IV. Evaluation of Existing Sustainability/Indicators Projects

In cooperation with the Northeastern Forest Resource Planners Association (NFRPA), the USDA Forest Service Northeastern Area Sustainability Program evaluated 60 sustainability/indicators efforts being implemented across the nation, including many across the 20 States served by the Northeastern Area. While there are more efforts that could have been included, this summary provides valuable information for agencies and organizations interested in developing and using criteria and indicators of sustainability. It includes information such as who is involved in these efforts, the level of public involvement, and sources of further information. These efforts vary in type, scale, motivation, and in many other ways. The efforts considered include the following:

- Initiatives that are still in the process of securing funding to established projects that have continual funding
- Projects spearheaded by government agencies (local, State, and national), nongovernment organizations, and citizens
- Efforts with only one agency or organization involved to those with multiple stakeholder involvement
- Efforts with and without public involvement
- Long-term monitoring projects as well as short-term research projects
- Initiatives with participants from one sector to wide-scale initiatives with multidisciplinary and stakeholder involvement

Thirty-nine of the projects had developed indicators, which were studied further and analyzed in comparison to the Montreal Process C&I framework. The review included similarities and differences in definitions among projects, the variety of hierarchical structures adopted by various efforts, the most and least common indicators used, and existing linkages to the Montreal Process C&I.

A. Analysis of Sustainability Efforts

A wide range of information was compiled and analyzed for the 60 different sustainability/indicators efforts. As presented below, key pieces of information include effort type, geopolitical scale, who is involved, reasons/motivation, goals and vision, steps taken, relationship of the effort to the Montreal Process C&I, effort timeframe, indicators used, and definitions of key terms.

For the purpose of this analysis, an "effort" was defined broadly. The efforts address forest sustainability, sustainable development, or environmental/ecological indicators. Efforts of every geopolitical scale were considered, including international, national, regional, State, and local. However, for the regional, State, and local scale efforts, emphasis was placed on those occurring within the 20-State region.

Effort Type

Each effort was categorized according to the overall focus, or type, as follows:

Forest Sustainability—Includes efforts focused on forest sustainability, with or without the development of indicators (e.g., *Sustaining Penn's Woods*).

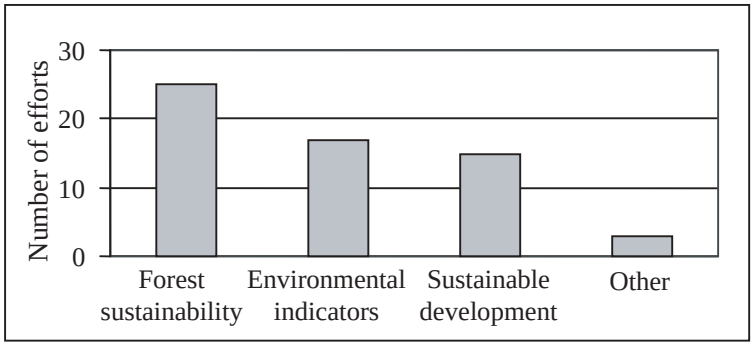
Environmental/Ecological Indicators—Includes efforts focused on environmental or ecological indicators (e.g., *Minnesota's Environmental Indicators Initiative)*. Although forestry is often included as a component, it is not the main focus or motivation of the effort.

Sustainable Development Indicators—Includes efforts focused on community sustainability indicators (e.g., *Sustainable Boston*). Although forestry may be included as a component, it is not the main focus or motivation of the effort.

Other—Includes other efforts that address sustainability/indicators, but do not fit into the above categories (e.g., *Missouri Resource Assessment Partnership*, a natural resource monitoring effort).

Of the efforts analyzed, 25, or just over 40 percent, are forest sustainability efforts, with the remaining entries roughly split between environmental/ecological and sustainable development indicators efforts (figure 2).

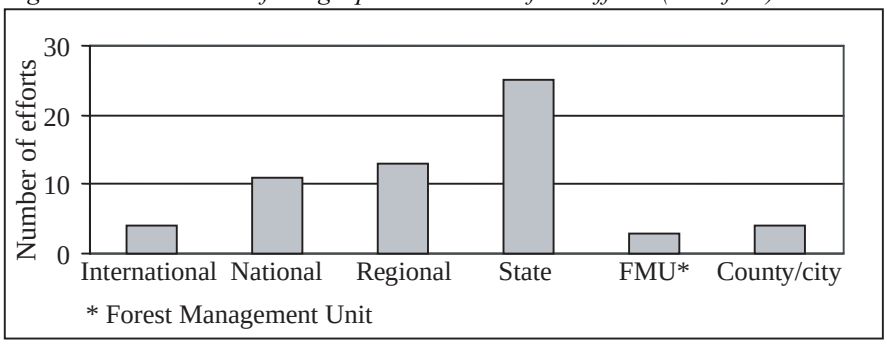
Figure 2. Distribution of the type of efforts (out of 60)



Geopolitical Scale

The geopolitical scale of the efforts analyzed here includes international, national, regional (multistate), State, county/city, and forest management unit scales (figure 3). The State scale accounted for the most efforts, with 25 efforts, or just over 40 percent, at that scale. Thus for many States, there is an existing C&I sustainability network to connect to. The next two highest categories are rather evenly split between national and regional scales, with roughly 20 percent of all efforts in the database at each scale. Small numbers of efforts (3 or 4) were focused at each of the remaining scales: international, Forest Management Unit, and county/city.

Figure 3. Distribution of the geopolitical scale of the efforts (out of 60)



Relationship to the Montreal Process Criteria and Indicators

To consider to what extent the efforts were connected with the Montreal Process C&I, each one was categorized according to its use of or connection to the Montreal Process. The following categories were used:

Independent Of—Montreal Process C&I were not cited or considered.

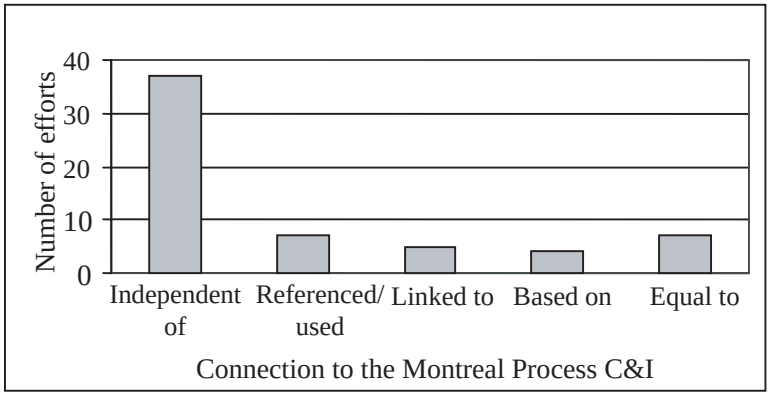
Referenced/Used—Montreal Process C&I were cited in a report, or at least considered.

Linked To—Although not the primary basis of their work, the Montreal Process C&I are explicitly linked to the effort's own criteria and indicators.

Based On—The core work of the effort is based on the Montreal Process C&I. The effort C&I are adapted from the Montreal Process C&I.

Equal To—The effort is direct Montreal Process C&I work, integrated as part of implementation of the Montreal Process C&I (figure 4).

Figure 4. Connection of the efforts to the Montreal Process C&I (out of 60)



Well over half of the efforts were conducted independently of the Montreal Process, that is, the Montreal Process C&I were not considered or cited (e.g., *New England Goals and Indicators Project/ Partnership)*. The rest of the efforts at least cited or used the Montreal Process to some extent. Almost 20 percent of the efforts were based on or were direct Montreal Process work. The following efforts are direct Montreal Process implementation work:

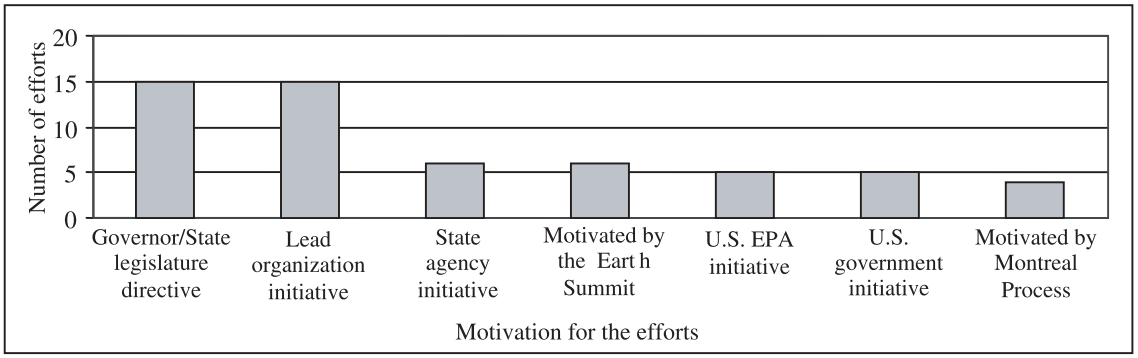
- Forest Sustainability Assessment Report for the Northern United States
- Illinois Report on Sustainable Forest Management
- Montreal Process Working Group
- NAASF First Approximation Assessment Project
- National Association of State Foresters Sustainable Forestry Implementation Committee
- U.S. First Approximation Report
- U.S. Roundtable on Sustainable Forests

Motivation/Reasons for Initiating the Efforts

To the extent available, descriptions as to why the effort was initiated were analyzed, including what motivating factors or reasons lead to the effort. Among the main reasons or motivation for the efforts, the top two, each with a quarter of the efforts, were (1) governor or State legislature initiatives, statutes, or mandates (e.g., the *Maine Forest Sustainability*

Standards was State legislature directed) and (2) initiatives of the lead organization, that is, the effort is closely aligned with the organization's mission and objectives (e.g., the American Forest & Paper Association *Sustainable Forestry Initiative Program)* (figure 5). Additional reasons or motivations cited repeatedly include State agency initiatives (e.g., Maryland Department of Natural Resources *Strategic Forest Lands Assessment),* efforts as a result of the United Nations Conference on the Environment and Development (e.g., *The World Commission on Forests and Sustainable Development)*, U.S. Environmental Protection Agency initiatives (e.g., *National Environmental Performance Partnership System),* Montreal Process implementation (e.g., *National Association of State Foresters First Approximation Report)*, and other U.S. Government initiatives (e.g., *U.S. Interagency Working Group on Sustainable Development Indicators).*

Figure 5. Main motivation/reasons for initiating the efforts (out of 60)



Who Is Involved

A wide variety of agencies, organizations, and other stakeholders were involved across the 60 efforts. Participants or categories of participants most often involved include the USDA Forest Service, State environmental/natural resource agencies, State forestry agencies, the U.S. Environmental Protection Agency, and universities (including ecologists, forest economists, and forest sociologists) (table 1). Each of these participants were involved in at least 20 percent of the efforts. Other participants involved in multiple efforts include State planning offices, The Nature Conservancy, the U.S. Geological Survey, funding foundations, the U.S. Fish and Wildlife Service, the USDA Natural Resources Conservation

Table 1. Participants most often involved in the efforts

Participant	No. of efforts
State environmental agencies and departments of natural resources	31
U.S. Environmental Protection Agency	23
USDA Forest Service	21
Universities	17
State forestry agencies	14
State planning offices	9
The Nature Conservancy	7
U.S. Geological Survey	7
Foundations (e.g., the MacArthur Foundation)	6
U.S. Fish and Wildlife Service	6
USDA Natural Resources Conservation Service	6
U.S. Department of the Interior (Bureau of Land Management 3 out of 6)	6
National Association of State Foresters	4

Service, and the National Association of State Foresters. In addition, numerous State and local agencies, organizations, and businesses were involved in many of the efforts.

Public Involvement

The public was involved to some extent in over half of the sustainability/indicators efforts. Many of these efforts involved the public in more than just public review and feedback on project reports. Some held informative workshops and elicited feedback during listening sessions. Other efforts requested feedback on draft indicators. A few efforts even involved citizen networks in data collection.

The extent to which the public was involved varied widely and was categorized on a scale from not involved to extensively involved:

Not Involved—The public was not involved in the effort.

Minimally Involved—The public was involved minimally in activities such as review of final reports.

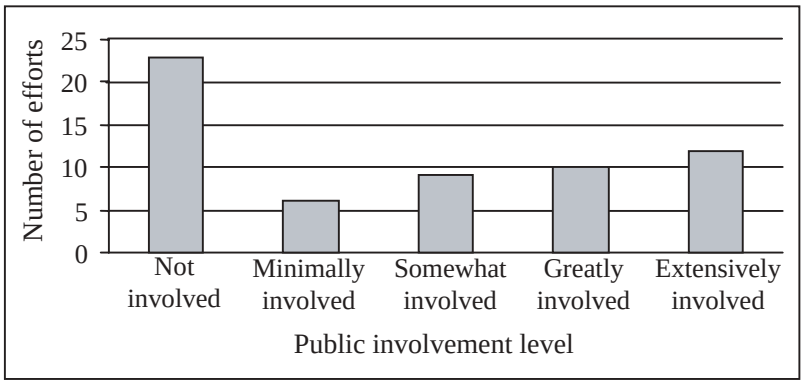
Somewhat Involved—The public was involved beyond the minimal level in activities such as providing input on draft reports.

Greatly Involved—The public was involved to a greater extent in activities such as workshops, listening sessions, and review of draft indicators.

Extensively Involved—The public was extensively involved and engaged throughout the process in activities such as workshops, development of the indicators, and data collection (figure 6).

The public was not involved in 23 of the efforts; however, they were involved to some extent in 37, or over half, of the efforts. Citizens were greatly to extensively involved in 22 efforts.

Figure 6. Public involvement in the efforts (out of 60)



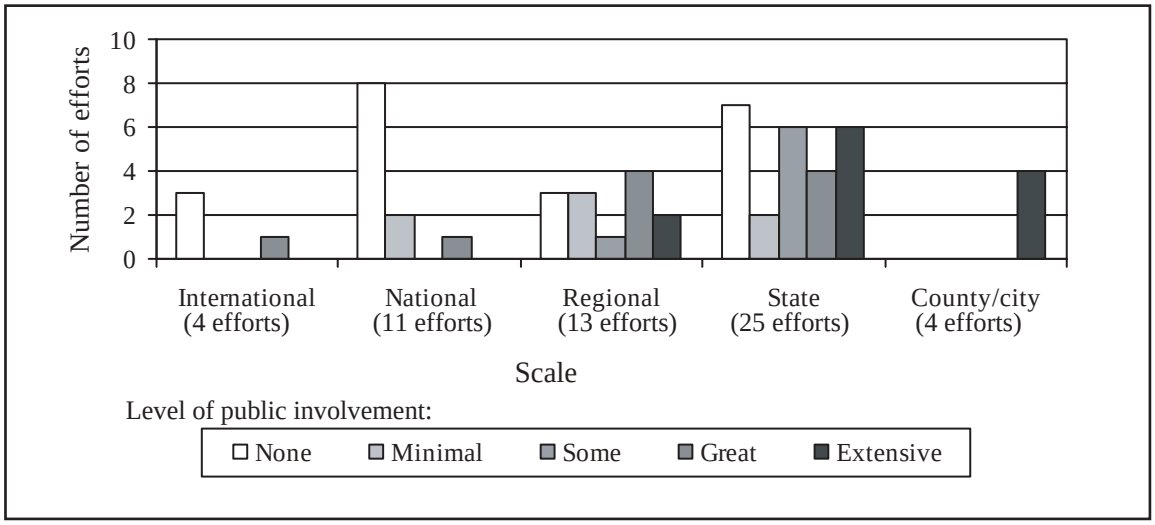
The following list provides specific examples of public involvement:

- The *minimally involved* level—The *U.S. Working Group on Sustainable Development Indicators* requested public comment on its report.
- The *somewhat involved* level—The *Maryland Environmental Indicators* effort involved the public in revision of draft indicator reports.
- The *greatly involved* level—The *Sustaining Penn's Woods* effort held a series of 15 public meetings across the State and facilitated on-line comment on the draft indicator framework.

- The *extensively involved* level—The *Sustainable Boston* effort held over eight major citywide events and involved the public in sustainability discussions, evaluation of the indicators, data collection, and review of reports.

Public involvement also varied by the scale of the efforts, with more extensive public involvement occurring in local efforts then in efforts at other scales (figure 7). At the international scale, 3 out of the 4 efforts had no public involvement; at the national scale, 8 out 11 efforts had no public involvement. At the regional and State scales, the level of public involvement varied. However, at the county/city scale, all of the four efforts had extensive public involvement.

Figure 7. Public involvement varied by effort scale, with more involvement in efforts at smaller scales.

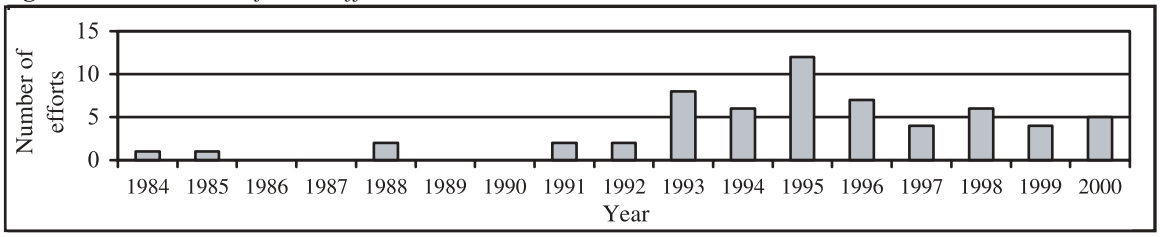


Effort Timeframe

Timeframe for the efforts was analyzed, including what year the effort began (figure 8) and, where relevant, what year the effort ended. It was also noted which efforts are ongoing.

A majority of efforts were started in 1995 or later. In fact, 12 of the efforts began in 1995. Figure 8 does not necessarily represent how long the efforts have been active—for example, an effort that began in 1988 may have ended 5 years later. The age of the efforts varies greatly. All but two of the efforts (*Narragansett Bay Estuary Program* and *Chesapeake Bay Program)* were fewer than 11 years old. Most of the efforts were 6 or fewer years old, with almost 40 percent only 1 to 3 years old. Ongoing efforts are those for which there is no specific end date. For example, the *Sustainable Forestry Partnership* is a

Figure 8. Distribution of when efforts were started



continual process (ongoing), whereas the *President's Council on Sustainable Development* was a 6-year project that has ended (not ongoing). Over half of the efforts are ongoing.

B. Analysis of Sustainability/Environmental Indicators

Thirty-nine of the 60 sustainability/indicators efforts evaluated had developed a set of indicators; therefore, the following analysis is based upon indicators from those 39 efforts.

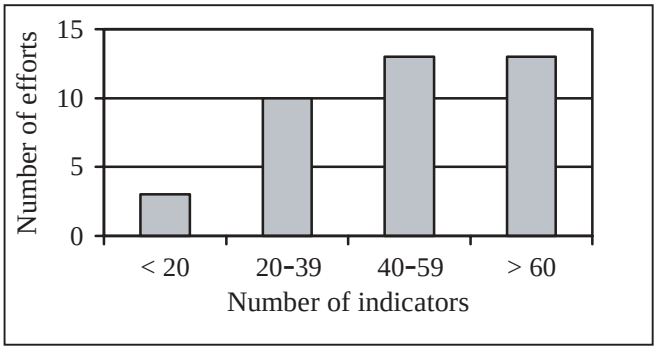
Comparison of Indicators by Effort Type

Sustainable development efforts often include indicators for social and economic sectors not considered in forest sustainability efforts. For example, *Sustainable Boston* has a section addressing "civic health" with indicators such as "universal access to health care." On the other hand, ecosystem indicators efforts often include additional ecological indicators not considered in forest sustainability efforts. For example, the Heinz Center *Report on the State of the Nation's Ecosystems* has a section on "croplands" with indicators such as "average size of farm fields." It is natural that indicator sets would vary depending upon the purpose for which they are developed. Clearly identifying the purpose for indicators early in the process is key for the development of indicators appropriate for the particular purposes and uses desired.

Number of Indicators

The number of indicators per effort is highly variable and depends upon the scope of the project. Overall, the number of indicators used by each effort ranged from 12 to 216 (figure 9). Only 3 efforts had fewer than 20 indicators. Ten efforts had 20–39 indicators, 13 efforts had 40–59 indicators, and 13 efforts had over 60 indicators.

Figure 9. The number of indicators used (for 39 efforts)



Overall, the average number of indicators used by forest sustainability efforts was 60. Complete indicator sets for forest sustainability projects ranged from 23 to 170 indicators (table 2). For many of these efforts, the indicators were developed through a comprehensive and iterative process, beginning with a large list and narrowing it to a workable number. The *Great Lakes Forest Alliance Sustainable Forest Management C&I Project* is an example of this process. Beginning with a list of over 150 indicators, participants spent over 2 years on an iterative process of technical review and public input to carefully narrow the number of indicators while maintaining the important aspects of sustainability (Hinrichs-Sanders 2000). The final set of indicators contains 33 indicators evenly distributed among ecological, social, and economic "pillars."

*Table 2. The number of indicators used by forest sustainability efforts varies from 23 to 170.**

Forest sustainability effort	Number of indicators
Forest Stewardship Council (FSC)	170
Great Lakes Forest Alliance Sustainable Forest Management C&I Project	33
Lake Superior State Forest Sustainable Forest Management Project	77
Local Unit Criteria & Indicators Development Project (LUCID core indicators)	42
Montreal Process C&I	67
North American Test of C&I of Sustainable Forestry	57
Oregon Forest Assessment Projects	23
Sustainable Forestry Initiative (SFI) Program	35
Sustaining Penn's Woods	79
Vermont Forest Resources Plan	26
Wisconsin Northern State Forest Assessments	54

*The Maine Forest Sustainability Standards is not included in this table because indicators have not been developed for all the criteria.

Hierarchical Structure

In almost all of the indicator sets developed and used by the 39 efforts, there were hierarchical levels used to structure the sustainability/environmental assessments. The Tropenbos Foundation recommends the use of "a set of principles, criteria, and indicators, or at least some combinations of these hierarchical levels, that serves as a tool to promote [sustainable forest management], as a basis for monitoring and reporting or as a reference for assessment of actual forest management," further stating that, "An unambiguous and well explained hierarchical framework is a prerequisite for a coherent and consistent [framework]" (Lammerts van Bueren and Blom 1997, p. 11). The Montreal Process utilizes a hierarchical framework with two levels: the 7 *criteria* and 67 underlying *indicators.*

The indicator set framework used by each effort varied somewhat (table 3). A majority of the efforts used either two (e.g., *criteria* and *indicators*) or three (e.g., *principles, criteria,* and *indicators*) hierarchical levels. Examples include the *Lake Superior Lakewide Management Plan* framework of criteria and indicators and the *North American Test of C&I of Sustainable Forestry* framework of principles, criteria, and indicators. Three of the efforts had four hierarchical levels (e.g., the Heinz Center *Report on the State of the Nation's Ecosystems* framework has *ecosystems, system aspects, ecosystem properties,* and *measures)*. In addition, two of the efforts listed the indicators without a hierarchical framework (e.g., *Sustainable Lansing Project* had a list of indicators that was not organized into categories). The large number of independently generated criteria and indicators efforts is a testament to the utility of this concept for guiding sustainability monitoring and assessment activities.

Table 3. Range of hierarchical levels used and examples (out of 39 sets of indicators)

Number of hierarchical levels	Number of efforts	Example structure/terminology	
4	3	Ecosystems ▼ System aspects ▼ Ecosystem properties ▼ Measures	Programs ▼ Goals ▼ Objectives ▼ Indicators
3	16	Principles ▼ Criteria ▼ Indicators	Criteria ▼ Indicators ▼ Benchmarks
2	18	Criteria ▼ Indicators	Goals ▼ Indicators
1	2	Indicators (not hierarchical)	

Definitions

Overall, most of the frameworks used by the efforts consist of at least *criteria* and *indicators*. As defined earlier, a *criterion* is a category of conditions or processes by which sustainable forest management may be assessed, and an *indicator* is a quantitative or qualitative parameter that can be assessed in relation to a criterion. Although this concept of broad categories of conditions or processes (criteria) with specific parameters that can be assessed in relationship to the categories (indicators) was evident throughout all but two of the efforts, the terms criteria and indicators were not always used. For instance, in several cases, instead of using the term criterion, efforts used terms such as *category*, *objective*, or *goal area.* Other efforts used the term *measure* in place of indicator. For example, the *Sustainable Boston* effort uses a framework of *sections, indicators,* and *measures,* where the indicators are short, criterion-like statements such as "healthy ecosystems" and measures are specific indicator-type parameters such as "acres of protected wetlands" (The Boston Foundation 2000).

In some cases, *proxy indicators* were used as a solution to account for the lack of ideal data available at the present time. In the iterative process of indicator development, the intention is for the proxy indicator to be used until a more adequate indicator can be developed. For example, the *Maine Forest Sustainability Standards* included proxy indicators in place of indicators in some places throughout their criteria, indicators, and benchmarks framework (Maine Forest Service 1999).

Tiers of Indicators

Tiering of indicators was used in different ways by a few of the efforts. Tiering is used by the Oregon Department of Forestry to utilize indicators for different purposes. They present the following three tiers of indicators (Oregon Department of Forestry 2000b):

- *Tier 3*—The full suite of Montreal Process indicators with the hierarchical framework of 7 criteria and 67 indicators
- *Tier 2*—A set of 23 core indicators, structured according to the Montreal Process criteria, intended to provide the Board of Forestry and other policy makers with a comprehensive system of indicators that describe environmental, social, and economic conditions
- *Tier 1*—A small set of 3 to 4 indicators contributing to the larger, multiagency *Oregon Benchmarks* to provide the general public with a "bird's-eye" view, or first point of contact, to understand forest conditions

In this example, all of the tier 1 indicators are contained in the tier 2 set and all of the tier 2 indicators are contained within the full tier 3 set.

Prioritizing Indicators

A few efforts prioritized their full list of indicators and then narrowed the list to a measurable set. The *New England Environmental Goals and Indicators Project* used this process and prioritized its long list of indicators according to the following four levels (Green Mountain Institute for Environmental Democracy 1996):

- *Level 1*—Indicators that meet the criteria regarding the indicator quality, as well as (a) have direct links to program activities and (b) would not require additional resources to collect and report the data supporting them
- *Level 2*—Indicators that do not meet the criteria for the Level 1 but are a high priority for further development because (a) they could potentially be moved into Level 1 with some rewording and/or clarification, (b) the indicators (and the issues they reflect) are of significant importance, and/or (c) they are in use or could be used by some but not all of the six States and the U.S. EPA's New England Region
- *Level 3*—All other indicators worth further consideration
- *Level 4*—Those indicators not worth pursuing further at this time (in their current form)

This prioritization enabled the project to identify the indicators they could begin reporting on without losing sight of other important indicators that were not easily measurable at the time.

Benchmarks

Qualitative or quantitative reference values or conditions are commonly called benchmarks. Bridge and others (2002) observed: "Some consider benchmarks to be an essential part of an indicator system, either by helping to place the indicator in context so that it can be understood by non-technical audiences, or by providing a reference condition against which changes in the indicator can be measured and assessed" (p. 4).

Benchmarks have been defined and used in different ways. Targets, milestones, and reference values have all been used as a form of benchmark. For example, the *Maine Sustainability Standards* defined benchmarks as "intermediate objectives for attaining goals" (Maine Forest Service 1999, p. 36). However, instead of benchmarks, the *Lake Superior State Forest Sustainable Forest Management Project* uses *targets*, defined as, "the desired level to be achieved by an indicator" (Hayes and others 1999, p. 3). The *Oregon Assessment Projects* are working on what they call *reference values* for their indicators.

Out of the 39 efforts with indicators, only 6 had developed benchmark-type statements. They range from broad qualitative, directional statements such as "reduced rate of agricultural and forest land conversions to non-resource use" (Maryland Department of the Environment 1999, p. 65), to quantitative, time-oriented statements such as "the amount of conservation land intended for public use will improve by 10 percent, from 957,622 acres in 1993 to 1,053,400 acres by at least 2000" (Maine Development Foundation 2000, p. 22). An additional four efforts were working on or planned to develop benchmarks.

Among the forest sustainability efforts, one had developed benchmarks *(Maine Sustainability Standards)* and an additional three were working on or planned to develop benchmarks *(Lake Superior State Forest Sustainable Forest Management Project, Local Unit Criteria and Indicators Project,* and *Oregon Forest Assessment Projects)*. In addition, two of the forest sustainability efforts are certification programs: the *Forest Stewardship Council* has regional indicators with verifiers, and the *Sustainable Forestry Initiative* has *performance measures* in place of indicators, which serve as "standards."

Comparison of Indicators to the Montreal Process Criteria and Indicators

Indicators from 28 efforts were compared to indicators from the Montreal Process framework (box 4). Only the relevant sections of indicators were compared for programs that included sections of indicators beyond the scope of the Montreal Process criteria, for example, "toxic chemical management." Consequently, for 12 of the efforts, the whole sets of indicators were compared to the Montreal Process criteria and indicators, and for 16 of the efforts, only select indicators were compared.

Comparison of Indicators to the Montreal Process Criteria

Most of the programs had indicators that link to the Montreal Process criteria dealing with the conservation of biological diversity (criterion 1), maintenance of forest ecosystem health and vitality (criterion 3), conservation and maintenance of soil and water resources (criterion 4), and maintenance and enhancement of long-term multiple socio-economic benefits (criterion 6). In addition, over half of the programs had indicators related to the Montreal Process criteria dealing with maintenance of productive capacity of forest ecosystems (criterion 2) and the legal, institutional, and economic framework for forest conservation and sustainable management (criterion 7). Only five programs had indicators comparable to the Montreal Process criterion addressing the maintenance of forest contribution to global carbon cycles (criterion 5).

Box 4. Indicators from the following 28 efforts were compared to the Montreal Process C&I.

- Ecosystem Indicators and Targets for Lake Superior
- Forest Stewardship Council
- Great Lakes Forest Alliance Sustainable Forest Management C&I Project
- Illinois Critical Trends Assessment
- Lake Superior State Forest Sustainable Forest Management Project
- Local Unit Criteria & Indicators Development Project
- Maine Forest Sustainability Standards
- Maryland's Environmental Indicators/ Performance Partnership Agreement
- Mid-Atlantic Integrated Assessment
- Minnesota Environmental Indicators Initiative
- New England Goals and Indicators Project/ Partnership
- New Jersey Future
- New Jersey Environmental Indicators and Performance Partnership Agreement
- North American Test of C&I of Sustainable Forestry
- Northern Forest Wealth Index
- Ohio Comparative Risk Project
- Oregon Forest Assessment Projects
- President's Council on Sustainable Development
- Report on the State of the Nation's Ecosystems
- Selection of Indicators for Great Lakes Basin Ecosystem
- Sustainable Boston
- Sustainable Forestry Initiative Program
- Sustaining Penn's Woods
- Trends in Sustainability Indicators Project
- U.S. Interagency Working Group on Sustainable Development
- Vermont Forest Resources Plan
- Vermont Strategic Plan and Agency of Natural Resources Indicators
- Wisconsin Northern State Forest Assessments

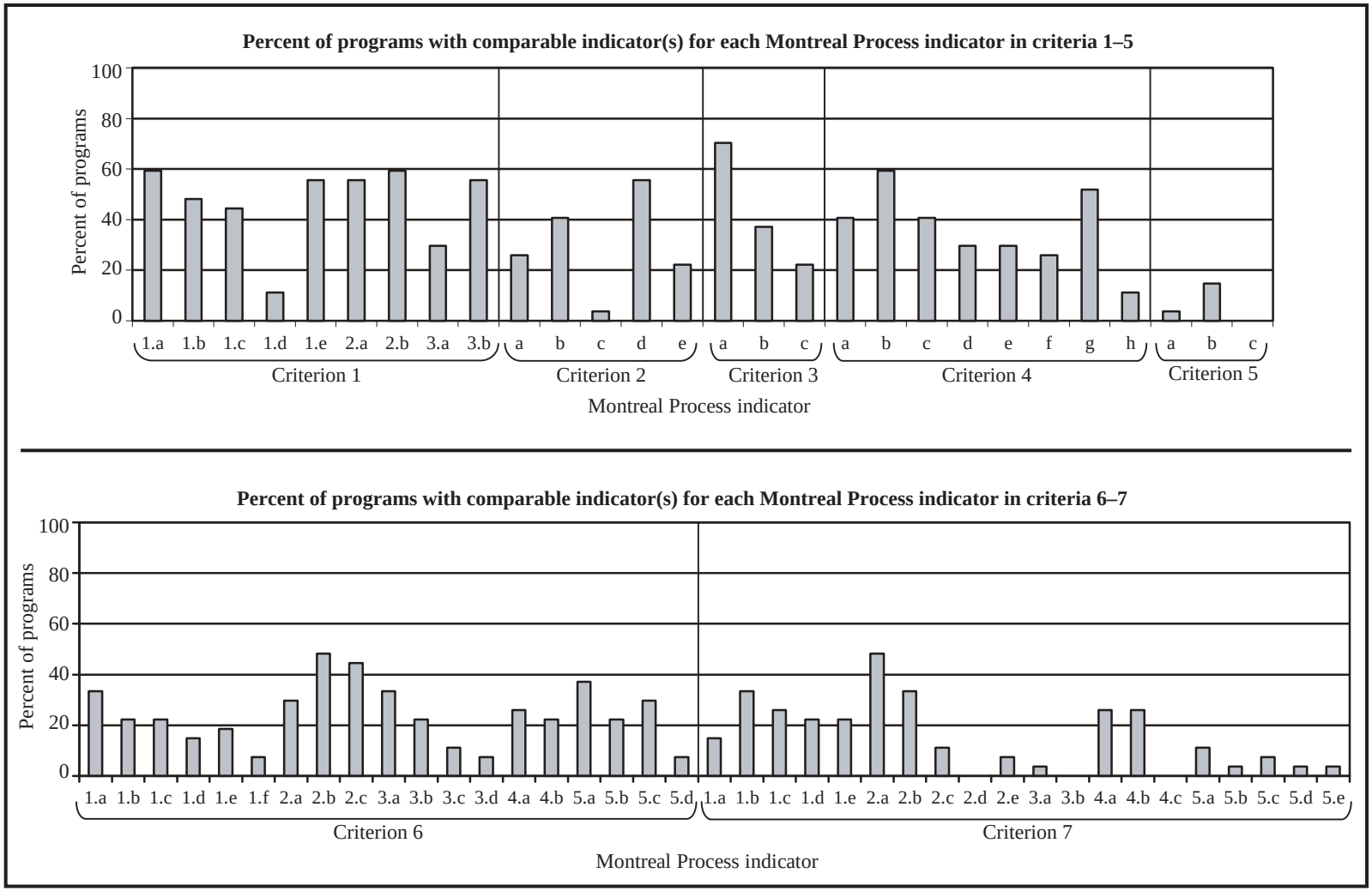
Comparison of Indicators to the Montreal Process Indicators

The percentage of programs with indicators that are comparable to the Montreal Process indicators varied (figure 10). Nine Montreal Process indicators had over 50 percent of the programs with comparable indicators, 19 had 30–49 percent of programs with comparable indicators, 23 had 10–39 percent of programs with comparable indicators, and 16 had fewer than 10 percent of programs with comparable indicators.

The Montreal Process indicators that had the highest number of programs with comparable indicators (at least 13 programs each) are not evenly distributed across the Montreal Process criteria (box 5). Of these 12 indicators, 6 are in criterion 1 (conservation of biological diversity) and 2 are in criterion 4 (conservation and maintenance of soil and water resources). There is one indicator each in criteria 2, 3, 6, and 7, and none in criterion 5.

In all, over 1,000 individual indicators from 28 different efforts were compared to the Montreal Process C&I. One third of these indicators did not fit well into the Montreal Process C&I framework. Overall, there was not a lot of commonality among those indicators; however, there are some categories of indicators that were used by more than one effort. Four of these categories are *land ownership* indicators, such as "percent of land owned by ownership types," *land use types* indicators, such as "conversion of cropland to other uses," *wetlands* indicators, such as "acres of wetlands lost (or gained)," and *potential nutrient loading* indicators, such as "area treated with herbicides, pesticides, fertilizer" (table 4). Although these indicators may be linked to one or more Montreal Process indicators, they are not explicitly addressed in the Montreal Process indicator wording.

Figure 10. Percent of programs with comparable indicator(s) for each Montreal Process indicator (out of 28 programs). For example, 59 percent of programs had at least one indicator comparable to Montreal Process indicator 1.1a*



*Refer to appendix A for the list of Montreal Process indicators.

Box 5. Montreal Process indicators that had the highest number of programs with comparable indicators

Criterion 1—Conservation of Biological Diversity

Extent of area by forest type relative to total forest area

Extent of area by forest type and by age class or successional stage

Fragmentation of forest types

The number of forest dependent species

The status (threatened, rare, vulnerable, endangered, or extinct) of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment

Number of forest dependent species that occupy a small portion of their former range

Criterion 2—Maintenance of Productive Capacity of Forest Ecosystems

Annual removal of wood products compared to the volume determined to be sustainable

Criterion 3—Maintenance of Forest Ecosystem Health and Vitality

Area and percent of forest affected by processes or agents beyond the range of historic variation (e.g., by insects, disease, competition from exotic species, fire, storm, land clearance, permanent flooding, salinization, and domestic animals)

Criterion 4—Conservation and Maintenance of Soil and Water Resources

Area and percent of forest land managed primarily for protective functions (e.g., watersheds, flood protection, avalanche protection, riparian zones)

Percent of water bodies in forest areas (e.g., stream kilometers, lake hectares) with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation, or temperature change

Criterion 6—Maintenance and Enhancement of Long-term Multiple Socio-economic Benefits to Meet the Needs of Societies

Number and type of facilities available for general recreation and tourism, in relation to population and forest area

Criterion 7—Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

Provide for public involvement activities and public education, awareness and extension programs, and make available forest related information

Table 4. A large number of indicators did not fit well into the Montreal Process framework. The following categories of indicators that did not fit well are those that were used by five or more efforts.

Category	Representative examples	Number of efforts with such indicators
Land ownership	Ownership type and land use Percent of land owned by ownership types	7
Land use types (nonforestry)	Conversion of cropland to other uses Urban land use in Ohio	6
Wetlands	Acres of wetlands lost (or gained) Wetland type, functions, value trends; change in wetland function/value	6
Potential nutrient loading	Area treated with herbicides, pesticides, fertilizer, etc. Potential nitrogen loadings to streams	5

C. Further Information About This Analysis

Additional information about this analysis can be found in appendix G, including background research, database development, and a full list of efforts analyzed. In addition, summary information and lists of efforts (with links, where appropriate) are posted on the Northeastern Area's Sustainability Program Web site (http://www.na.fs.fed.us/sustainability/). Several types of database reports were also developed as a result of the analysis. A few of the reports developed and contained in the databases include a list of the efforts, a summary of the information displayed on a single page for each effort, definitions of key terms grouped by term, and reference information grouped by effort. These reports are available upon request.[4] Those who would like to explore and analyze the database content may request to receive an electronic copy of the databases (this is possible to the extent that the database software is compatible).

[4] To request a copy of the database(s), please contact Sherri Wormstead, NA Sustainability Program Assistant, at swormstead@fs.fed.us or 603-868-7737 or access additional information on-line at http://www.na.fs.fed.us/sustainability/.