

CHAPTER 3. SELECTING SUSTAINABILITY INDICATORS

We define indicators as measures that present relevant information on trends in a readily understandable way. Indicators can be presented in the form of numbers, charts, graphs, or maps. Based on the four major categories of indicators, the SWRR initially identified over 400 indicators. These indicators are provided in Appendix C. A critical task of the roundtable was to reduce this to a reasonable number of the most essential indicators. The SWRR settled on 17 indicators using a rigorous selection process.

The SWRR began to identify indicators for achieving sustainable water resources with a systematic set of principles. Fortunately, a group of world-renowned experts had gathered at the Rockefeller Foundation's Study and Conference Center in Bellagio, Italy in 1996 to assess progress in the art and science of sustainability indicators. They met in response to a call by the World Commission on Environment and Development and others for development of new ways to assess progress toward sustainable development. The result was the Bellagio Principles, a set of ten purpose and process factors that guide the development and use of sustainability indicators, which the SWRR adopted at its June 2003 meeting.

The Bellagio Principles

The principles encompass the whole process of community planning and assessment. They cover how indicators fit within a community's planning process, how to choose and design them, and how they can best be interpreted and communicated. The authors specified that the principles are interrelated and should be applied as a complete set. They also intended for the principles to apply to organizations at all levels, from the neighborhood to the nation. Table 3.1 shows the ten Bellagio Principles. These ten principles encompass four elements of assessing progress. The first element (principle 1) is the starting point of any assessment – a vision of sustainable development and clear goals for achieving that vision. The second element (principles 2 through 5) concerns indicator content. The third element (principles 6 through 8) deals with process issues. The fourth element (principles 9 and 10) addresses the need to establish a continuing capacity for assessment.

Table 3.1
The Bellagio Principles

1. GUIDING VISION AND GOALS

Assessment of progress toward sustainable development should:

- Be guided by a clear vision of sustainable development and goals that define that vision

2. HOLISTIC PERSPECTIVE

Assessment of progress toward sustainable development should:

- Include review of the whole system as well as its parts
- Consider the well-being of social, ecological, and economic sub-systems, their state as well as the direction and rate of change of that state, of their component parts, and the interaction between parts
- Consider both positive and negative consequences of human activity, in a way that reflects the costs and benefits for human and ecological systems, in monetary and non-monetary terms

3. ESSENTIAL ELEMENTS

Assessment of progress toward sustainable development should:

- Consider equity and disparity within the current population and between present and future generations, dealing with such concerns as resource use, over-consumption and poverty, human rights, and access to services, as appropriate
- Consider the ecological conditions on which life depends
- Consider economic development and other, non-market activities that contribute to human/social well-being

4. ADEQUATE SCOPE

Assessment of progress toward sustainable development should:

- Adopt a time horizon long enough to capture both human and ecosystem time scales thus responding to needs of future generations as well as those current to short term decision-making
- Define the space of study large enough to include not only local but also long distance impacts on people and ecosystems
- Build on historic and current conditions to anticipate future conditions - where we want to go, where we could go

5. PRACTICAL FOCUS

Assessment of progress toward sustainable development should be based on:

- An explicit set of categories or an organizing framework that links vision and goals to indicators and assessment criteria
- A limited number of key issues for analysis
- A limited number of indicators or indicator combinations to provide a clearer signal of progress
- Standardizing measurement wherever possible to permit comparison
- Comparing indicator values to targets, reference values, ranges, thresholds, or direction of trends, as appropriate

6. OPENNESS

Assessment of progress toward sustainable development should:

- Make the methods and data that are used accessible to all
- Make explicit all judgments, assumptions, and uncertainties in data and interpretations

7. EFFECTIVE COMMUNICATION

Assessment of progress toward sustainable development should:

- Be designed to address the needs of the audience and set of users
- Draw from indicators and other tools that are stimulating and serve to engage decision-makers
- Aim from the outset for simplicity in structure and use of clear and plain language

8. BROAD PARTICIPATION

Assessment of progress toward sustainable development should:

- Obtain broad representation of key grass-roots, professional, technical and social groups, including youth, women, and indigenous people - to ensure recognition of diverse and changing values
- Ensure the participation of decision-makers to secure a firm link to adopted policies and resulting action

9. ONGOING ASSESSMENT

Assessment of progress toward sustainable development should:

- Develop a capacity for repeated measurement to determine trends
- Be iterative, adaptive, and responsive to change and uncertainty because systems are complex and change frequently
- Adjust goals, frameworks, and indicators as new insights are gained
- Promote development of collective learning and feedback to decision-making

10. INSTITUTIONAL CAPACITY

Continuity of assessing progress toward sustainable development should be assured by:

- Clearly assigning responsibility and providing ongoing support in the decision-making process

- Providing institutional capacity for data collection, maintenance and documentation
- Supporting development of local assessment capacity

The SWRR Criteria

The roundtable adapted and condensed the Bellagio Principles to establish five criteria for identifying, organizing, evaluating and choosing appropriate indicators. Because the Bellagio Principles encompass the whole process of community planning and assessment, and because the SWRR required selection criteria for a much narrower purpose, the roundtable decided to establish its own, smaller set of guiding principles. The roundtable adapted and condensed the Bellagio Principles to establish five criteria. These criteria provided guidance on: 1) what indicators should describe; 2) what makes them relevant; 3) how they should address time horizon and scale; 4) what's needed to make them realistic and defensible; and 5) the importance of their being easily understood. Table 3.2 lists the five criteria.

Table 3.2
SWRR Criteria for Selecting Indicators

Criteria for identifying, organizing, evaluating and choosing appropriate indicators

1. DEFINING THE STATE OF THINGS

Indicators must consider the condition and capacity of social, ecological and economic systems, including:

- System condition and capacity
- Direction and rate of change
- Interactions across systems and system parts

2. RELEVANCE

Indicators must focus on what's most relevant to sustainability (things of both current and long-term consequence to the well-being of ecological, social, and economic systems).

3. APPROPRIATE TIME HORIZON AND SCALE

Criteria and indicators must adopt a time horizon long enough to capture both human and ecosystem time scales, thus responding to the needs of future generations as well as those of short-term decision-making. They also must define a space of study large enough to include local- and long-distance impacts on people and ecosystems.

4. INDICATOR INTEGRITY

Indicators must be measurable, unbiased, and scientifically defensible; geographically located and differentiated; and at some point, supported by available data. They also should possess a short lag time between the state of affairs referred to and the ability to measure the indicator.

5. UNDERSTANDABILITY

People must be able to "get it" or the indicator will have little value.

Defining the state of things

The SWRR criteria ask that sustainability indicators define the condition and capacity of water-related social, ecological and economic systems, and that they address not only system condition and capacity, but direction and rate of change of these systems and interactions across system parts.

Each recommended indicator, whether it's the total amount of water available in a watershed or the amount of water needed to sustain biological systems, should allow people to track its direction and rate of change over time. The indicator should also illuminate cause-and-effect relationships. In other words, the system of indicators the SWRR recommends must look at condition and capacity as it evolves over time, and must gather the information necessary to understand not only what's happening, but why.

Relevance

It is easy to get trapped into thinking that what we measure is important *because* we can measure it. This SWRR criterion asserts that we must focus on those factors that are relevant to both the current and long-term well-being of social, ecological and economic systems. This isn't an easy task, since we may not always know what's really of long-term consequence. But it's useful to pause and ask whether a measure has much chance of being important 25, 50 or 150 years from today. Asking this question helps distinguish the noise from the music.

Time Horizon and Scale

Time and geographic scale pose complicated issues for indicator design. Because sustainable development means meeting today's needs as well as those of the indefinite future, indicators must record information that is, or is likely to be, important both today and well into the future.

But this factor also recognizes that some variables change slowly over decades or centuries. One example is the succession of a disturbed forest ecosystem, which may take hundreds of years to evolve from pasture and pine forest to its ultimate climax state of a hardwood forest. In this example, potential indicators tracking changes in that plot of land should measure parameters that might indicate important changes in the future, as well as what seems important today.

The geographic side of scale imposes similar considerations. In particular, people need to look at a large enough picture to fully understand what's going on. For example, a community might get a false sense of the sustainability of its actions if it didn't consider the effects of importing water on the basin of origin, as well as the receiving watershed.

Geographic scale brings another set of issues that affect indicator design and selection: how society organizes itself to meet needs. People have generally organized governments along political boundaries with only a passing connection to natural systems. And yet sustainable development requires the understanding and thoughtful interplay between natural and political systems. As a result, indicators need to present information in both formats.

Indicator Integrity

For an indicator to be effective, its quality, source and reliability – in short, its integrity – must be scientifically defensible. Otherwise, people won't trust it. The integrity of an indicator must be perceived as being "above the fray" to insulate it from criticisms of special interests who may deny the trend it suggests and oppose the decisions it implies.

In addition to being scientifically defensible, a good indicator tells people in various regions (i.e., at various scales) information of importance to them. This suggests that, where possible, information should be geographically located or mapped. It also suggests that people be able to assemble the indicator with sufficient speed that its message to those who can do something about it arrives in a timely manner.

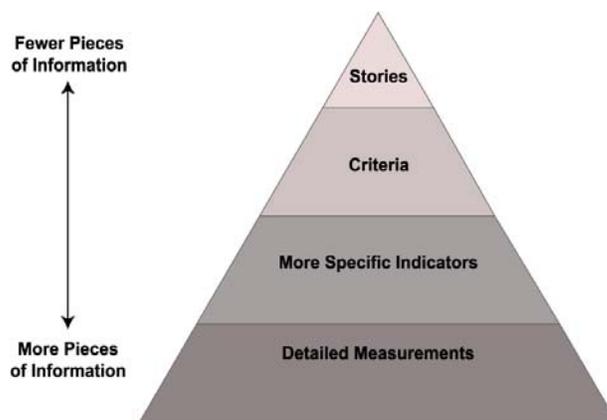
Finally, the SWRR argued that, at some point, sufficient data be available to support the indicator. It goes without saying that sound data is essential to a good indicator. But it's also important that the best indicator not be ignored because supporting data is not yet available. There are many gaps in availability of data on water. In some cases data is proprietary to private land owners and not available. Given all of this, the SWRR wanted to present the indicators it believes should be adopted, even when the data to support them has yet to be collected.

Understandability

A good indicator sends society an important signal. It tells the story that needs telling. Further, to become part of a story and to have informative value, people must be able to "get it." That's a challenge as often in presentation and packaging as in the collection and management of data.

The Information Pyramid in Figure 3.1 shows a general concept that has become well accepted as a basis for developing environmental indicator systems.¹ It shows a hierarchical arrangement with relatively general and simple stories that most people can absorb at the top and increasing detail, specificity and complexity at successively lower levels in the pyramid. The pyramid metaphor is based on the idea that there are more building blocks, more pieces of information, in the lower tiers of the pyramid.

Figure 3.1
Information Pyramid



At the top of the Information Pyramid is the most widely communicated form of information, relatively simple stories that are told in various media. Such stories can be developed by interpreting more detailed criteria and indicators that are produced using data from measurements. Data from measurements is the most detailed form of information and tends to be used mostly by experts.

Criteria are more general and less detailed than indicators. The SWRR identified three types of criteria:

- A specific target that is accepted as a threshold of success for an objective.
- A generally desirable direction of change for a category of phenomena.
- A general category of phenomena for which society may later specify the desirable direction of change or a specific target.

Three concrete examples illustrate these three types of criteria:

- Criteria as target: 10% increase in water for irrigation.
- Criteria as direction of change: Increase water for irrigation.
- Criteria as category for potential directional goal or target: water for irrigation.

At this juncture, the third approach might be best suited to the SWRR's goal. The second approach was used in the Forest Roundtable's identification of the "Criteria and Indicators for Conservation and Sustainable Management of Temperate and Boreal Forests." The second, directional or targeted approach, often encounters controversy because of peoples' different values and desired outcomes. However, consensus on specific targets may emerge from ongoing discussions within our roundtable.

Given the hierarchy of information, the SWRR also identified three views of the roles and uses of indicators:

- Assessment, Diagnosis, Prognosis, Prescription, Treatment, Reassessment
- Policy-Making, Forecasting and Evaluation, and Management
- Research and Education

The first view distinguishes between information on conditions (assessment), information that can explain the causes of observed conditions (diagnosis) and information that forecasts future conditions (prognosis). As we know from our experience with the health care system, different types of information are used to perform these different functions. In particular, health assessment uses a relatively small number of indicators of overall health, while diagnosis uses more detailed and specific information about the causes of illness. These differences reflect both the costs of acquiring and using various types of information and the effectiveness of different measures.

The second view takes a management perspective. Here too, different types of information are useful in performing different functions. High-level policy and resource allocation decisions tend to be based on more general information, while operational management uses more detailed, often spatially specific, information.

Research and education produce and communicate knowledge of how systems work. Such information is often very detailed and specialized, although in education it is often simplified. The knowledge developed by research often includes improved understanding of the causal relationships among the components and subsystems of a system. The interpretation of indicators to assess and diagnose water resources sustainability can be improved by such research.

One common aspect of all three views is the role of information as feedback in a cyclical process of decisions, actions, observation of consequences, decisions, etc. In health care, treatment is accompanied by feedback from monitoring and continued assessment of the patient's condition. In policy and management, feedback is used in performance measurement, program and policy evaluation, and monitoring of management practices. In research, observation provides feedback on the validity of hypotheses. In all these contexts, continual improvement occurs as feedback promotes learning and evolution. Indicators for sustainable water resource management can also facilitate feedback in order to promote more effective learning and evolution of policies and management practices.

Conclusions about Sustainability Indicators

Sustainability indicators tell us “where we are” in the quest for short- and long-term equilibrium between social, economic and ecological needs. They highlight important trends and help us begin to evaluate their causes and effects. They educate people and build awareness about the challenges we face. They give us a common language that allows us to share a deeper understanding of issues and forge the collective responses that every level of society must take.

The roundtable believes that effective indicators will enable people in every watershed and every community to gain new understanding and tools to make good decisions. And perhaps more than anything else, an informed citizenry will give the nation the best chance to ensure that its management of water-related resources is sustainable. As Donella Meadows emphasizes in her work on indicators for sustainable development:

It's easy enough to list the characteristics of ideal indicators. It's not so easy to find indicators that actually meet these ideal characteristics.... (But) despite their difficulties and uncertainties, we can't manage without indicators.

The next chapter presents the 17 indicators identified by the SWRR for the four major categories of indicators discussed in the previous chapter.

End Notes

1. Hammond, A., Adriaanse, A., Rodenburg, E., Bryant, D., and Woodward, R. 1995. *Environmental Indicators*. World Resources Institute, Washington, D.C.