the indicator is primarily of global significance;

Conceptual underpinnings and methodologies associated with the indicator, including the underlying definitions measurement methods, and a summary of its limitations and alternative definitions;

Phase 1
Content of the Methodology Sheets

Data availability to illustrate the importance of regular data collection and updating to support systematic reporting;

Listing of the agency(ies) (lead and cooperating) involved in the preparation of the methodology sheets;

Other information (e g , contact points, other references and readings)

The methodology sheets were to form a base and starting point for the process of indicator development and were understood to be open for enhancement, refinement, amendment, and change

Phase 2
Training and Capacity Building

To address the need for building the necessary capacity and knowledge on the use of indicators, a series of briefing and training workshops at the regional level was initiated from November 1996 through June 1997.

The main objective of all the workshops was to provide an introduction and training in the use of indicators as tools for national decision-making and to explore related methodologies for indicator development. Special attention was given to identifying national priorities and relating them to the process of indicator identification and selection.

Phase 2
National Testing

At the Fourth Session of the CSD in 1996, the Commission encouraged Governments to pilot test, utilize and experiment with the proposed initial set of indicators and related methodologies over a 2-3 year period.
The purpose of the national testing was to gain experience with the use of indicators, to assess their applicability according to national goals and priorities of sustainable development, and to propose changes to the set and its organizational framework.
The national testing programme was launched in November 1996. Twenty-two (22) countries covering all regions of the world participated, on a voluntary basis, in the testing process.

Phase 2
National Testing

The Statistical Office of the European Communities (Eurostat) prepared a test compilation of 54 CSD indicators drawing on statistical data existing within the European Community.

Most of the testing countries adopted different approaches to the testing exercise, ranging from plain evaluation of data availability for all or a few selected indicators to embarking on the whole process of developing their own independent set of national indicators while using the CSD indicators as a point of reference. Nevertheless, the majority of the countries aligned their processes with the CSD Testing Guidelines while others integrated the guidelines into their own unique design.

The meeting of testing countries (Prague January 1998) took stock of the progress of implementation and discussed ways to improve the process and ultimately the results of the programme.

Phase 3
Evaluation of the Testing Results and Indicator Set

The testing phase was officially concluded in December 1999 with the International Workshop on CSD Indicators of Sustainable Development

All relevant information on the testing programme including country reports was compiled and organized into a database (CSD ISD Database). This database served as an analytical tool for reviewing testing results, the indicator framework and the working list of indicators.

The testing exercise not only heightened awareness of the value and importance of indicators but also increased levels of understanding on sustainable development issues.

Phase 3
The Working List of Indicators

Testing results showed that sustainable development indicators clearly have potential for assisting in national decision-making.

Countries reported to have used or planned to use the indicators to:

- bring important issues to the political agenda;
- help to identify main trends in priority sectors;
- facilitate reporting on the state of sustainable development to decision-makers and the general public, both domestic and international;
- promote national dialogue on sustainable development;
- help to assess the fulfilment of governmental goals and targets, and in the revision of these goals and targets;
- facilitate the preparation and monitoring of plans;
- help to assess the performance of both policies and actions when implementing the plans;
- state the concept of sustainable development in practical terms; focus the national and sectoral programmes and state budgets towards sustainability.

Phase 3
The Working List of Indicators

As could be expected, not all of the indicators in the working list were found relevant in the context of a testing country.

Testing countries proposed to develop indicators to cover areas that had not been addressed in the testing such as: reef conservation and the health of reef ecosystems and specific coastal issues; energy; biotechnology; trade and environment; safeguarding of cultural heritage; social and ethical values; human resource development; under-employment; expatriate labour force; natural resource accounting; and capacity-building.

Most countries, nonetheless, shared the view that the final list of indicators should be short, focused, pragmatic and flexible so that it could be adapted to country-specific conditions.

Phase 3
Revising the Framework and Indicator List

Guided by the reports from the testing countries and continuing expert discussions on the indicators and the framework, the CSD began, in early 1999, the process of defining the appropriate measures to take in the light of the various concerns raised during the implementation of the work programme.

At its fifth meeting in April 1999, the Group addressed the following issues:

1. inclusion of new areas identified as priorities by the testing countries;
2. deletion of issues less reported on by countries; possible revision of the DSR framework;
3. selection of criteria for the core set of indicators and furthering the testing in selected countries.

Phase 3
Linkages and Aggregation

The resulting organization presents the indicators under four major dimensions, further broken down into themes and sub-themes.

The Secretariat has initiated work on the linkages and aggregation of sustainable development indicators.

Guidelines

Procedures for the Development, Testing and Use of Indicators

The procedures and processes vary from country to country, depending on:

- Country specific conditions
- National priorities and objectives
- Available infrastructure
- Expertise and the availability of data and other information for decision-making

Procedural issues

1. Organization
2. Implementation
3. Assessment and Evaluation
4. Reporting

Organization

The underlying theme of sustainable development is the integration of economic, social environmental issues in decision and policy making at all levels.

This integration implies the involvement of virtually all traditional sectors of economic and government activity, such as economic planning, agriculture, health, energy, water, natural resources, industry, education and the environment, and so forth, according to the principal ministries of government.

The assumption of integration is reflected in the indicators of sustainable development, which contain social, economic, environmental and institutional indicators, and should be taken up in mechanisms for institutional integration, such as national sustainable development councils, committees etc

Organization

The national coordinating mechanism could take a variety of forms depending on each countries' needs

It should build upon and utilize already existing institutional arrangements and experience and should be flexible and transparent making use of the widest possible consultation and participation among stakeholders involved

Implementation

The national coordinating mechanism may determine the current status of indicator use in the country

- Determining which indicators are already being used within the country, by whom they are used, for what purposes and the degree of parallels with the CSD approach;
- Reviewing data already being collected for indicators or other uses, by whom, where and its availability

Implementation

The initial stages of implementation might then include the following:

- specifying a number of selected priority issues identified in the national strategy and selecting indicators from the CSD list that correspond to those priorities, and selecting country-specific indicators not identified in the CSD list, as needed;
- matching the priority indicators selected with the list of indicators already in use in the country;
- assessing data availability for those priority indicators for which data are not already being collected;

Implementation

- establishing necessary arrangements to collect the missing data, where possible, which may include modifying current data compilation arrangements where necessary;
- making an initial evaluation of any training and other capacity-building that may be needed to collect that data and to perform other functions required by the testing process;
- collecting and/or compiling data needed for the indicators selected;
- developing a strategy for dissemination of indicator information to stakeholders (via annual reporting, headline indicators, newsletters or bulletins)

Assessment and Evaluation

Assessment should focus on:

1. Technical Issues :
   - Usefulness of the methodology sheet for developing the indicators
   - The availability of data for the indicators and the source, continuity, delivery and reliability of that data
   - The data product
   - Planning for the short, medium and long term data development
2. Decision Making Issues :
   - Usefulness of the indicators for national decision-makers
   - The analysis of the data into concise, policy-relevant information
   - The use to which the decision maker puts the information
3. Institutional Support and Capacity Building Issues :
   - The need for training
   - The need for institutional support for data collection & analysis
   - Other capacity-building needs for the development of a national indicator programme
     - An evaluation of twinning process, where relevant, and of other international and bilateral cooperation of relevance to indicators of sustainable development

Reporting

The national coordinating mechanism and the Focal Point may establish a government web site or mechanism for regular reporting on progress during various phases of the indicator development work.

This would provide a ready mean of communicating results and obtaining feedback from the various participants. Regular meetings should also be held by the coordinating body during the course of its work. Results, difficulties and problems may also be reported to the CSD Secretariat in terms of any advice or support that the Secretariat may be able to provide.

At the end of the development phase, a final, comprehensive evaluation of the process may be needed in order to make further adjustments to the national indicators and methodology sheets.

Reporting

The evaluation report could contain such items as:

A Introduction

1 Background and objectives

2 Identification of the users and relevance to national decision-making

3 Institutional, organizational and resource arrangements for indicator development

4 Experience with twinning, as applicable

B Identification and selection of the indicators

Description of the process through which the indicators were chosen, and the criteria for selection, including reference to:

1 National strategies, targets and priorities

2 Existing indicators and indicator programmes

3 Data availability

4 Other parameters

Reporting

C Usefulness of the indicators
- 1 Usefulness of the methodology sheets
- 2 Relevance of the data product
- 3 Development of linkages among the indicators, of national indicator frameworks and of aggregated indicators
- 4 Comments and suggestions on changes and improvements

D Challenges
- 1 Problems encountered in data availability, reliability and delivery
- 2 Strengthening and training of human resources
- 3 Other capacity-building needs
- 4 Other

E Recommendations

CSD Core Indicator Framework

The framework employed in the CSD work programme to guide the selection of sustainable development indicators has evolved from a driving force-state-response approach to one focusing on themes and sub-themes of sustainable development.

The early indicator work under CSD organized the chapters of Agenda 21 under the four primary dimensions of sustainable development—social, economic, environmental, and institutional

DSR Framework for SDI

The following table illustrates the essence of this framework

SD Dimension	Chapter of Agenda 21	Driving Force Indicators	State Indicators	Response Indicators
Social				
Economic				
Environmental				
Institutional				

Sustainable development indicators

The number of indicators in the last core set (2000) has been considerably reduced from the suggested preliminary list of indicators used in the testing phase. In total, 58 indicators are included in the core set compared to the original 134 presented by the 1996 publication.

Between 1996 and 1999, 22 countries from all regions of the world were engaged in the testing process on a voluntary basis to gain experience with the selection and development of sustainable development indicators and to assess their application and suitability to assist decision-making at the national level.

Those indicators retained in the core set represent a better balance of the sustainable development themes common to national policy development, implementation, and assessment needs.

These core set is divided in four key themes:

- Social
- Environmental
- Economic
- Institutional

Sustainable development indicators

The theme framework has been developed to address the following considerations:

- Future risks
- Theme correlation
- Sustainability goals
- Basic societal needs

In addressing future risks, the framework becomes a proactive tool to assist decision-making especially where quantitative thresholds/limits are know

A successful framework for sustainable development must reflect the linkages between all dimensions, themes, and sub-themes

It should implicitly reflect the goals of sustainable development to advance social and institutional development, to maintain ecological integrity and ensure economic prosperity

Sustainable development indicators Criteria of Selection

The indicators should be:

- primarily national in scope;
- relevant to assessing sustainable development progress;
- understandable, clear, and unambiguous, to the extent possible;
- within the capabilities of national governments to develop;
- conceptually sound;
- limited in number, but remaining open-ended and adaptable to future needs;
- broad in coverage of Agenda 21 and all aspects of sustainable development;
- representative of an international consensus to the extent possible;
- dependent on cost effective data of known quality

Sustainable development indicators

It is clear that the framework cannot totally capture all the themes (mining, tourism, groundwater)

As a result of this iterative process, a final framework of 15 themes and 39 sub-themes has been developed to guide national indicator development

SOCIAL

THEME	SOME INDICATORS
Equity	% Population Living below Poverty Line, Unemployment Rate
Health	Nutritional Status of Children, Life Expectancy at Birth, Population with Access to Safe Drinking Water
Education	Secondary or Primary School Completion Ratio, Adult Literacy Rate
Housing	Floor Area per Person
Security	Number of Reported Crimes per 1 000 Population
Population	Population Growth Rate, Population of Urban Formal and Informal Settlements

ENVIRONMENTAL

THEME	SOME INDICATORS
Atmosphere	Emission of Greenhouse Gases, Ambient Concentration of Air Pollutants in Urban Areas
Land	Use of Fertilizers, Use of Agricultural Pesticides, Forest Area as a Percent of Land Area
Oceans, Seas and Coasts	Algae Concentration in Coastal Waters, Percent of Total Population Living in Coastal Waters
Fresh Water	Annual Withdrawals of Ground and Surface Water as a Percent of Total Renewable Water, Biochemical Oxygen Demand in Water Bodies, Concentration of Faecal Coliform in Freshwater
Biodiversity	Area of Selected Key Ecosystems, Protected Area as a Percent of Total Area, Abundance of Selected Key Species

ECONOMIC	
THEME	**SOME INDICATORS**
Economic Structure	Gross Domestic Product Per Capita, Investment Share in Gross Domestic Product, Balance of Trade in Goods and Services ,Debt to Gross National Product Ratio
Consumption and Production Patterns	Intensity of Material Use, Annual Energy Consumption Per Capita , Energy Use Per Unit of GDP (Energy Intensity), Generation of Industrial and Municipal Solid Waste, Generation of Hazardous Wastes, Waste Recycling and Reuse
ISTITUTIONAL	
THEME	**SOME INDICATORS**
Institutional framework	National Sustainable Development Strategy, Implementation of Ratified Global Agreements
Institutional Capacity	Number of Internet Subscribers per 1000 Inhabitants, Main Telephone Lines per 1000 Inhabitants, Expenditures on Research and Development as a Percent of Gross Domestic Product, Human and Economic Loss due to Natural Disasters

Methodology sheet

USE OF FERTILIZERS		
Environmental	Land	Agriculture

1. INDICATOR

(a) **Name:** Use of Fertilizers.

(b) **Brief Definition:** Extent of fertilizer use in agriculture per unit of agricultural land area.

(c) **Unit of Measurement:** kg/ha.

(d) **Placement in the CSD Indicator Set:** Environmental/Land/Agriculture.

Methodology sheet

2. POLICY RELEVANCE

(a) **Purpose:** The purpose of this indicator is to measure the intensity of fertilizer use in agriculture (crop husbandry).

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** The challenge for agriculture is to increase food production in a sustainable way. This indicator shows the potential environmental pressure from agricultural activities. Extensive fertilizer use is linked to eutrophication of water bodies, soil acidification, and potential of contamination of water supply with nitrates. The actual environmental effects will depend on pollution abatement practices, soil and plant types, and meteorological conditions.

(c) **International Conventions and Agreements:** Not available.

(d) **International Targets/Recommended Standards:** Targets should be based on national situations.

(e) **Linkages to Other Indicators:** This indicator is closely linked to others in the agricultural, water, and atmospheric groups, such as pesticide use, biochemical demand in water bodies, algae index, and emissions of greenhouse gases.

Methodology sheet

3. METHODOLOGICAL DESCRIPTION

(a) **Underlying Definitions and Concepts:** The concepts are available. Data on the quantities of fertilizers used are converted into the three basic nutrient components and aggregated. The three components are nitrogen (N), phosphorous (P_2O_5), and potassium (K_2O). Factors for chemical breakdown are standardized. Agricultural land is the sum of arable and permanent crop land and land under permanent pastures and meadows. However, due to the limitations discussed in section 4(d) below, this indicator should be regarded as interim for sustainable development purposes.

(b) **Measurement Methods:** Data on fertilizers are compiled from industry sources and non-traditional sources. Data for developing countries generally refer to domestic disappearance based on imported products. The derived figures in terms of nutrients are then divided by the agricultural land area.

(c) **Limitations of the Indicator:** Environmental impacts caused by leaching and volatilization of fertilizer nutrients depend not only on the quantity applied, but also on the condition of the agro-ecosystem, cropping patterns, and on farm management practices. In addition, this indicator does not include organic fertilizer from manure and crop residues, or the application of fertilizers to grasslands. The indicator assumes even distribution of fertilizer on the land.

(d) **Status of the Methodology:** Not available.

(e) **Alternative Definitions/Indicators:** A more relevant and sophisticated indicator would focus on *nutrient balance* to reflect both inputs and outputs associated with all agricultural practices. This would address the critical issue of surplus or deficiency of nutrients in the soil. This would need to be based on agro-ecological zones.

Methodology sheet

4. ASSESSMENT OF DATA

(a) **Data Needed to Compile the Indicator:** Data on fertilizer use for N, P_2O_5, and K_2O; and agricultural area.

(b) **National and International Data Availability and Sources:** Data for all countries exist at the national level only. The data are updated on a regular basis. At the international level, the Food and Agriculture Organization of the United Nations (FAO) is the primary source.

(c) **Data References:** see 6(a).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the Assistant Director-General, Sustainable Development Department, FAO; fax no. (39 06) 5705 3152.

(b) **Other Contributing Organizations:** The International Fertilizer Association is associated with the development of this indicator.

6. REFERENCES

(a) **Readings:**

FAO. 1998. *Food and agricultural sector profiles. Country tables 1997.* Statistics Div.; FAO, Rome (Italy). Agriculture and Economic Development Analysis Division, 427 pp.

(b) **Internet sites:**

FAO Statistical Databases. http://apps.fao.org/

Ecological Footprint and Biocapacity

- Nature can restore renewable resources only at a certain rate Humans consistently and increasingly consume renewable resources at a faster rate than ecosystems can restore them
- The decisive factor is not just what we use and how much we use, but how fast we use a specific resource
- The idea of using area units as a measure of life-supporting natural capital is based on the fact that many basic ecosystem services are driven by surfaces at which the process of photosynthesis takes place
- Nowadays the broader regenerative process is included in the definitions of the ecological footprint and the available biocapacity

Ecological Footprint and Biocapacity

The ecological footprint (EF) measures how much bioproductive area (whether land or water) a population would require to produce on a sustainable basis the renewable resources it consumes, and to absorb the waste it generates, using prevailing technology

Biocapacity (BC) measures the bioproductive supply that is available within a certain area (e g of arable land, pasture, forest, productive sea) EF and BC are tantamount to the concepts demand and supply in Economics

When used together, they form the EF/BC accounts it is frequently referred to only as “EF accounting” but the use of “EF/BC accounting” is more appropriate as it considers the fact that the accounting tool compares demand and supply - and not just demand (as suggested by the term “EF accounting”)

Ecological Footprint and Biocapacity

When the EF is larger than the BC the renewable resource accounting results in a deficit

A national ecological deficit can be compensated through trade with nations that process ecological reserves or through liquidation of national ecological assets

In contrast, the global ecological deficit cannot be compensated through trade, and is therefore equal to overshoot

Vice versa, if the EF is smaller than the BC, one speaks of an ecological reserve The EF decreases with smaller population size for a given area, less consumption per person, and higher resource efficiency (prevailing technology)

Ecological Footprint

The Ecological Footprint (EF) is a method to answer the following research question: “How much of the regenerative capacity of the biosphere is occupied by human activities?”

EF expresses the consumption of renewable resources (crops, animal products, timber, and fish), the result of the consumption of energy and the use of built-up areas in standardized units of biologically productive area (in gha)

It is a measure of how much biologically productive land and sea an individual, population or activity requires to produce the renewable resources it consumes and to absorb the waste

Ecological Footprint

The *global yield factor by type of consumption* (crops, pasture, fisheries, timber) translates a product (or waste) into an area (local hectares) required to produce the product (or to absorb the waste) It describes the resource productivity for the selected time period (one year), the selected product (crops, animal product with pasture fed, fish) and the connected land type (cropland, pasture, fisheries area)

Ecological Footprint

The *equivalence factor* (in gha/ha) translates a specific land type (such as crop-land or forestland) into a global hectare This equivalence factor represents the world's average potential productivity of a given bioproductive area relative to the world average potential productivity of all bioproductive areas

For example, because the average productivity of cropland is higher than the average productivity of all other land types, it needs to be converted using its corresponding equivalence factor in order to be expressed in global hectares Equivalence factors are the same for all countries, but vary from year to year due to changes in the relative productivity of ecosystem or land-use types because of environmental factors (such as weather patterns)

The equivalence factors are derived from the suitability index of Global Agro-Ecological Zones (GAEZ) 2000, which is a spatial model of potential agricultural yields

Biocapacity

The biocapacity (BC) is a method to answer the question: “How many of the renewable resources have been made available by the biosphere’s regenerative capacity (are produced by the various ecosystems)?”

BC represents the bulk of the biosphere’s regenerative capacity

It is an aggregate of the production of various ecosystems in a certain area (of arable land, pasture, forest, productive sea) Some of it may also consist of built up or degraded land The earth’s BC increases with a larger biologically productive area and with a higher productivity per unit area

Biocapacity

Biocapacity is dependent not only on natural conditions but also on prevailing land use practices (farming, forestry)

The *country-specific yield factor* describes the discrepancies between countries in productivity of a land type and technological advancements

Each country and each year has its own set of yield factors. For example, in 2002, German cropland was 2 5 times more

productive than world average cropland The German cropland yield factor of 2 5 is used to convert German cropland into world cropland

Again, the *equivalence factor* (in *gha/ha*) translates a hectare of a specific land type (such as cropland, pasture, forestland, marine water, or built-up areas) into a global hectare. It is the same for all countries but vary from year to year

EF/BC Accounting

The EF/BC accounts are formed by combining the EF and the BC, thereby turning the approach into a more complete accounting tool for natural resources

The algebraic difference between BC and EF is called “Ecological Deficit” if it is negative or “Ecological Reserve” if it is positive

EF/BC accounts make use of extensive data sets largely from national and international statistical and scientific bodies like UN agencies or countries’ annual statistics in areas like agriculture, forestry and energy Domestic production and trade are taken into consideration for consumption (or final demand) calculation Data gaps are filled in with the help of a variety of governmental, academic or private sources

The margin of error of EF/BC accounts based on shortcomings of the data sources is hard to quantify

EF/BC Accounting

The strength of the EF/BC accounts is also its weakness: it is a complex, multi-dimensional composite indicator. It summarises some of the problems of the sustainable consumption using several technical decisions (selections of input variable, weighting factors, and data sources), which are not transparent or comparable with other information due to the lack of agreed standards.

Its scope is limited to renewable resources, i e resources that can regenerate in a limited time period can be covered by knowledge-based weighting factors. A number of important environmental issues cannot be included appropriately because nature has no significant regenerative or absorptive capacity

Bibliography

- EEA - EEA core set of indicators - Guide, 2005;
- European Commission - Ecological Footprint and Biocapacity - The world's ability to regenerate resources and absorb waste in a limited time period, 2006;
- EEA - Environmental indicators:Typology and overview, 1999;
- The World Bank Environment Department -Indicators of Environment and Sustainable Development -*Theories and Practical Experience,* 2002;
- UN Division for Sustainable Development - INDICATORS OF SUSTAINABLE DEVELOPMENT: GUIDELINES AND METHODOLOGIES

  www.un.org/esa/sustdev/publications/indisd-mg2001.pdf