

Considerations in the Selection and Use of Indicators for Sustaining Forests

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Considerations in the Selection and Use of Indicators for Sustaining Forests

based on the

INDICATORS THINKTANK

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Thinktank Participants

Chris Bernabo, National Commission on Science for Sustainable Forestry and National Center for Science and the Environment; Connie Carpenter, USDA Forest Service; Graham Cox, New York Audubon; John Fedkiw, retired, USDA Forest Service; Rich Guldin, USDA Forest Service; John Hagan, Manomet Center for Conservation Sciences; Maureen Hart, Sustainable Measures; Theodore Heintz, White House Council on Environmental Quality; Jeff Horan, Maryland Department of Natural Resources; Elaine Kohrman, USDA Forest Service; Kristin Magis, Portland State University; Ruth McWilliams, USDA Forest Service; Mary Mitsos, National Forest Foundation; David Morman, Oregon Department of Forestry; Don Outen, Baltimore County Department of Environmental Protection & Resource Management; Guy Robertson, USDA Forest Service; Laurie Schoonhoven, Sustainable Forestry Partnership; Louise Tritton, The Heron Group; Charles Van Sickle, USDA Southern Forest Experiment Station; Alison Welde, Sustainable Forestry Initiative; Jay West, The Meridian Institute; Andrew Whitman, Manomet Center for Conservation Sciences; Ethel Wilkerson, Manomet Center for Conservation Sciences.

Report Take-home Messages

1. **Indicator selection and use is primarily a social process**, to be informed and supported by data and science. Indicators are not about the numbers as much as they are about an open social conversation about forest values. To be useful, the selection and use of forest indicators must be embedded in a larger, ongoing, adaptive social process for pursuing sustainability. Sustainability is not an endpoint, but rather an ongoing social process that integrates and adapts to new knowledge and changes in societal values.
2. **Develop a sustainability decision making system.** Understand how you will use indicators from the start. Who will make decisions based on the indicators? How often will data be reported, and to whom? How will stakeholders provide feedback? Who decides what actions will be taken? How can new indicators be added to the system? All these questions should be clear in advance of setting up an indicator system.
3. **Engage and involve key stakeholders** (or their representatives) from different sectors to help design and implement an indicator selection process that ensures transparency. Remember that indicators reflect what values will be tracked and what values might be left behind. Indicators thus get caught up in issues of power and disenfranchisement. A thoughtful social process (see #1 above) can help avoid the conflict that often plagues forest sustainability.
4. **Set goals (or targets) for indicators if you can**, but do not compromise the flow of relevant data. Goals can be set once participants have had a chance to discuss and understand the meaning of the data.
5. **Know your spatial scale.** The larger the spatial scale the harder it is to have an inclusive social conversation about forest values. National-level indicators, or even state-level indicators, may not resonate with the public because the scale of relevance is larger than most people either care about, or feel that they can do anything about. Most people tend to care about the place they live and work (e.g., a 50-100 mile radius). Be careful to define the geographic extent for the indicator effort so that the proper people can be involved.
6. **Think through in advance how much time you (and the stakeholders) wish to invest in indicator selection.** It is easy to “burn out” stakeholders. When this happens, the usefulness of the indicator system can be called into question.
7. **Think through in advance what resources it will take to collect, summarize, and communicate the indicator results to your target audience.** Do not promise more than you can deliver.
8. **Be informed by existing forest indicator systems**, such as the Montreal Criteria and Indicators, but do not be constrained by them. Indicators must be relevant to the stakeholder community the system is intended to serve.

Considerations in the Selection and Use of Indicators for Sustaining Forests

John M. Hagan¹ and Andrew A. Whitman²

Abstract

Indicators are fundamental to forest sustainability. Without measures how can we know whether we are succeeding or failing at sustaining society's forest values? The use of indicators for assessing forest values came on the scene in North America through an international effort called the Montreal Process in the mid 1990s. Montreal Criteria and Indicators were designed for nations, but many other jurisdictions, such as states, counties, communities, and forest certification systems for single ownerships also have now developed indicator systems. What has been learned from these indicator efforts? Are these systems really helping us assess forest sustainability? Are decision makers using these indicators to inform their decisions?

In September 2006, 23 people from across the U.S. with experience in selecting and/or using indicators convened in Baltimore, Maryland to discuss lessons learned from their experience with indicators. Our approach was to discuss and answer together a series of questions posed in advance of the conference, such as “what is the purpose of indicators?”, “who are indicators for?”, “who should be involved in indicator selection?”, and “should numerical targets be set for indicators?”. Participants came from many different geographic areas and worked at many different scales, from the community level to the national scale. Spatial scale turned out to be critically important in terms of how indicators were selected and used. Indicators derived from small-scale efforts (i.e., communities) resonated more with the citizenry, whereas larger-scaled efforts were more important to policy makers. Scalable indicators that can be used at local and national scales make intuitive sense, but what people value about forests can be very different in different places, and thus different indicators may be needed. The selection and use of indicators is not about the *indicators* themselves, but about having the larger social conversation about what people want to sustain within their forests.

Through the collective experiences of the participants, this report sheds light on a number of issues in the selection and use of indicators in forest sustainability that continue to confuse many people. We hope this report is especially helpful to any group that may be planning to develop forest sustainability indicators for their community, state, ownership, region, or nation.

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Introduction

We use indicators all the time in day to day life. We don't call them indicators. The gas gauge in your car indicates when it is time to refill. Your bank balance tells you something about what you're able to afford, or whether you can or cannot take that vacation. Leading economic indicators inform the Federal Reserve Chairman about whether to raise or lower interest rates. This latter example illustrates an important point—indicators are not perfect. Rather, good indicators suggest that some action might be needed in order to achieve a desired state or goal (i.e., the avoidance of being stranded by the roadside). We would not use indicators if we could do just as well using a coin toss to inform our decision making. But are indicators driving good decisions in forest sustainability?

This report summarizes the work of an indicators “Thinktank” held in Baltimore, Maryland in September, 2006. The purpose of the Thinktank was to try to clarify some of the confusion surrounding the selection and use of indicators in forest sustainability by bringing together a diverse group of individuals that have worked with forest indicators at different spatial scales. The group sought to extract some of the major lessons learned from their different experiences. The participants tackled questions such as:

Are indicators driving good decision making in forest sustainability?

- What is the purpose of indicators?
- How do different indicator systems serve different indicator needs?
- Who are sustainability indicators for?
- What is the role of stakeholders in indicator selection?
- Can (should) indicators be scalable (from municipality to nation)?
- How should we handle the mismatch between data availability and data needs?
- Can indicators be used to tackle integration of economic, social, and environmental values?
- Should targets be set for indicators?
- What would a successful indicator system look like? How would we know if indicators are “working”?

The indicators Thinktank, and this resulting report, are part of a research agenda set out by the National Commission on Science and Sustainable Forestry five years ago. The purpose of the Commission is to improve the scientific basis for the design, conduct, and evaluation of sustainable forest practices in the United States (www.ncssf.org). Early on, NCSSF targeted the role of indicators in sustainable forestry as an area that needed further understanding. What was the central conclusion of this work? Despite having been led by scientists, the conclusion was that indicator selection and use is primarily a social issue, not a technical or scientific issue (Hagan and Whitman 2006). This report helps clarify that fundamental conclusion.

What is the purpose of forest indicators?

Perhaps the simplest single answer is “to help maintain or achieve forest values.” This begs the question of ‘whose values?’, a question we will revisit later. Indicators should inform us when we are falling short of where we want to be with any particular value. Like the Federal Reserve Chairman, we want to be informed when action is needed—when a course correction is needed—in our case to protect one or more forest values. That is, we want forest indicators to inform our decision making about forests. But as we discovered, there can be many other, sometimes subtle purposes of indicators (Table 1). In fact, forest indicator systems have an unclear record of actually informing decision making, of changing behavior, or of leading to on-the-ground action.

For example, simply *having* forest indicators can serve to create public awareness about forests. Indicators can help people relate to the forest, even when no formal decision making framework exists. Indicators can help prioritize funding (e.g., the need for fuels reduction management in many western states). Just going through the process of selecting indicators provides a mechanism for democratic and civic engagement in conversations about forest resources. Indicators, once selected, measured, and reported, can provide some legitimacy that decision makers and managers are paying attention to society’s forest values. A structured process of selecting indicators that engages the public can provide a vehicle for understanding how economic, social, and environmental forest values are interconnected. Forests are highly complex “crossroads” of diverse societal values (e.g., paper, lumber, recreation, clean water, jobs). Indicators, if selected well, have a way of simplifying this complexity so that the public, managers, and policy makers gain some insight into what is most important to the public about forests and what a sustainably managed forest would look like. In short, indicators provide a means for civic engagement about forests.

The degree of civic engagement is initially set by the sponsor of the given indicator effort. Most projects are coordinated, facilitated and/or funded by some level of government on behalf of the citizenry to help fulfill various legislated mandates, but sometimes the catalyst for indicators comes from the citizenry. Other times non-government efforts, such as those initiated by industry and environmental organizations, provide the impetus for indicators. But the selection of indicators is only the beginning of what needs to be an ongoing social discussion about forest values. A shortcoming of many indicator efforts is an overemphasis on the mechanics of selecting indicators, and not on the importance of the social conversation about what forest values people care about. It’s not about the indicators. It’s about having an ongoing social conversation to identify and achieve the forest values that are important to people. Without this conversation, indicators are relatively useless.

It’s not about the indicators. It’s about the social conversation to identify what forest values are important to people.

One common observation from Thinktank participants was that the purposes of indicators can change over time. Initially, the purpose may be to simply create a dialogue among forest stakeholders, to create a shared level of understanding of forest values, or to develop a shared vision. But as indicator data start to come in, and results begin to emerge, a decision making system should be implemented so that on-the-ground actions can be taken, if needed, to sustain forest values.

Table 1. Primary purposes of forest indicators as identified by Thinktank participants.

1. To raise awareness about the forest resource
 2. To inform decision making
 3. To prioritize funding
 4. To measure progress
 5. To create a shared vision
 6. To measure the success of policies
 7. To set goals
 8. To predict the future
 9. To engage stakeholders in a social conversation
 10. To involve stakeholders in decision making
 11. To demonstrate a national commitment to forest sustainability
 12. To integrate economic, social, and environmental values
 13. To manage the complexity of natural systems
 14. To involve citizenry in science
 15. To motivate a commitment to monitoring our environment
 16. To hold policy makers accountable
 17. To facilitate collaboration among diverse stakeholders and decision makers
 18. To prevent the need for regulation and legislation (through accountability)
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How do different indicator systems serve different indicator needs?

The Montreal Process Criteria and Indicators (C&I) system is probably the most widely known forest indicator framework (Montreal Process 1995). The Montreal Process C&I was developed in Santiago, Chile, in February 1995, where ten nations endorsed a comprehensive set of criteria and indicators for forest conservation and sustainable management. The Montreal Process C&I were developed primarily for nations. In 2003 the U.S. Forest Service produced a set of indicators (with initial measurements) for the United States (USDA 2004). These indicators were adapted from the Montreal C&I.

Also in the 1990s sustainable forestry certification systems emerged (notably SFI, FSC, and CSA in North America), and each developed its own indicator system for the land-unit scale (thousands to millions-of-acres scale). In the last seven years many U.S. states have developed state-level forest indicator systems (e.g., Minnesota, Oregon, Maine). More recently, 20 Northeastern U.S. states developed forest indicators at a regional scale¹. How do these systems relate to each other? Should these systems be linked in some way? Will they end up competing with each other and confusing the people they are designed to inform?

The Montreal C&I was an early system of forest indicators and is often used as a starting point in developing new indicator systems. Though there are advantages to using an existing set of indicators as a template, at least two problems arise by copying another system. First, the Montreal C&I may not be comprehensive or entirely relevant to the forest values or objectives of more local interests. The people of a state, or a community, may have forest values that are not captured by the Montreal indicators. By failing to go through a values identification step *prior to* selecting a set of indicators (Hagan and Whitman 2006), a group can end up with a set of “off the shelf” indicators that do not tell them very much about what *they* care about. In the end, they may feel frustrated by an inability to use the indicators to inform them about the condition of their own particular forest values.

The second problem is related to spatial scale. The Montreal C&I system was developed for the national scale to inform policy-making. But the decisions made locally are the ones that, in aggregate, determine whether the nation as a whole is sustaining its forest values. A common criticism of the National Report on Sustainable Forests—2003 (USDA 2004) is that it fails to be meaningful to local people. Local people simply don’t know what to do with indicators measured at the national scale. The National Report can tell local people how widespread their local issues are and the likelihood that they can form common cause with others nationally and regionally to work toward solutions. But the information in the Report cannot tell which parcels of land require what particular actions. Leaders of the National Report on Sustainable Forests—2003 (USDA 2004) have been clear that it is not their responsibility, or mandate, to take action using the indicator results. “*Better data leads to better dialog, which leads to better decisions*” has been their philosophy. Their job is to provide the data (indicators). Decisions about what to do with the indicators lie primarily with the citizenry through a political or social process.

At present many cities, counties, and states are developing their own indicator systems, largely independently of one another. In Oregon in 2005 there were three separate state government efforts to generate environment-related indicators. Many efforts look to the Montreal C&I for reference, but in the end, the people in the place have to decide what is

¹ <http://www.na.fs.fed.us/sustainability/base/base.shtm>

Table 2. Primary purposes, or reasons, for indicators for some different projects or initiatives.

Hopewell Big Woods Project, southeast Pennsylvania	To inform decision making To measure progress To establish a vision
State of Oregon (Department of Forestry)	To raise awareness To inform decision making To define goals
Sustainable Forestry Initiative (SFI)	To measure progress To meet a goal To be an alternative to regulation
Heinz Center Indicators	To inform scientific community To inform decision making To measure progress To integrate disciplines/sectors To motivate long-term consistency and data collection
The Montreal Process	To raise awareness To support democratic decision making To measure progress (toward sustainability) To create international dialogue To gain/maintain international credibility To integrate economic, social, environmental values
State of Maryland	To inform decision making To set a vision
State of New Hampshire	To set a vision To engage diverse stakeholders (and get buy-in) To facilitate collaboration

important to them, how much they can afford to measure, and what they will measure. If the state of Oregon is not particularly interested in how they compare to, say, Maine, then there is no need for coordination between the two states in indicator systems. If Weyerhaeuser has no interest in understanding how their ownership compares to, say, Plum Creek's timberland, or to forest conditions at the state scale, then there is no need to coordinate indicator systems.

The authors' experience with helping groups select indicators from the state level down to the community level indicate that local groups are better able to produce useful indicators tailored to their particular interests. This may be because local people feel a greater connection and dedication to the local place in which they live day in and day out. At larger scales the stakes can become very high, especially for advocacy or special interest groups. Consequently, political agendas seem to be more active at larger scales and the social process of selecting indicators, not surprisingly, becomes more difficult to manage. More is at stake at larger scales simply because more forest area is involved in the discussion.

To summarize, different indicator systems support decisions at different spatial scales and for different constituencies (Table 2). Forest indicators that are good for one spatial scale or constituency may not be very good for another spatial scale or constituency. Copying an indicator system designed for one scale onto another scale, or onto a specific socio-economic situation, may be inappropriate and result in frustration. Use existing indicator systems (such as Montreal C&I) to the extent they match the values of the people

...different indicator systems support decisions at different spatial scales and for different constituencies.

in the “place” (geography) you are working. We might rearrange the indicator philosophy for local places as “Better *dialog* leads to better *data*, which leads to better decisions.” The dialog to identify forest values should come before indicators are selected. Then, indicators that best represent the values can be selected.

Who are sustainability indicators for?

This question was posed to the Thinktank participants because different indicator systems seem to engage different audiences. Participants came up with a long list as a response (Table 3). The answer to the question depends on the context. In the case of national-level indicators, such as the Heinz Center’s Ecosystem Report Card (Heinz Center 2002), the primary audience seems to be higher-level policy makers and opinion leaders. The same might be said of the National Report on Sustainable Forests—2003 indicators (USDA 2004). These indicator systems were not designed for states or local communities.

There was a dichotomy among the thinktank participants about who indicators are for in relation to scale. Participants who worked at smaller community scales were more focused on public stakeholders, making decisions, and taking action. Those who had more experience with national indicators were more focused on policy makers (government, business, and large NGOs). National-scaled indicator system experts were more likely to view themselves as separate from decision making processes, whereas local-level experts preferred a greater level of integration of all actors, technical and non-technical, in the selection and use of indicators. The national systems seemed to be more techno-centric, that is, driven by technical experts and datasets.

Indicators can serve society as a whole, but not everyone is interested in forests, much less forest indicators. One challenge is to identify and engage those who *are* interested in forests, either in the indicator selection process and/or in the consideration of what indicators can tell us about the condition of the forest. A second challenge is to engage those who are not presently interested in forests, or those who may not appreciate the values provided by forests. Depending on the resources available, concentrating indicator efforts on those who already care about forest values may yield greater civic engagement and results (on the ground action to sustain forest values).

Indicator efforts should identify, at the outset, the primary audience for the indicators.

Table 3. Who are indicators for? The answer differs by situation (location, scale, and context).

Communities
Scientists
Government
Business
Educators
Policy makers
Planners
Managers
Media/information intermediaries
Story tellers
Opinion leaders
People with influence (e.g., funders)
NGOs
Underserved people
Grassroots organizations
Future generations
Historians

Indicator efforts should identify at the outset who the primary audience will be for the indicators. Concentrate energy on engaging that target audience, and clearly acknowledge that other audiences may not be a high priority or even relevant to the indicator initiative. Rather than saying indicators are for society, articulate a strategy for how the indicators can best be used to make decisions about forests, by whom and for whom. In some cases, especially at larger spatial scales, engaging decision leaders and opinion leaders may be the best mechanism for serving ‘everybody.’

What is the role of stakeholders in indicator selection?

This question is closely related to the previous question, but is slightly different in that it refers to the selection of indicators, not the use of indicators. The question was posed to the participants because some indicator selection efforts tend to be exclusive rather than inclusive. How and when should an indicator selection effort engage the public?

The word ‘stakeholder’ first needs a definition. Operationally, we defined stakeholder as *anyone whose values might be affected by the forest resource under consideration*. Clearly, everyone is affected by forest resources, whether they realize it or not. Those who *consciously* care about forests were the focus of our conversation. Those are the people who are most likely to engage in an indicator selection effort and to seek to participate in forest resource decision making.

Participants tended to have different views on who should be involved in indicator selection, again depending on the scale at which participants had experience. At the national scale, participants tended to view indicator selection more as a technical task that should involve scientists, or other technical specialists from organized groups with some experience in forest management and conservation. Diverse perspectives should be sought by ensuring the technical pool was drawn from a broad range of disciplines, e.g., government, for-profit and non-profit organizations, and universities. Participants who worked at more local levels felt that forest stakeholders should play the lead role in indicator selection, but not to the exclusion of scientists and scientific input. The problem with focusing solely on scientists is that they are not always tuned in to what forest values stakeholders care about. On the other hand, scientists can play a key role in advising stakeholders about which indicators will best measure their forest values.

Participants identified an important ‘power’ issue in indicator selection. Indicators should reflect the forest values for our society. Decisions can only be made about what is measured. If some value (say, old-growth forest) is not measured, it has a much higher risk of being unknowingly or unwittingly lost from the geographic area of interest. Therefore, indicator selection is a critical social process. The selection process is the stage at which “society” (or those with power, or empowered) determines what is important enough to be measured. The forest values of people who are excluded from the selection process run a higher risk of being lost because those values may not be measured, and what is not measured cannot be managed. Thus, failure to include stakeholders in the selection process leads to mistrust, and mistrust can lead to indicator sets that are viewed as illegitimate by the public. It is important that indicator selection efforts recognize the societal implications of what gets measured and what does not get measured.

At the same time, an indicator selection process can become unwieldy if it is open to full public participation, or if it is not clear at the outset who is responsible for making decisions, and how. Which stakeholders are invited into the process is a common challenge for indicator selection leaders. What is needed is stakeholder representatives who are willing

Indicators are intended to inform stakeholders about the status of their forest values.

Therefore, stakeholders need to be involved in the indicator selection process.

and able to devote a reasonable amount of time to a process that can take many months and numerous meetings to complete. Stakeholder management may be the most challenging component of indicator selection.

Most Thinktank participants felt a combination of stakeholders, scientists, and policy makers should be involved in indicator selection. Depending on the spatial scale, it might make sense to involve these participants in sequence. For example, stakeholders might first identify important forest values to sustain. Then, scientists determine how to best measure those values. Policy makers implement the indicator system. Finally, stakeholders are engaged again to discuss the meaning of results, once data begin to come in. For practical reasons, this sequential approach might be better for larger spatial scales (e.g., regional or national). At the state scale and below, for the sake of openness and transparency and for building trust, the involvement of stakeholders, scientists, and policy makers (including land managers) perhaps should be simultaneous. Even at local scales, though, it can make sense to create working groups (e.g., scientific) that are charged with producing scientifically legitimate indicators that are then vetted with the full group of stakeholders and decision makers together.

Scientific legitimacy is important, but social legitimacy trumps scientific legitimacy where use of the indicators is concerned. A technically rigorous set of indicators may not match at all the forest values of stakeholders. Indicators are supposed to support societal forest values, not scientists' or policy makers' forest values. Failure to involve those who are affected by, or concerned about, the forest resource, runs a higher risk of creating a poor set of indicators.

The conversation to identify stakeholders' forest values should come before indicators are selected.

Thinktank participants were careful to distinguish between “selection” of indicators and “use” of indicators. In selection, it is important to make sure diverse interests are involved and represented in the process. Selection of indicators can be a time consuming process, and often contentious, because forest values are at stake. Because stakeholders are key to selecting legitimate indicators, it is important to design an indicator selection process that engages stakeholders but that does not lead to “stakeholder fatigue.” If the process becomes too demanding, or if diverse values are not respected, the process may unravel, or simply fizzle to a stop. The selection process must be well thought out, and as streamlined as possible. A common fault of indicator selection processes is that they are too complex, too time consuming. If stakeholders begin to drop out of the process for any reason, the selection of legitimate indicators may be compromised. Stakeholders should be enlisted early on to help design an indicator selection process that will work for them; this also helps ensure buy-in to the process and to the indicators that result.

Stakeholders provide social legitimacy to indicators. Without legitimacy we cannot expect indicator systems to be enduring, or to win the necessary funding to be enduring. Indicators are of little value if they are not measured repeatedly over time, and we cannot expect political support (funding) for indicators unless the indicators have meaning to stakeholders. Any indicator selection process must carefully assess the best way to engage the participation of stakeholders. This is not an easy task, and there is no single answer for how to do this, but here are some basic principles:

- Identify all the key stakeholder interests.
- Enlist the key stakeholder groups (i.e., representatives) in designing an indicator selection process to make sure it meets their needs.
- Make sure every part of the process is transparent, even parts that require technical work.
- Design a process that builds trust and respect among stakeholders.
- Provide a written description of the process so everyone is clear about the timeline and the goals, and how much time will be required.

Should indicators be scalable?

Every night you can watch the local news and get the daily high and low temperature for the next several days, probably for your specific town. More often than not, that prediction is correct. This is possible because of an elaborate, *scalable* (and expensive), meteorological data gathering system. Now imagine that every local community, or every county in the U.S., measured the same forest indicators, using the same protocols, and with the same units of measure. We might predict, with confidence, which areas within a state are going to face serious loss of forest values. As with weather data, we would have the ability to understand the condition of forest values at small scales and at any higher level of aggregation.

The possibility of a fully mathematically scalable system of forest indicators in the U.S. seems unrealistic at present. Why? First of all, unlike rainfall data where methods of measurement are scale independent (to make rainfall data scalable it is enough to intensify the number of rainfall recording stations), many cost-effective methods to measure and summarize social, economic and ecological data are scale dependent. This is true even when the actual indicator is relevant at all spatial scales (e.g., description of the type and extent of forest cover). In addition the United States does not have one over-riding institutional structure that is responsible for collecting all the information needed, but rather many different institutional structures operating at many different scales with relatively little or no coordination (USFS Forest Inventory, NatureServe Data base, individual states, US Geological Survey, Census Bureau, etc.) (Figure 1).

The most well-known data source on forests in the U.S. is the Forest Inventory Analysis data (FIA), but there is only 1 data collection site every ~5000 acres. Baltimore County, MD

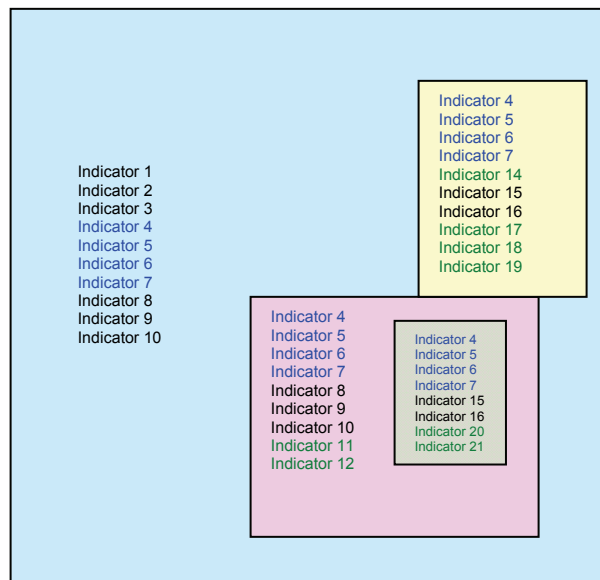


Figure 1. The concept of scalable indicators. The larger box might represent a nation, or a state within a nation. The smaller boxes represent smaller geographic areas (states, or counties, or cities). We might expect some indicators (blue) to be shared among all scales and systems. Some indicators may be shared among only some of the areas/scales (black), and other indicators will be unique to a particular jurisdiction (green). Hopefully, any given system will be aware of, and informed by, indicator systems above or below their scale of interest.

has only 1 FIA point, and it is not located in a forest. How much can Baltimore County conclude about its forest from the one FIA data point? The FIA dataset cannot answer the questions the citizens of Baltimore County have about their forests, though the U.S. Forest Service is working hard to make the FIA data more instructive as smaller scales. But for now, it is left to Baltimore County to create its own indicator system, and to find, or generate, its own data sources.

Unlike the weather, where everybody everywhere would like to know the answer to the same question, “How warm or cold will it be tomorrow, and will it be sunny?”, people in different locations may have different questions about their forests. As a result, it is fundamentally difficult to create a scalable system of forest indicators. One might legitimately ask ‘why bother?’ Coordination of such a hierarchical system would be tremendously expensive. National-level forest policy makers have questions they must ask *at the national scale*, and the FIA data source largely meets their needs. At smaller spatial scales, where FIA data are too thin to be meaningful, stakeholder and decision makers struggle to find data sources that match their needs. Given the expense of creating an indicator system and an enduring data stream, states and communities can ill afford to measure forest values that do not resonate with the people the indicator system is designed to serve. Still, given the thinking and investment in existing systems, such as Montreal C&I, or the Northeastern States adaptation of Montreal C&I, it makes sense that any new effort be informed about what others have done, but not be constrained by them.

One issue of terminology emerged from the Thinktank discussion regarding indicators vs. metrics. In some indicator systems, the indicator is a number, with units of measure. In other systems, the indicator is more like a particular forest value, e.g., a ‘healthy’ salmon fishery. One or more “metrics” will be needed to describe whether the fishery is healthy (e.g., population size, reproductive success). Under this framework, indicators are more likely to be shared among communities or states, while the metrics may differ (including the particular units of measure) because local available data sources are different or because local interests are different. When defined this way, participants noted there can be remarkable similarity among ‘indicators’ in different geographies even when the specific metrics that support the indicator differ. This situation is still problematic for the notion of *mathematically* scalable indicators, which would need to be in the same units of measure, even if derived from different data sources.

Developers of indicators should be aware that sometimes the terms ‘indicators’ and ‘metrics’ mean different things. At some level something has to be measured or assessed, and usually units of measure need to be specified.

What do you do when there is a mismatch between data needs and availability?

There are three data situations typically encountered in indicator selection:

1. Data are available and directly measure the forest value.
2. Data are not available, but the value can be measured with a reasonable surrogate indicator.
3. Data are not available, not even surrogate data.

What do you do when a forest value cannot be tracked (#3 above)? For example, stakeholders in Oregon were concerned about the impacts of roads on a variety of forest values, including wildlife and water quality. Yet there were no data sources that adequately monitored road impacts. Policy leaders acknowledged the importance of this data gap and assigned the value to a “holding bin” for new data needs. The great concern expressed by stakeholders about road impacts on key forest values argued for developing road-related

indicators. This is an example where an indicator selection process, which if done well, can be a mechanism through which new information needs are identified. Policy makers then have an opportunity to respond to a real public concern for data regarding a key forest value.

The Heinz Center Report Card for the Nation, and the National Report on Sustainable Forests—2003, also encountered many indicator data gaps. Where data were unavailable, and where reasonable surrogate indicators could not be generated, these systems stated “no data available” and launched a systematic process to determine what it might cost to generate good data streams. Such honesty is important in indicator selection. If there is a forest (or environmental) value deemed important by stakeholders, and no data are available, it is important to retain the value and work to create a way to assess and track that value. This approach makes it clear to stakeholders that their values were not dismissed simply because no data were available. The very real limitation of cost, and who pays, also becomes a transparent part of the stakeholder/policy maker discussion.

Another common problem is the level of acceptability of surrogate data. Because most indicator systems do not have money for creating new data streams, leaders often work hard to find existing data sources that provide some, even if imperfect, information about forest values important to stakeholders. Because policy makers often end up scraping and scratching for any relevant information for a particular forest value, sometimes indicators are used that are simply not very satisfying for the expressed value; the indicator can be such an indirect measure that the relationship to the value of interest is a stretch. It will always be a judgment call as to whether any given indicator is better than no indicator at all. It is important to revisit the final set of indicators before they become operational to make sure they will be reasonably informative. Do not use indicators as a matter of convenience when they do a poor job of measuring the forest value of interest. Rather, work to find or create a better indicator.

A way to deal with data gaps should be an ongoing component of most indicator efforts, and a workgroup on data gaps might be formed specifically to address and track this issue. In the end, it is important that stakeholders are involved in a discussion of whether an indicator provides an adequate representation of their values

Sometimes a forest value needs greater definition before indicators can be selected. In the Montreal C&I there is an indicator pertaining to forest cultural values. How that might get measured at a national scale may be meaningless to Yakima tribal values in Oregon. At the national scale, “area in protected archaeological sites” might be a good indicator of cultural value, but at the local level that may fail completely to reflect values of the Yakima tribe. In this specific case, it has even been a challenge to determine what *would be* meaningful, due to cultural and language barriers. It can take a great deal of work to identify exactly what the value is, but this has to be done before you can determine what data might be suitable to measure the value.

Another good example of an indicator data challenge is forest fragmentation. Concern for forest fragmentation is often a forest value identified by stakeholders. But fragmentation can mean ownership fragmentation (i.e., parcelization), or it can mean habitat fragmentation from a species perspective. Likely there will be stakeholders that care about both. There are many ways to mathematically measure fragmentation, usually requiring GIS data that can be expensive to generate if it does not already exist. But it can be difficult to interpret the meaning of fragmentation metrics in relation to any real stakeholder value. Is it better to have some measure rather than no measure, even if the metric cannot be interpreted? On the other hand, if the fragmentation metric is getting smaller or larger over time, that might prompt further inquiry to find out what mechanisms are driving that change, and whether that change is relevant to forest values.

There will be many cases where data are not available to measure and track forest values, at the national scale or the local scale. Acknowledge when data gaps exist and do not force a

When no data are available to assess a particular forest value, it is important to be honest with stakeholders.

match between a data set and a forest value. If the value is important enough, through a policy process, funding may become available to get the data.

Can indicators be used to integrate economic, social, and environmental values?

Indicators provide an opportunity to objectively evaluate the tradeoffs among economic, social, and environmental values.

Theoretically, once economic, social, and environmental values (and associated indicators) have been identified by a group of stakeholders, it should be possible to explore the tradeoffs among values. If, say, economic indicator #6 doubled, what would happen to the environmental and social values in the community or state or nation? Interest groups in our society have a tendency to pursue or advance one category of values (economic, social, OR environmental). But if indicators are well selected, they could support a process for integrating values. Such a process should be clearly thought out because dealing with tradeoffs among economic, social, and environmental values is a common point of contention.

We polled our group for any examples of where indicators were used to integrate and balance values, but no clear examples were given. In several examples it was clear the relevant stakeholder group was engaging in identifying and understanding the different values sets, but it was not apparent that indicators, specifically, were being used to weigh the costs and benefits to the full suite of values. A number of groups were using tools that facilitated integration of values (e.g., multi-criteria analysis), or balancing values in decision making, but none explicitly were built on, or dependant on, a set of indicators.

Although it was clear that integration of economic, social, and environmental values was taking place in a number of situations, indicators did not seem fundamental to the process. There may be a yet untapped opportunity for indicators to help create a social conversation about balancing economic, social, and environmental values—a conversation that is based on data and that helps manage a very complex mix of forest values.

Should you set numerical targets for indicators?

If indicators are to inform stakeholders and policy makers about whether forest values are being sustained, it would seem logical that a goal would need to be set for each forest value. Without a numerical goal, decision makers have no idea whether action is warranted to make adjustments in the condition of the forest value (Figure 2). It's analogous to being far out at sea with precise GPS coordinates, but with no map for reference and no particular destination in mind. On the other hand, if you ever do figure out the coordinates of your destination, that GPS reading will come in very handy. It's the same with indicators.

In an ideal world, numerical targets make perfect sense. But in the real world, targets don't always make sense. Targets might come later, *after* social discourse and debate have determined what a sustainable level might be.

The ultimate purpose of forest indicators is to ensure that forest values are sustained. The problem with setting numerical targets is that some agreement must be reached about what a sustainable level is. How much forest cover should the state of Oregon have? This is not a science question. A scientist might be able to say, 'if the forest cover drops below X amount, species A, B, and C will likely be extirpated.' But usually no such analysis is possible. Moreover, there are many other factors that must be taken into account before a decision can be made about a desirable level of forest cover.

Thus, setting goals requires a thoughtful social process that is informed by science. At the U.S. national scale, there is no existing social process to set goals for any of the Montreal indicators. Such a process would be tremendously complex. For this reason, the National Report on Sustainable Forests—2003 did not attempt to set target levels for any of the indicators. Interest groups and forest stakeholder will have to decide for themselves whether the indicators suggest forest values are at a sustainable level. Herein lies the problem with setting targets—everybody’s definition of a level that indicates sustainability is different. Unless there is a social process to bring the different interests together to have the conversation about desired levels, indicators will fail to fulfill their full potential for informing decision making.

Setting target levels for indicators was another subject that elicited different responses from Thinktank participants depending on the scale at which they worked. Those who worked at the community scale, or even National Forest scale, tended to advocate setting targets. They argued that if you didn’t set quantitative goals, stakeholders would never get beyond the ‘forest values’ stage (though a worthy goal in itself) and to the serious discussion about what sustainability really means. It is much easier to say “I want old-growth forest in my community” than it is to say “I want ‘X’ amount of old-growth forest in my community.” Setting a target for old-growth forest, or any other value, is going to require a more serious social conversation, with perhaps some sacrifices or compromises.

Those who worked at the state or national scale tended to be cautious about setting targets. This probably derives from the incredibly more complicated challenge of reaching state or national consensus on indicator levels. Even though local issues can be quite contentious, the social process is far more manageable, and people tend to be willing to devote more time to social processes that are local in scale, partly because all decisions are directly relevant to the place in which they live, and partly because travel to a local meeting is much more manageable (affordable in time and money) than travel to multiple state or national meetings. People care deeply about their *place*, and are willing to commit more time and energy to reaching consensus about their place.

Another reason not to set indicator targets occurs when a forest value is clearly of high interest to stakeholders but there is simply not enough scientific understanding to advise the citizenry what a “healthy” or “sustainable” level might be. This is a common problem with coarse woody debris (CWD), a critically important forest structural component for biodiversity. How much? How big? How distributed? All these questions come up that scientists cannot yet answer. We know CWD is important, but we don’t know much about how much is needed. In this case it is important to have the data stream coming in so that stakeholders can know how much CWD exists and whether the *trend* is upward or

In the absence of a numerical target, a decision maker has no idea whether the forest system is above or below the desired position.

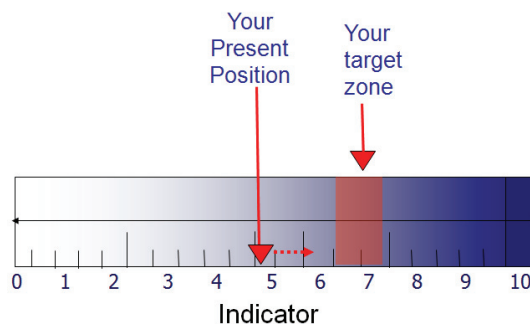


Figure 2. A hypothetical indicator that ranges from 0 to 10. The system’s present position is measured at 4.6. In the absence of a numerical target, a decision maker has no idea whether the system is above or below the desired position, and no action can be taken.

downward. A trend one way or the other might trigger action, even in the absence of specific targets for CWD. Sometimes only the trend in an indicator is needed to precipitate action.

Even if targets are set, targets may change over time, as social values change. Perhaps a conflict will arise among values in the future that requires the citizenry to rethink what an acceptable level would be. Maybe if the price of construction lumber doubles people would want to rethink how much old-growth needs to be set aside. Or maybe a host of species becomes threatened due to loss of old forest, and citizens decide to increase the target amount of old forest.

Set targets if you can, but make sure there is a well-designed social process to accomplish this task.

Indicators should tell us when we have strayed off course. Or preferably, *before* we have strayed.

Decision making with indicator systems

Though there can be many purposes for forest indicators, the main purpose is usually to ensure that forest values are not compromised (i.e., are being sustained for present and future generations). Indicators should tell us when we have strayed, or preferably before we stray, off course. They are called indicators because they are supposed to *indicate*.

For indicators to indicate, they need to be embedded in a decision making framework. That is, decision makers and stakeholders need to know *when* to take action; *who* will take action; *what* action(s) might be taken, based on the indicator data. It appears rare that an indicator decision making framework is set up when indicator systems are created. This may be one reason there is so often frustration with indicator systems—there is no plan, no framework for making decisions with the indicators. Those who invested their time in selecting indicators, and even those who do the hard work to create the indicator data, can become frustrated if there is no mechanism to put the indicators to use in decision making. A decision making framework should be developed *before* indicators are selected, so everyone understands how the indicators will be used.

A decision making framework for how to use forest indicators should in turn be embedded in a larger social process for pursuing sustainability. Sustainability is fundamentally a social endeavor, supported by science, not dictated by science. What does society want from forests? What does society want to leave for future generations? If we have no way to ask and answer these questions, indicators will be of limited use. Yet indicators can help inform social discourse on defining sustainability. Knowing how much we have of forest value x , y , or z can help foment a discussion of how much we want, and how to achieve that level or desired condition.

The lack of a decision making framework in most indicator efforts is not too surprising because such a framework requires some hard work and hard decisions. For example, an indicator in the Montreal C&I system under the *Criterion 1, Conservation of Biological Diversity* is “extent of area by forest type relative to total forest area.” Setting a goal for how much forest of each type could be socially and politically challenging—there are many competing interests for land use. It is simply easier to start the data flowing, and worry about decision making later, once a more quantitative understanding of the value is realized (see discussion above). But again, if stakeholders do not understand how indicators will be used, and who will be making decisions, stakeholder (and policy maker, and land manager) frustration can grow and undermine the indicator effort. This has happened many times in indicator efforts.

The State of Maryland offers a good example of how decisions can be made with indicators even in the absence of a formal decision making framework. (J. Horan, pers. comm.). Maryland’s forest indicators showed that 17,000 acres of forestland were being lost

(converted) each year. This figure was alarming to policy makers and stakeholders. In response, Maryland passed the Forest Conservation Act (FCA) in 1991 to promote the conservation of forestland where development was occurring. That is, action was taken based on a numerical trend. The FCA dictates that developers must (1) delineate forest areas on a site before development, and (2) draft specific plans for retaining and protecting existing forested areas (CBF 2004). This is a good example of how an indicator was converted into action through policy.

Other examples of decisions made based on numerical trends are not uncommon, e.g., “no-net-loss of wetlands,” the Clean Air Act, the Clean Water Act, the Endangered Species Act. Many environmental policy decisions are made based on numerical data, even if not derived from a formal decision making framework. A less formal approach to decision making may be more realistic, i.e., “once we have the chance to see and interpret the data, we’ll make a decision on whether or not action is warranted.” But even if this informal approach is taken, stakeholders should understand how decisions will be made with indicators, who will make them, and how stakeholders can participate.

Take-home Messages

1. **Indicator selection and use is primarily a social process**, to be informed and supported by data and science. Indicators are not about the numbers as much as they are about an open social conversation about forest values. To be useful, the selection and use of forest indicators must be embedded in a larger, ongoing, adaptive social process for pursuing sustainability. Sustainability is not an endpoint, but rather an ongoing social process that integrates and adapts to new knowledge and changes in societal values.
2. **Develop a sustainability decision making system.** Understand how you will use indicators from the start. Who will make decisions based on the indicators? How often will data be reported, and to whom? How will stakeholders provide feedback? Who decides what actions will be taken? How can new indicators be added to the system? All these questions should be clear in advance of setting up an indicator system.
3. **Engage and involve key stakeholders** (or their representatives) from different sectors to help design and implement an indicator selection process that ensures transparency. Remember that indicators reflect what values will be tracked and what values might be left behind. Indicators thus get caught up in issues of power and disenfranchisement. A thoughtful social process (see #1 above) can help avoid the conflict that often plagues forest sustainability.
4. **Set goals (or targets) for indicators if you can**, but do not compromise the flow of relevant data. Goals can be set once participants have had a chance to discuss and understand the meaning of the data.
5. **Know your spatial scale.** The larger the spatial scale the harder it is to have an inclusive social conversation about forest values. National-level indicators, or even state-level indicators, may not resonate with the public because the scale of relevance is larger than most people either care about, or feel that they can do anything about. Most people tend to care about the place they live and work (e.g., a 50-100 mile radius). Be careful to define the geographic extent for the indicator effort so that the proper people can be involved.

6. **Think through in advance how much time you (and the stakeholders) wish to invest in indicator selection.** It is easy to “burn out” stakeholders. When this happens, the usefulness of the indicator system can be called into question.
7. **Think through in advance what resources it will take to collect, summarize, and communicate the indicator results to your target audience.** Do not promise more than you can deliver.
8. **Be informed by existing forest indicator systems,** such as the Montreal C&I, but do not be constrained by them. Indicators must be relevant to the stakeholder community the system is intended to serve.

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