

# Introduction to the State Indicators of National Scope

## Overview of the State Environmental Goals and Indicators Project



The *State Indicators of National Scope (SINS)* is a product of the State Environmental Goals and Indicators Project, a cooperative agreement between the United State Environmental Protection Agency (EPA) Office of Policy, Planning and Evaluation, and the Florida Center for Public Management (FCPM) of Florida State University. The purpose of the project is to assist state environmental agencies in improving their environmental management capabilities through the development of environmental goals and indicators and integrating them into their environmental management systems. Environmental indicators attempt to describe the actual environmental conditions and present scientifically-based information on environmental trends and their significance. Environmental indicators look at the effects of human activities on the environment as well as the implications of those actions for human health, quality of life and the integrity of ecosystems.

In the past five years the growth in the use of indicators at both the federal and the state level has been explosive. In 1990 only a handful of states were using indicators in any direct sense and only two -- Florida and North Carolina -- had made any explicit attempt to systematically develop and document a comprehensive environmental indicator system. EPA was only beginning to think about indicator systems. That has radically changed. There is now so much indicator work going on that the situation is almost chaotic. Almost 30 states have developed or are finishing initial work of environmental indicators or closely related environmental reporting documents, and virtually all states report they expect to undertake indicator development projects in the near future. At the federal level there are a number of interagency and intra-agency organizations at work to develop indicator systems and, perhaps more importantly, to begin the process of the redesign of federal environmental monitoring systems. EPA is moving toward concluding the development of a set of national environmental goals that are measured by indicator supported benchmarks. An agency-wide process -- Core Measures -- involving both EPA and the states is nearing completion that will provide a uniform set of environmental and program measures for state and federal use. The Office of Water at EPA is concluding a three-year process to develop a set of national water indicators and the Office of Air and Radiation, in partnership with FCPM, is in the process of developing a set of national air and radiation indicators to be completed by April, 1997. The cornerstone of a revised federal-state relationship at EPA are Performance Partnership Grants that are founded in the achievement of environmental results, again, measured explicitly by environmental and program indicators. At the local level and, even at the community-based level, use of indicators is just now beginning.

Under the cooperative agreement, the FCPM has provided both technical assistance to state agencies and produced tangible products for state use. Technical assistance has involved workshops ranging from a basic overview of what environmental indicators are to the selection and development of indicators for a particular state's environmental management system. The Project has worked with USEPA Region 4 and respective states in developing a Regional Environmental Strategic Plan, an indicator-driven strategic planning and management system. The project has assisted USEPA Region 9 and its states in the preparation of a regional state-of-the-environment report and assisted the Pacific Northwest Indicators Working Group with the development of a regional set of indicators. Indicator workshops were delivered in 6 of the other EPA regions. The Project has identified over 2,000 environmental practitioners at various government levels and has developed an Internet Website to serve as an information clearinghouse at <http://www.fsu.edu/~cpm/segip.html>. An extensive listing of environmental practices among state agencies was published in *State Environmental Management Activity in State Environmental and Natural Resources Agencies*.

The major publications of the Project are included in the *Environmental Indicator Technical Assistance Series*, a four volume set that contains:

- *Volume 1: Catalog of Environmental Indicators*. An analysis, compilation and cross-referencing of over 1000 indicators employed in 30 federal and state indicators documents. Provides the user with practical examples of indicators actually used in indicators documents and provides a linkage back to the originating data set.
- *Volume 2: Catalog of Data Sources*. An identification and analysis of important data sources appropriate for indicator development.
- *Volume 3: State Indicators of National Scope (SINS)*. The presentation of a group of recommended indicators for use by state agencies in developing their own indicator systems for a comprehensive list of national environmental issues of concern to states.
- *Volume 4: Directory of Environmental Indicator Practitioners*. A compilation of 2000 federal, state, local nonprofit and international environmental practitioners and organizations.

## Overview of the State Indicators of National Scope (SINS)

The first two volumes of the series attempt to provide states with the tools to develop or expand their own indicator systems by showing states what EPA and the other states had used in their documents and by identifying and analyzing the major national sources of indicator quality data. In *Volume 3: State Indicators of National Scope (SINS)* the Project attempts to draw upon its cumulative experience gained over the past two years to provide states with our best possible advice concerning the specific choice of indicators for use by states in the own systems. Our hope is that states beginning an indicator process or refining an existing system will be able to use this document to help themselves sort through all of the options available to them. In the remaining pages of this document 82 recommended indicators will be presented in support of 19 national-level environmental issues of state concern. In addition to the recommended indicators, an additional 142 alternative indicators suitable for the 19 issues will also be listed.

## Process

In September of 1994, staff of the FCPM met with representatives of the Northeast Center for Comparative Risk and the Western Center for Comparative Risk to review the issue lists from 16 state comparative risk assessment studies to identify a set of national environmental issues of concern to states. This review identified 26 initial issues. The purpose of this exercise was to establish a framework for the development of a set of indicators capable of dealing with all or most of the environmental issues of concern to states. It was our belief that a common set of issues developed from this series of state-based projects would provide us with the best possible issues to structure the indicators.

FCPM staff then examined each of these issues to identify the major dimensions, or subissues, of each of these issues. For our purposes what this created was a structure or framework to guide the development of a comprehensive set of indicators that states might find useful in the development of their own indicator systems. This initial list of 26 issues has by subsequent review been reduced and consolidated to the 19 issues found in this document. For the past two years FCPM staff have been reviewing indicators developed in other state and federal processes and have been investigating available data sources for other possible indicators. The indicators found in this document represent the best that we have been able to identify.

## Qualification Standards

For each individual indicator system being developed, it is useful to list with as much precision and with as much completeness as possible the specific criteria used to define an acceptable indicator for that system. Described in such criteria -- termed qualification standards -- might be such concerns as:

- the geographic scope of the indicators (national, statewide, regional, ecosystem, local),
- the selection criteria used,
- the acceptable types of indicators (environmental, program, administrative),
- the availability of data (is it available now or is it a prospective indicator?), or
- how it is intended to be used (its purpose).

By clearly identifying such standards early in the process and constantly comparing the selection of indicators against them, attention can remain focused on indicators appropriate for the system to be developed.

The qualification standards for *SINS* include:

- the indicators should reflect issues that are national in scope, but are of concern to states,
- the indicators should support the development of trends at the state level. Exceptions include some indicators of global climate change and stratospheric ozone.
- the Type A indicators should meet FCPM Selection Criteria (see below).
- the indicators should measure environmental pressures, conditions or results, not program activities. Exceptions to this standard should be restricted solely to measures of program results, not to measures of program activity or program efficiency.
- the indicator should be useful to states in developing their own indicator systems.

## The Indicators

For each issue two groups of indicators are presented -- **Recommended Indicators and Other Potential Indicators**. The recommended indicators are those which we believe to be the best available and are the indicators we suggest be used. For these indicators we provide a full analysis. There are, however, other indicators which can be used and might be more appropriate for some states or for some situations. They are identified in a matrix at the end of each issue. Most of the indicators found in this document can also be found in the companion document in this series -- *Volume 1: Catalog of Environmental Indicators* -- for those who wish to pursue them further.

# Definition and Uses

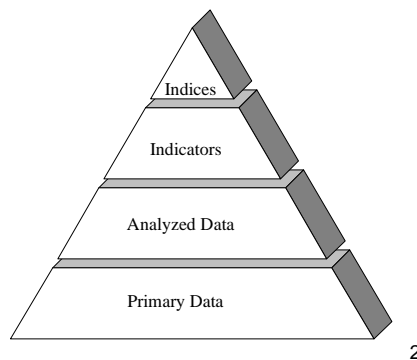
## Definitions

Basic indicator-related definitions include:

- **Parameter:** A property that is measured or observed.
- **Indicator:** A parameter, or value derived from a parameter; which points to; provides information about; or describes the state of a phenomenon, environment, or area with a significance extending beyond that directly associated with a parameter value.
- **Index:** A set of aggregated or weighted parameters or indicators.<sup>1</sup>

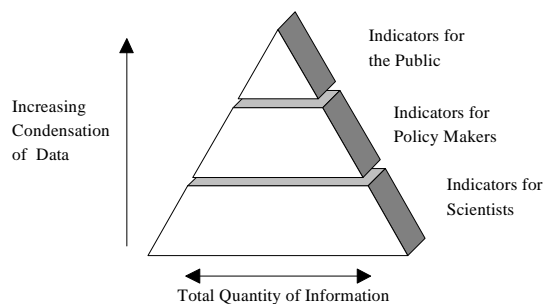
The key point to be made about an indicator is that it is a measure that has significance that is broader than the measure itself; that is, the measure represents a much wider issue, condition, phenomenon or circumstance than what is directly measured.

The relationship between data and its reduction into more refined forms is summarized in the graphic below:



The increasing reduction of data represented in this pyramid shows the progression from raw data to analyzed data (used by scientists and program managers used for specific program, resource protection and research purposes) to indicators (used by decisionmakers to make strategic and operational decisions and to summarize environmental conditions to other decisionmakers and the general public) to indices (higher order indicators).

As data becomes more and more condensed, its utility in conveying environmental information to different stakeholders in environmental conditions broadens and becomes more powerful.



A complex environmental organization needs to measure performance at five levels:

- **Administrative.** All organizations need information on how they are performing as an organization regardless of the substantive direction of their mission. Are their financial management systems working well? Are the employees motivated, well trained and performing well? Is the organization meeting its legal obligations? All of these questions

<sup>1</sup> Group on Environmental Performance, *OECD Core Set of Indicators for Environmental Performance Reviews, Synthesis Report by the Group on the State of the Environment*, October 15, 1993, p. 6.

<sup>2</sup> Braat, Leon. The predictive Meaning of Sustainability Indicators," in Kui, Onno, and Verabruggen, Marmen, In Search of Indicators of Sustainable Development, in Kluwer Academic Publishers, Dordrecht.

<sup>3</sup> Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development, World Resources Institute, May 1995.

are important to organizations of any type and can be supported by indicators. They do not, however, measure any type of mission-based result and will not be of further interest here.

- **Program Activity and Efficiency.** Environmental organizations need to know if their programs and activities are functioning efficiently. Are they running smoothly? Are they cost effective for the activities completed? Program efficiency measures document how well the program is operating mechanically and what and how many outputs it is producing, but they do not show if the program is achieving the results that its mission specifies. These are the infamous “beans” of measurement systems.
- **Program Performance.** Program performance measures are focused on measuring the achievement of program results or outcomes. Each program has a mission, a purpose that it is trying to accomplish. Program performance measures document how well the program is doing in fulfilling its mission, in achieving the outcomes and results it is intended to achieve. In some cases a program performance indicator can be expressed as a direct or indirect environmental result, but in most cases results are expressed as program outcomes.
- **Policy.** A hybrid type of both environmental and program performance indicators are policy indicators. Most environmental agencies, in addition to measuring program and environmental results, also attempt to implement policies across all of their programs and activities to achieve some purpose that may not be purely environmental. Two examples of policy issues are environmental justice and pollution prevention. Both policies have, in addition to their environmental and programmatic components, broader social, economic and cultural concerns. Agencies are increasingly drawn to including policy indicators in their systems.
- **Environmental.** The most important type of indicator for the purpose of this discussion is the environmental indicator. Environmental indicators are the most important type of measure simply because they tell us what we ultimately want to know -- what is happening to the environment. It may be useful to know how our organizations are working, how well our programs are doing their job and how well our policies are being carried out, but environmental indicators provide us with information that answers the central questions for all environmental organizations, striking at the heart of why they ultimately exist. Is the environment getting better or worse? What is the character of changes in the environment? Are we achieving our mission?

All five of these categories are important parts of an organization's management system. For the purpose of post-decision assessment, however, administrative and program activity indicators will not be treated, and attention will be focused on program performance, policy and environmental indicators. These final three types of indicators are important because they deal with the achievement of **results**. They provide an assessment of how well we are doing -- directly or indirectly -- in our efforts to protect the environment.

Definitions of environmental, policy and program performance measures as used in this document are:

- **Environmental Indicator:** *Direct or indirect measures of environmental quality that can be used to assess status and trends in the environment's ability to support human and ecological health.*

Examples of environmental indicators might include:

- Emissions of sulfur dioxide,
  - Exceedances of the ambient standard for ozone,
  - Toxic releases to air of heavy metals and metal compounds.
- **Policy Indicators:** *Direct or indirect measures of either environmental or program measures that can be used to assess the status and trends in the accomplishment of an environmental achievement set in a broader social, economic and cultural context.*

Examples of policy indicators might include:

- Number of tons of chemical pollutants recycled by pollution prevention participants.
  - Average Pollutant Releases Grouped by Racial Composition.
- **Program Performance Indicators:** *Direct or indirect measures of the achievement of the intended purpose of a program, expressed as either an environmental result or a program activity.*

Examples of program performance measures might include:

- Number of square feet of Greenlights lighting upgrades,
- Number of homes and schools tested for radon, and
- Number of industrial categories meeting NESHAPS.

## Uses

It is axiomatic that environmental agencies at all levels should use indicators to make key strategic decisions concerning the success of their efforts and to make important program and budget adjustments. Surprisingly, this is much too often not the case. Most of the measurement and reporting that occurs deals with program activities rather than measures that deal with trends in environmental conditions. With leadership from some federal agencies and a few of the states, this is starting to change with the initiation of projects that use results-based data and information as the foundation for making decisions.

The development of an indicator system capable of providing measures of environmental, policy and program results is one of the most powerful general purpose tools that any agency can possibly develop. Among their many uses are the following

- mission-level tool to provide a broad evaluation of environmental agencies' performance in protecting and managing the environment,
- foundation of measurements for structuring environmental goals,
- basis for measuring environmental achievement and progress,
- basis for making strategic budget decisions,
- means of evaluating the performance of individual programs and activities,
- system to monitor the health of individual ecosystems within the context of statewide environmental conditions,
- measuring environmental, programmatic and personal accountability,
- constituency building process,
- structure around which to develop environmental education programs, and
- tool for public relations and information dissemination.

## Conceptual Frameworks

The relatively young and emerging science and art of developing indicators and indicator systems is evolving some simple conceptual tools to provide clarity and order to the process. The following presents several conceptual approaches presently in use by FCPM in describing and displaying the indicator systems with which they are associated.

### Classification of Availability

FCPM classifies all of its indicators according to their immediate availability for use, sorting indicators into one of three groups based on their current utility. Classifying indicators in this way allows distinctions between indicators based on when they will be of direct use in an indicator system and sets directions for future growth in available indicators. This classification is used in the almost universal circumstance where development of the indicator system lacks a sufficient number of existing indicators with data that meet FCPM Indicator Selection Criteria to implement a full indicator system. The use of availability classification allows the presentation of indicators that may not currently exist as part of the system in order to show what will be needed to establish a fully functioning system. Three types of indicators are identified:

**Type A: Indicators for which adequate data are available now and can be used to support the indicator without significant cost considerations.** To be classified as a Type A indicator:

- meets all essential selection criteria and most preferred criteria,
- is presently available for use in its present condition, and
- can be acquired easily at little or no cost.

**Type B: Indicators which are presently feasible and data are available, but cannot be provided due to inordinate cost, analytical complexity or time constraints.** Type B indicators are those that could be made available if some barrier can be overcome. The data needed to produce the indicator exist but because of cost concerns, analytical difficulties, time constraints, manpower issues or some other impediment, the indicator cannot be provided.

Type B indicators provided in this document are generally restricted to those that states could develop on their own from some combination of federal, state and local data without the expenditure of enormous resources. We have tried to provide models from other states as a starting point for states that wish to develop such indicators.

**Type C: Prospective indicators for which there is no prospect of development but are of critical importance in representing the issue.** Type C indicators are purely prospective. The data do not exist and there is no clear intent to collect. Type C indicators exist as designs or one-time studies.

Type C Indicators found in this document are included for one of the following reasons:

- the indicator has a high likelihood of being collected in the future due to its association with ongoing, planned activities (supports a Nation Environmental Goal benchmark, is an Office of Water Indicator, is proposed as part of an EMAP activity, or is proposed by the Presidential Council on Sustainable Development, among others.)
- the indicator is extraordinarily important and is worthy of the effort of individual states to collect,
- the indicator has been collected in only one or two states, but serves as model for other states to follow.

## Selection Criteria

Ideally, each indicator finally included in an indicator system should meet a series of standards designed to ensure high and consistent quality. Listed on the following page are the selection criteria employed by FCPM in all of its indicator work. Selection criteria are of two types; **essential**, which are criteria an indicator **must** meet, and **preferable**, which are criteria an indicator **should** meet.

### Essential Criteria include:

- **Measurable:** The indicator measures a feature of the environment that can be quantified simply using standard methodologies with a known degree of performance and precision.
- **Data Quality:** The data supporting the indicators are adequately supported by sound collection methodologies, data management systems, and quality assurance procedures to ensure that the indicator is accurately represented. The data should be clearly defined, verifiable, scientifically acceptable, and easy to reproduce.
- **Importance:** The indicator must measure some aspect of environmental quality that reflects an issue of major importance to the region and the states in demonstrating the current and future conditions of the environment.
- **Relevance:** The indicator should be relevant to a desired significant policy goal, issue, legal mandate, or agency mission (e.g., contaminated fish fillets for consumption advisories; species of recreational or commercial value) that provides information of obvious value that can be easily related to the public and decision-makers.
- **Representative:** Changes in the indicator are highly correlated to trends in the other parameters or systems they are selected to represent.
- **Appropriate scale:** The indicator responds to changes on an appropriate geographic (e.g., national, state, or regional) and/or temporal (e.g., yearly) scale.
- **Trends:** The data for the indicator should have been collected over a sufficient period of time to allow some analysis of trends or should provide a baseline for future trends. The indicator should show reliability over time, bringing to light a representative trend, preferably annual.
- **Decision support:** The indicator should provide information to a level appropriate for making policy decisions. Highly specific and special parameters, useful to technical staff, will not be of much significance to policy staff or management decision-makers.

### Preferable Criteria include:

- **Results:** The indicator should measure a direct environmental result (e.g., an impact on human health or ecological conditions). Indicators expressing changes in ambient conditions or changes in measures reflecting discharges or releases are acceptable, but not preferred. Process measures (e.g., permits, compliance and enforcement activities, etc.) are not acceptable.
- **Understandable:** The indicator should be simple and clear, and sufficiently non-technical to be comprehensible to the general public with brief explanation. The indicator should lend itself to effective and appealing display and presentation.
- **Sensitivity:** The indicator is able to distinguish meaningful differences in environmental conditions with an acceptable degree of resolution. Small changes in the indicator show measurable results.
- **Integrates effects/exposures:** The indicator integrates effects or exposure over time and space and responds to the cumulative impacts of multiple stressors. It is broadly applicable to many stressors and sites.
- **Data comparability:** The data supporting an indicator can be compared to existing and past measures of conditions to develop trends and define variation.
- **Cost effective/availability:** The information for an indicator is available or can be obtained with reasonable cost and effort and provides maximum information per unit effort.
- **Anticipatory:** The indicator is capable of providing an early warning of environmental change.

## Pressure-State-Response

The **Organization for Economic Cooperation and Development (OECD)** has developed a framework for organizing indicators that reflects three different, but related and integrated, types of indicators for each environmental issue. They are:

- **pressure indicators:** measures of pressures on the environment caused by human activities.
- **state indicators:** measures of the quality of the environment and the quality and quantity of natural resources.
- **response indicators:** measures that demonstrate what and how much society is doing to respond to environmental changes and issues.

The value of this approach is that it allows a group of indicators to show the source of pressures affecting each issue, the environmental status of the issue or resource, and the measures that society is taking to deal with the issue, thereby connecting cause or source with the resulting condition and the results of corrective action.

## Hierarchy of Indicators

The Hierarchy of Indicators was developed to measure the quality of indicators employed to reflect environmental values. The ability of individual indicators to provide information varies significantly. The very best indicators are those that provide direct measures of the health of humans and wildlife. Unfortunately, there are relatively few areas where such definitive, end-result kinds of measures are available. Where such quality indicators are not available other, less direct, measures must be used. The table below identifies a hierarchy of indicator levels that reflects the usefulness of different types of data in illustrating actual environmental conditions.

Hierarchy of Indicators					
Administrative		Environmental			
1	2	3	4	5	6
Actions by Federal or State Regulatory Agency	Responses of the Regulatory Community or Society	Changes in Discharge or Emission Quantities	Changes in Ambient Conditions or in the Quantities of Natural Resources	Changes in Uptake and/or Assimilation	Changes in Health, Ecology or Other Effects

Data types 1 and 2 measure administrative, bureaucratic, or activity measures and are only weakly associated or completely unassociated with the capacity to measure environmental quality. Some of the environmental indicators are types 1 or 2, and those that do exist may be eventually replaced by higher quality indicators.

Data types 3-6 are measures that reflect indicators of environmental performance. As the indicators progress from type 3 to type 6, the quality of environmental information increases. Ideally, all indicators should be type 6 indicators,

This framework is useful for pollution-based indicators but is less effective for ecological indicators.

## About the Florida Center for Public Management

The Florida Center for Public Management (FCPM) is a professional services organization whose primary mission is to maximize positive change in the public sector by developing leadership, management, and organizational capacities in public organizations. FCPM accomplishes this public service mission through management consulting and training, policy development, decision support technologies, applied research, and a broad publications program. FCPM operates with the philosophy of working in partnership with federal, state, and local governments in achieving the best possible results. Thus, by blending practical experience with the application of scientific knowledge, FCPM helps to meet the needs of appointed and elected officials through a balanced approach for constructive change to how government functions in the best interests of the citizens of the nation.

The Environmental Management Unit of FCPM provides consulting, training, and technical services to federal, regional, state, and substate environmental agencies and organizations in Florida and across the nation in the use of specialized environmental management processes and techniques. Present activities focus on the implementation of strategic planning processes specially designed for environmental organizations, the conduct of comparative risk assessment projects, and the development of environmental indicator systems.

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