



Roundtable on Sustainable Forests

A Partnership for the Future

**RESULTS OF THE ON-LINE
STAKEHOLDER CONSULTATION ON
THOUGHTS ON REFINEMENTS TO THE
MONTREAL CRITERIA AND INDICATORS
JANUARY 1—FEBRUARY 28, 2005**

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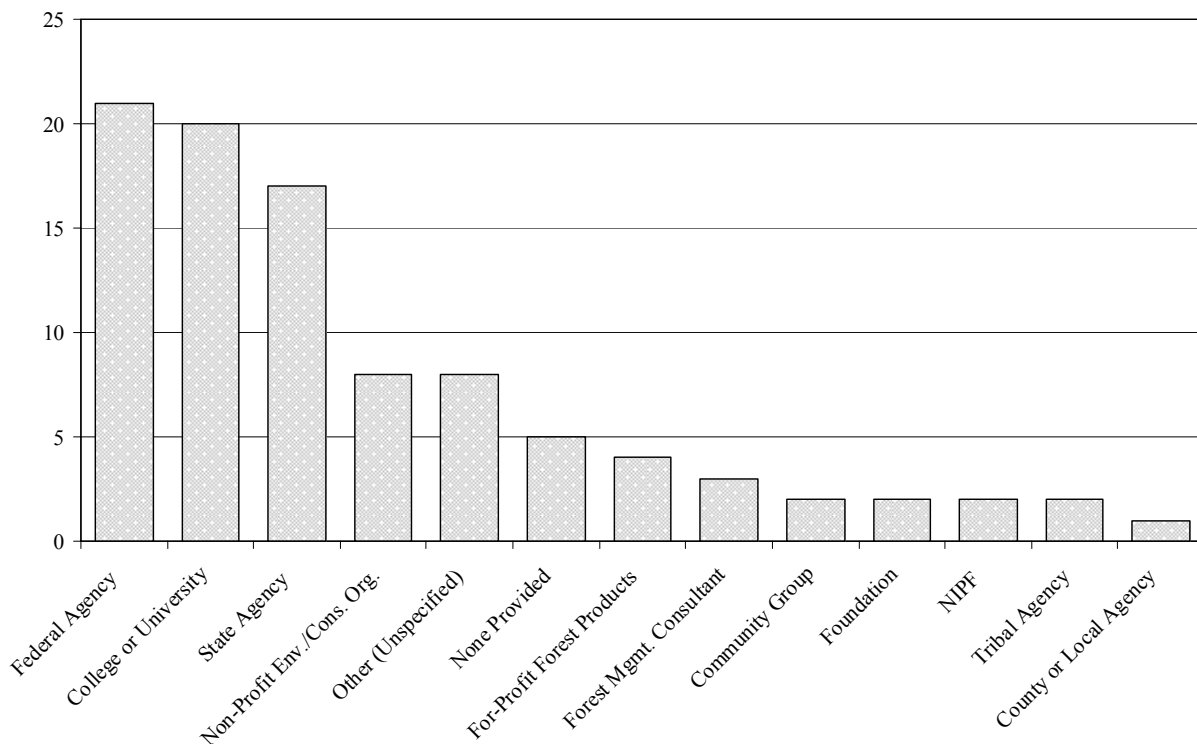
INTRODUCTION

This document contains responses received from 95 respondents to an on-line consultation on potential refinements to the Montreal Criteria and Indicator (C&I). The consultation consisted of 22 questions: one for the criteria overall, one for each of the criteria and sub-criteria, and one to collect any additional comments. The consultation was open from January 20, 2005, to February 28, 2005.

Respondents self-selected from a pool of approximately 2,400 persons in Meridian Institute's Forest Stakeholder Database. That database consists of participants in forest-related processes that Meridian Institute has convened or facilitated. Participants in the Roundtable on Sustainable Forest constitute approximately 10% of that list.

Respondents were asked to provide the name of their organization and to characterize their stakeholder category from a predetermined list. In some cases respondents did not provide both. For example, two respondents identified their stakeholder group as a Tribal Agency, but only 1 provided the name of that Agency. Each of the categories in the predetermined list was selected by at least once. The number of respondents by stakeholder group is depicted in Figure 1. The proportion of respondents by stakeholder group is depicted in Figure 2. A list of organizations submitted, organized by stakeholder category chosen by the respondent, is provided in Appendix A.

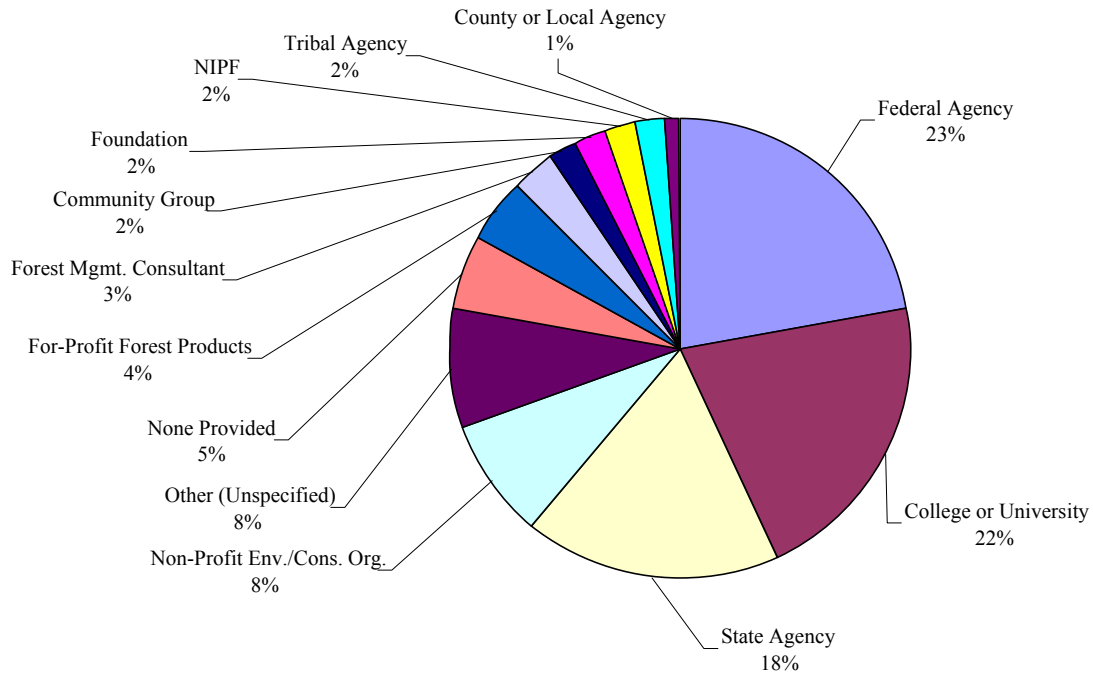
FIGURE 1. NUMBER OF CONSULTATION RESPONDENTS BY STAKEHOLDER GROUP



Respondents were asked to indicate whether their organization worked at the national, regional, state, or county/local levels, and they were allowed to select more than one answer if appropriate. Forty-one percent of respondents indicated that their organization works at the national level. Forty-five percent

said that their organization works at the regional level. Forty-eight percent said that their organization worked at the state level, and 23% said that their organization worked at the county/local level.

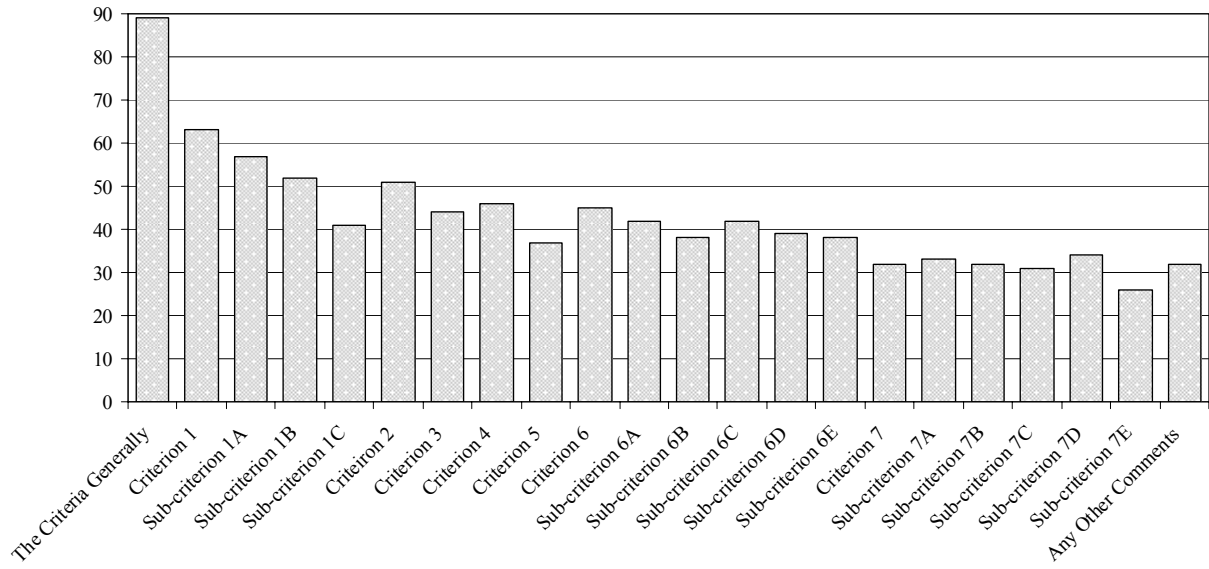
FIGURE 2. PROPORTION OF CONSULTATION RESPONDENTS BY STAKEHOLDER GROUP



The consultation yielded a grand total of 944 responses over the 22 questions. The average number of responses per question was 43. The lowest number of responses for any question was 26, and the highest number was 89. The median number of responses was 40. The number of responses for each question is depicted in Figure 3.

The remainder of this document presents the comments provided by respondents to each of the 22 consultation questions. Comments are grouped by Meridian Institute into general categories based upon the major points contained within each comment. The comments have been edited for spelling and grammatical errors, as well as for inadvertent direct attribution. In some cases, comments contained two or more separate and distinct points. In such cases, only the portion of the comment relevant to each response category is provided in order to avoid what would otherwise be frequent duplication of material. For each question, many respondents indicated that the criteria, sub-criteria, or indicators in question were adequate. Such comments typically consisted of statements such as ‘The indicators are adequate.’ Specific comments of this type are not listed, but the number of such comments for each question is documented in each question next to the category heading ‘Adequate: No Suggested Modifications.’

FIGURE 3. NUMBER OF RESPONSES TO EACH QUESTION



THE CRITERIA OVERALL

Criteria are defined as conditions or processes by which sustainable forest management may be assessed. Therefore, sustainable forest management, as described by the criteria is concerned with the:

1. Conservation of biological diversity.
2. Maintenance of productive capacity of forest ecosystems.
3. Maintenance of forest ecosystem health.
4. Conservation and maintenance of soil and water resources.
5. Maintenance of forest contribution to global carbon cycles.
6. Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies.
7. Legal, institutional and economic framework for forest conservation and sustainable management.

Does the list of seven criteria above cover your broadest concerns about forest management, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (41 RESPONSES)

ADEQUATE: WITH COMMENT/QUALIFICATION

1. In broad scope the seven are fine -- however, they do not adequately address the fact that many issues are not best understood as being socioeconomic driven. There are important sociodemographic and sociocultural characteristics that are critical to attaining anything near sustainability.
2. Yes. Several criteria overlap and measure the same processes. For example, maintenance of productive capacity of a forest ecosystem is a direct product of maintenance of soil and water resources. I wonder if measuring the same processes twice skews the results.
3. This seems well thought out, but I cannot say for certain whether or not these cover my broadest concerns, because in my opinion, I do not have allotted time to carefully analyze each and every criterion. The 45 minutes suggested participation in the e-mail sent to me might be enough to carefully assess the first 2 criteria. Based on a brief review, it looks acceptable.
4. Yes, they meet my concerns although several intersect.
5. The seven criteria do cover my broadest concerns. However, I believe that several vitally important factors are missing from the document as now written.
6. In a very broad sense the 7 criteria cover my broad concerns. I would like to see greater emphasis on societal concerns. I feel these are going to become more important in the future.
7. For the most part yes...although WGA's experience is that much of forest sustainability plays out at the level of "communities." "Societies" may be a surrogate, but some mention of the operational level, where all these criteria get applied, might be worthwhile.
8. Mostly fit, but I would need to work with several in my area of natural resource management
9. Some of the subcomponents are only peripherally relevant or redundant. These seven criteria are

extensive and complete; certainly none need to be added.

10. Yes - in fact there is clear overlap among these 7.

INADEQUATE: WITH COMMENTS

1. The criteria do address the broad issues. The allocation where 5 of the criterion address biological elements and only 2 address the economic and social elements suggests that this approach is distorted.
2. No it does not. The criteria focus upon biological and economic measurement factors but do not focus enough upon the social and cultural values of the forests. Social and cultural values are hard to categorize and difficult to place a dollar value on. There needs to be an effective way to measure the social and cultural value
3. No. I believe is important to preserve and support traditional knowledge as a primary resource of forest systems and insure that the people who live close to the land have a means for continuing to practice a life-style that support continuation of that knowledge. Also, developing a means for reconnecting people as part of natural systems.
4. No. An additional consideration of conformance with ecosystem natural cycles is needed, whether by separate criterion, or as an inherent characteristic. By way of explanation, in managing seral types with a fire dependency for regeneration, but a long natural cycle, some clear cutting, and/or regeneration harvest should be included to assure regeneration. In contrast, natural rain forests and types with mixed hardwoods may never need the regeneration harvests. This will mean that there will be times when a cycle of management will temporarily reduce diversity during the regeneration period. As long as the rotation age, and the logging practices are adequate to assure the return of the diversity of the biological components, no damage is done. However if this element is not included, I fear that there may be a tendency to manage forests in a way that is not consistent with the natural cycle of regeneration required for maintenance of long-term health of the area.
5. No, it seems odd that the word "cultural" is never once mentioned when forests are extremely important for the role they play in the development and nurturing of cultural traditions. 'Socio-economic benefits' does not come anywhere close to encompassing all the aspects of what is encompassed by "cultural traditions". It is a very poor substitute, if that is what it is intended to be.

COMMENTS ON THE CRITERION OVERALL

1. The appropriateness of the criteria depends on the purpose and scale of the application. Sustainable forest management can be described as having several dimensions or applications: Ethic; Concept; Policy; Program; management application. These purposes are often unspecified when describing C&I but without doing so results in some confusion and misunderstanding. Criteria are useful as a framework for concept, policy and program applications and are appropriate for this purpose. The seven criteria are not needed to justify the sustainable forest ethic. For management purposes, criteria 1-4 are sufficient.

The hierarchy of SF dimensions is only partly related to scale. Large organizations like the Forest Service span all applications. At more localized scales however, especially on private ownerships, program and policy considerations are not a significant consideration. At local scales, the criteria of interest mainly relate to management objectives which do not depend on C-5, 6, &7.
2. These criteria reflect social and political interests in the forests of the world. However, they do not

allow for assessing the interaction among systemic processes in order to provide either an early warning of impending problems (social, political, economic, or ecological) or provide an insight into supportive or inhibiting processes for sustainability. This set of criteria expanded the Helsinki agreement with the addition of global climate change and the legal, institutional and economic framework. Nonetheless, there is nothing in these criteria that foster the kinds of cross-sectoral policy coordination, iterative and adaptive policy processes, or learning across organizations and communities that is now commonplace in other international agreements regarding forests. I would propose adding some of the criteria found in the FSC certification standards regarding labor protection, worker safety, health, community engagement, indigenous rights (this is partly in Criterion 7 now).

3. Keep Criterion 1, 2, 6. The remainder are redundant.
4. I think it is critical that the number of criteria must be kept to a minimum.
5. Criteria 1-5 also fit under Criterion 6. I have always been puzzled by the implied separation of many Forest functions from the Human Dimensions of ecosystems. Human values are always the underlying reason for Forest management. The Forests don't care only people care..... Why do we care about diversity? What is the definition of Ecosystem Health? Health for what purpose? - Aesthetics, commodities, clean air, pure water to drink, etc...I have no problems with the Criterion individually but I suggest they be reordered under a heading that recognizes that human values are the driving reasons for their development.
6. The seven Criteria very effectively cover the entire range of issues related to forest sustainability in temperate forests. They also allow us to evaluate forest, from both a scientific and a social context. The National Report on Sustainable Forests – 2003 offers several important messages on national trends and conditions for forest resources. The MP C&I framework and the National Report have created a “common language” that researchers, decision makers and professional resource managers can use to discuss and work toward forest sustainability at virtually any scale. These agreed upon indicators and their detailed definitions will contribute significantly to forest sustainability by helping stakeholders understand, assess and monitor progress at the scale appropriate to that stakeholder. This common language will also encourage data collection and analysis of C&I data at finer and finer scales that can eventually be used to make policy and sustainability decisions at all levels.

COMMENTS ON CRITERION 1

1. I would add “native” to Criterion 1: as in Conservation of native biological diversity.
2. I would hope that native forest diversity would be included somewhere. I'm not sure biological diversity includes it, but native forest types need to be sustained across the landscapes in which they occur.
3. I would like to see Criterion 1 modified by the addition of the words "with each species viable over most of its 'historic range'." Without these words or something similar it is easy for managers to claim success in preserving biodiversity even when populations are not large enough or occur over a large enough area to be viable in the long term.
4. I have never understood the logic of implementing standards for the conservation of biological diversity, ecosystem productivity or forest ecosystem health for the forestry land use when other uses of forest land such as residential development and agriculture are not subjected to similar standards. That said, Criterion 1, 2 and 3 should be combined under the heading "Conservation of biologically diverse, productive and healthy forest ecosystems." The real question: is the forest land base being retained and managed in such a way as to conserve the diversity of species, protect the

biological productivity of the forest sites and maintain the overall ecological system in balance so that the forest is sustained in the long run and can continue to meet the management objectives into perpetuity.

5. Could drop Criteria 1 & 4 if 3 is written right (or those could be merged into 3). All of these are nevertheless important.

COMMENTS ON CRITERION 2

1. Criteria 2 and 3 and 4 have substantial overlap. Criterion 2, as you defined it, is almost identical to Criterion 6 (with a little of 4 thrown in). I'd delete it.
2. Yes. Several criteria overlap and measure the same processes. For example, maintenance of productive capacity of a forest ecosystem is a direct product of maintenance of soil and water resources. I wonder if measuring the same processes twice skews the results.
3. See comment 4 under the previous category.

COMMENTS ON CRITERION 3

1. Criterion 3 is ambiguous enough, that you might consider replacing it with the two aspects not already included (Ecosystem Processes and Integrity, both of which are more clearly definable). [See comment 2 above as well.]
2. Criterion three is problematic. Ecosystem health is a concept only vaguely described. It means so many different things to different people. Ecosystems can be defined as many hundreds of squares miles or a small watershed depending upon who is talking about what. Health is in the eye of the beholder. Consider changing to something like measuring forest condition and tracking trends over time. That is something we can do.
3. Forest ecosystem health would seem to me to be more of a goal that is equivalent to sustainability rather than a criterion itself. The conservation or production of soil, clean water, biological diversity, forest products, etc., are the measurable outputs that will reveal the health or sustainability of forest management. I would drop criterion 3.
4. See comments 4 and 5 under criterion 1 comments.
5. See Comment 1 under criterion 2 comments.

COMMENTS ON CRITERION 4

1. It seems that air resources could logically be added to Criterion 4.
2. See comment 5 under criterion 1 comments.
3. See comment 1 under criteria 2 comments.

COMMENTS ON CRITERION 5

1. The list of seven criteria covers my broadest concerns about forest management, with the exception of Criterion 5. I would prefer that Criterion 5 be restated as: "Maintenance of forest contribution to global climatic cycles". Global carbon cycles are a subset of global climatic cycles. Forests also influence and are influenced by global climate in other important respects (e.g., in relation to

elements other than carbon, wind, and air quality, to name a few).

2. I think that it might be beneficial to broaden Criterion 5 to address more than just carbon sequestration. Forests are great at sequestering carbon and it is something that can be measured. Forests are also good at providing other benefits that may ameliorate global warming and biosphere abnormalities. It may be beneficial to insert language that would allow the development of additional measures that will provide benefits to the environment.
3. In its Forest and Range Assessment, entitled, the Changing California: Forest and Range 2003 Assessment, all seven criteria were used. Criterion 5 was broadened to Forests and Climate Change. This seemed much easier to understand.

COMMENTS ON CRITERION 6

1. No. Criterion 6 is too narrowly economic. Maintenance and enhancement of long-term and culturally significant multiple socio-economic benefits and values that meet the needs and well-being of societies would be much more inclusive.
2. In the broadest sense the criteria can potentially cover the concerns of workers and forest dependent peoples. However, the description of criterion 6 is inadequate as it misses most of the key indicators to determine social well-being and benefits. As such the legitimacy crisis facing the industry will continue. It is our experience that in those places where the social criterion is more well documented and prioritized as more important, the industry faces far fewer social and oddly enough environmental problems. The narrow range of social benefits which arise from criterion 6 as currently worded and practiced denies the industry the political base at the community level required to keep its social license to operate as witnessed by the dramatic loss of harvestable land during the past two decades
3. Yes, as long as Criterion #6 considers residents as an integral part of sustainability. I do not mean residents who work for large companies or sell to large companies, but people who make a living off the land as a small business, specifically making use of commercial and non-commercial forest products in addition to trees.
4. Yes, I think the 7 criteria are adequate assuming criterion 6 includes the need to meet society's other needs such as food and living space. Our forestry goals, needs and strategies, must [be] considered along with the goals and needs of the other sectors.
5. Overall, the seven criteria appear to be adequate. Regarding Criterion 6, "the needs of societies" I would suggest a better description would be "the needs and values of societies".
6. It's critical that sustainable forest management properly address cultural factors both as part of socio-economic analyses and independent of them. This is already done minimally for prehistoric and historical cultural resources, especially where tribes are concerned or areas of Euro-American historical interest. I would strongly suggest working closely with cultural anthropologists and geographers and rural sociologists to understand how to effectively identify and monitor cultural indicators.
7. Criterion 6: I believe that by addressing the other criteria, the social and economic issues can be brought forward through long-term environmental conservation. This is to say that society needs to work within a finite natural environment.
8. Criterion 6 & 7 best get at what I believe should be major criteria however they seem a bit vague and over-encompassing. Local ownership and control of forest resources should definitely be a criterion by which sustainable forest management may be assessed. When a local community has control over its own resources, the benefits of both sustainable development as well as

conservation of natural resources are retained directly by the stakeholders. When ownership is transferred to absentee forces, both the economy and ecology can become stultified. Of course, there are those examples of indigenous peoples ruining their own ecology. However, education, political, and technical advances encompassed in criterion 7 (?) should counter balance this primarily historic tendency.

9. Yes. I hope and trust that Criteria 6 and 7 will include attention to local cultural issues, including Native American and other indigenous and minority concerns.

COMMENTS ON CRITERION 7

1. I would seriously consider eliminating criterion 7 altogether. Most indicators under this criterion are stated so vaguely that the actual measurement endpoints that might be used to characterize the indicators are extremely unclear. As a result, the choices of sources of information are likely to be highly subjective and highly variable from one country to another. Different forms of government and institutional structures will tend to accentuate the above problem. Given all the above, it is difficult to justify the use of this criterion.
2. See comments 8 and 9 in the section immediately above.

SUGGESTED ADDITIONS

1. The individual criteria cover a wide range of issues. There should be one criterion that addresses how well a perfect condition could possibly meet all of the criteria simultaneously so that we have a reference condition to compare to. I suspect that no forest could score well for any single criteria. Without a reference how will we know how well we are doing?

Another criterion should address this issue somehow: In order to sustain forests are we creating bigger environmental issues by using non-renewable resources as a substitute for forests products at a higher cost to the environment? Example - burning coal instead of wood, or producing high energy non-renewable steel or plastic studs for building construction?

Another criterion should address: Overly dense forests, non-sustainable forests that have expanded beyond their historic range because of fire suppression and protection.

2. I would propose adding some of the criteria found in the FSC certification standards regarding labor protection, worker safety, health, community engagement, indigenous rights (this is partly in Criterion 7 now)
3. In its Forest and Range Assessment, entitled, the Changing California: Forest and Range 2003, ... subcategories were defined that in effect clarified the focus of the more general category and led to individual indicators of the more general category.
4. Maintenance of forest health [and] maintenance and enhancement of forest products and economy.
5. I recommend the addition of a Criterion that addresses Historic Range of Variability. Such a Criterion would address indications of sustainability not captured within the uncertainty that exists in all current criteria.
6. It seems that air resources could logically be added to Criterion 4.

SUGGESTED DELETIONS

1. Criterion 1, 2 and 3 should be combined under the heading "Conservation of biologically diverse, productive and healthy forest ecosystems." The real question: is the forest land base being retained and managed in such a way as to conserve the diversity of species, protect the biological productivity of the forest sites and maintain the overall ecological system in balance so that the forest is sustained in the long run and can continue to meet the management objectives into perpetuity.
2. Forest ecosystem health would seem to me to be more of a goal that is equivalent to sustainability rather than a criterion itself. The conservation or production of soil, clean water, biological diversity, forest products, etc., are the measurable outputs that will reveal the health or sustainability of forest management. I would drop criterion 3.
3. Keep Criterion 1, 2, 6. The remainder are redundant.
4. Criteria 2 and 3 and 4 have substantial overlap. Criterion 2, as you defined it, is almost identical to Criterion 6 (with a little of 4 thrown in). I'd delete it. Criterion 3 is ambiguous enough, that you might consider replacing it with the two aspects not already included (Ecosystem Processes and Integrity, both of which are more clearly definable).
5. Could drop Criteria 1 & 4 if 3 is written right (or those could be merged into 3). All of these are nevertheless important.
6. I would seriously consider eliminating criterion 7 altogether. Most indicators under this criterion are stated so vaguely that the actual measurement endpoints that might be used to characterize the indicators are extremely unclear. As a result, the choices of sources of information are likely to be highly subjective and highly variable from one country to another. Different forms of government and institutional structures will tend to accentuate the above problem. Given all the above, it is difficult to justify the use of this criterion.

OTHER COMMENTS

1. This format of e-study is cumbersome. Native plants define bioregions and nations. Reducing indicators is foolish; the black holes in the knowledge of our landscapes are many. Example, *Ligusticum porteri* and other medicinal plants may have values far greater than timber; all are connected (often with mycorrhiza). *L. porteri* is sustainably harvestable far more often than timber. No mechanisms exist for commercial harvesting of NTFP's for which there is no FORMAL knowledge. Local humans often have a great understanding of local forests; this knowledge often only exists within the world of locals. The locals are often NOT involved in forest planning even though they have interacted with a given forest for great periods of time. The Week's Act and the history of the creation of the NFS are pertinent- clean water. Rare and endangered plants moved into areas with fire suppression. Now this fire suppression "error" is being "corrected" without any study of nature's changes. locals matte
2. Biodiversity and human use seems to be balanced.
3. Private property rights in relation to societal demands.

CRITERION 1. CONSERVATION OF BIOLOGICAL DIVERSITY

The monitoring of trends important to the conservation of biological diversity has been divided into three sub-criteria:

1. Ecosystem diversity
2. Species diversity
3. Genetic diversity

These sub-criteria represent major aspects of the conservation of biological diversity. Do they do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (33 RESPONSES)

COMMENTS ON THE SUB-CRITERIA OVERALL

1. The lack of assessment of human dimensions will leave you unable to make informed decisions about the conservation aspect of biological diversity. For example, recent scientific studies on non-timber forest products clearly shows large numbers of people are engaged in harvesting, many of these having been a part of old traditions whereby intimate understandings of the habitat have been gained. I'm not referring to folklore but rather observations of species diversity at the local level. Many harvesters actively engage in actual experiments in the forest to better understand what stewardship of the resource looks like. Many are champions of maintaining biodiversity but frustrated at the lack of opportunities to build working relationships with scientists and managers. Other management practices like logging and cattle grazing have had severe impacts on the biodiverse habitats that nurture most non-timber forest product harvest regimes.
2. These criteria assume a natural world disconnected from its social context. I think that if these criteria connected diversity of ecological systems with diversity of social and political systems - as much new research is doing - we would have a much more robust measure of long-term sustainability of biological diversity. As we learn in nature reserves of many kinds, without the work of people to actively maintain and sustain biological diversity, it is easily diminished over time. This means that the artificial separation of natural and social criteria and indicators is a serious problem of sustainability assessment.
3. As a practical matter, the sub-criteria listed above need are not easily used. California focused on biodiversity and forest/range health. While valid, genetic diversity is too hard to measure and I would delete it. California used nine measures of biodiversity (historic loss of forests and rangelands; parcelization of forests and rangelands; area and distribution of habitat types; conifer forest structural characteristics-size and density; old growth forests; area and distributions of hardwoods; management and distribution of hardwoods; population status of native species; and status of T&E species. For forest health, six sub measures were used (land management activities; development; wildfire; pests and disease; exotic and invasive species; and air pollution). Under each of these sub-categories additional subcategories and indicators were defined.
4. How could there fail to be sufficient ecosystem diversity if species diversity was maintained? Fundamentally, ecosystems are made up of individual species and their interactions with the environment. Each species functions in response to other species and the environment. Cumulatively, these functions are the ecosystem. If species are missing, the variety of interactions and functions will be diminished resulting in a less complex system of life forms thus less ecosystem diversity. So why have separate categories for species diversity and ecosystem

diversity. I suspect that it is really more about the politics of natural resource management and the need to flash eco- words as often as possible rather than a scientific assessment of the long-term earthly need of mankind.

5. The sub-criteria you have identified relate to the Quality of Ecosystems only. A more comprehensive set of indicators would include: Quantity Indicators, Pressure Indicators, and Response Indicators.
6. An element of time needs to be considered. During some part of the rotation, the natural stands will undergo a reduction of diversity that will return as long as the rotation is long enough to return, and as long as stand entries are spaced appropriately both [in] space and time.
7. Again, I would differentiate between native and non-native in each of these.
8. Biodiversity (necessarily biological diversity) is usually defined as plant and animal species the structures and process necessary to maintain these species. Alternatively ecologists think of ecosystems as being topically organized in terms of composition, structure, and process/function. The Montreal Process framework (1) fails to harmonize with the well accepted definition of biodiversity or with ecology as a discipline, (2)"spreads" biodiversity across several criteria, and (2) separates ecosystem function (in other Criterion) from composition (this criterion). I can live it but it is awkward.
9. To be realistic in their application, these sub-criteria need to acknowledge and include metrics for conserving diversity in a dynamic context. As humans continue to influence and disturb ecosystems, biodiversity will respond. The sub-criteria should establish some absolute thresholds to let us know when we're succeeding or failing, but they should also include some 'normal' ranges, to illustrate that a system can look or function differently and still be healthy and diverse.
10. Need to provide the context on why these items are important to people.

COMMENTS ON MEASURING BIODIVERSITY

1. Ecosystem and generic diversity are fairly straightforward, simple to monitor and provide criteria directly related to the stability and functions of forested landscapes. Species diversity is more problematic. How diverse does an ecosystem have to be? Is that the same for early successional systems as opposed to mature ones? How many species? Or are their functions more important? Can we realistically even measure all the species in a system? How many of the rare species important? I'd rather see a criterion based on the functions that such species serve. Are all the trophic interactions represented? Is there some diversity within each? Can we use smaller groups (such as arboreal flying beetles) as a measure of such diversity? Anything to avoid overtaxing our taxonomists would be appreciated ... and preferably something that can be done quickly and efficiently. The world isn't able to wait 10 yrs for the result of a diversity study.
2. Monitoring trends requires that indicators be sensitive to change and that measurements be consistent and repeatable. These requirements must be stipulated for evaluating all indicators. Which of the sub-criteria is important, and when, depends on the scale of application. Ecosystem diversity, as measured by forest type, is a useful measure of diversity although its significance declines at larger scales. Species diversity is only useful if it can measure change with some degree of confidence. In the U.S., species diversity may be measurable for large regional landscapes but this indicator is relatively meaningless for local scales. On private ownerships, for example, diversity can only be defined in the context of the aggregate condition across surrounding ownerships. In countries where program and policy considerations must be defined at a smaller geographic scale, these sub-criteria must be used even if the scale is inappropriate.

3. To be realistic in their application, these sub-criteria need to acknowledge and include metrics for conserving diversity in a dynamic context. As humans continue to influence and disturb ecosystems, biodiversity will respond. The sub-criteria should establish some absolute thresholds to let us know when we're succeeding or failing, but they should also include some 'normal' ranges, to illustrate that a system can look or function differently and still be healthy and diverse.

COMMENTS ON SUB-CRITERION 1: ECOSYSTEM DIVERSITY

1. Ecosystem diversity is a slippery concept. Splitters can create many "ecosystem types" as in NatureServe, but these are not real entities like species are. This splitting creates pressure to create nature reserves all over the place. In Europe, classification of community types goes even farther to the absurd degree... These concepts, unlike some other indicators, lack baseline and lack sufficiency (how much is enough) standards.
2. This may be covered under social criteria, but the fracturing of forested lands is an important effect of an ecosystem. Specifically the conversion of forested land to other uses such as residential development. Conservation of biological diversity of an intact ecosystem may be better off than a fractured ecosystem.
3. Keep 1, 2, No. 3 is redundant.

COMMENTS ON SUB-CRITERION 2: SPECIES DIVERSITY

1. [S]pecies diversity is often used as a surrogate for old growth. These concepts, unlike some other indicators, lack baseline and lack sufficiency (how much is enough) standards.
2. Delete Species diversity; add "Native Species Diversity," not to be confused with exotic species.
3. 2 and 3 seem redundant if written right.
4. See comment 1 in section on measuring biodiversity above.
5. See comment 3 in comments on sub-criterion 1 above.

COMMENTS ON SUB-CRITERION 3: GENETIC DIVERSITY

1. I believe Indicators 8 and 9 (Genetic Diversity) should be eliminated. They are too vague (e.g., how small is "small") and generalized to be useful, and require too much effort to obtain information. They do not allow good comparison between areas, even areas having the same ecosystem types, due to the large amount of interpretation required in applying them. If a genetic diversity indicator is considered necessary under this criterion, it should be a single indicator that allows measurement with a reasonable amount of effort, that will be interpreted in the same manner by different individuals collecting and interpreting data and that allows a step-down analysis for regional and local use.
2. We know even less about genetic diversity, which is therefore a questionable conservation goal or indicator. There are very few field genetics people and little data... These concepts, unlike some other indicators, lack baseline and lack sufficiency (how much is enough) standards.
3. Genetic diversity could become extremely contentious.
4. I am unsure where genetic diversity applies, is in within species? If so this makes sense to me.
5. While valid, genetic diversity is too hard to measure, and I would delete it.

6. See comment 3 in comments on sub-criterion 1 above.
7. See comment 3 in comments on sub-criterion 2 above.

SUGGESTED ADDITIONS

1. Habitat or Community diversity. There is a level between Ecosystem Diversity, and Species Diversity, best represented by the "Plant Association" or "Plant Community" concept, which is very important, and not represented (generally) in these three concepts.
2. No. There needs to be a "1.5" of Population diversity (i.e., ecotype diversity). This may be considered part of "genetic diversity" but if genetic diversity only refers to the molecular level rather than the population level, it is too narrow. That is one species can manifest significantly different characteristics depending on the population of which it is a part. This is particularly important in considering native plant restoration.
3. I have proposed additions to criteria 2, 6, and 7 whereby net importation of wood and wood products would be considered. Under this criterion [criterion 1] there should be some measure of the extent to which biological systems outside U.S. borders, including rare and endangered plant and animal species in such systems, are impacted by U.S. net imports of wood and wood products.
4. I understand that for some medicinal plant species, the diversity of phytochemical compounds within populations is an important additional sub-criterion. For example, when considering conservation measures for a medicinal plant species, it is critical to understand and identify those populations which have special value to traditional or indigenous healers because of their phytochemical or medicinal value.
5. "Societal diversity" related to the economic demands placed on biodiversity over a spatial reference.
6. The sub-criteria you have identified relate to the Quality of Ecosystems only. A more comprehensive set of indicators would include: Quantity Indicators, Pressure Indicators, and Response Indicators.
7. A few of the concerns are the fragmentation of the landscape and anthropomorphic influences on ecosystem, species and genetic diversity.
8. Again, I would differentiate between native and non-native in each of these.
9. Delete Species diversity; add "Native Species Diversity," not to be confused with exotic species.

SUGGESTED DELETIONS

1. I believe Indicators 8 and 9 (Genetic Diversity) should be eliminated. They are too vague (e.g., how small is "small") and generalized to be useful, and require too much effort to obtain information. They do not allow good comparison between areas, even areas having the same ecosystem types, due to the large amount of interpretation required in applying them. If a genetic diversity indicator is considered necessary under this criterion, it should be a single indicator that allows measurement with a reasonable amount of effort, that will be interpreted in the same manner by different individuals collecting and interpreting data and that allows a step-down analysis for regional and local use.
2. As a practical matter, the sub-criteria listed above need are not easily used. California focused on biodiversity and forest/range health. While valid, genetic diversity is too hard to measure and I would delete it. California used nine measures of biodiversity (historic loss of forests and

rangelands; parcelization of forests and rangelands; area and distribution of habitat types; conifer forest structural characteristics-size and density; old growth forests; area and distributions of hardwoods; management and distribution of hardwoods; population status of native species; and status of T&E species. For forest health, six submeasures were used (land management activities; development; wildfire; pests and disease; exotic and invasive species; and air pollution). Under each of these sub-categories additional subcategories and indicators were defined.

3. How could there fail to be sufficient ecosystem diversity if species diversity was maintained? Fundamentally, ecosystems are made up of individual species and their interactions with the environment. Each species functions in response to other species and the environment. Cumulatively, these functions are the ecosystem. If species are missing, the variety of interactions and functions will be diminished resulting in a less complex system of life forms thus less ecosystem diversity. So why have separate categories for species diversity and ecosystem diversity. I suspect that it is really more about the politics of natural resource management and the need to flash eco- words as often as possible rather than a scientific assessment of the long-term earthly need of mankind.
4. Delete Species diversity; add "Native Species Diversity" not to be confused with exotic species.
5. Keep 1, 2, No. 3 is redundant.
6. 2 and 3 seem redundant if written right.

OTHER COMMENTS

1. These are the ones people usually cite so they are okay. However, I find it confusing if diversity is good or bad. Forest fragmentation certainly creates ecosystem diversity, which could be positive or negative. We should be clear in what it is we are shooting for.
2. Depends on how far they go and if they leave space for the unknowns. For instance, we are learning more and more about micro-biological interactions in the soil and among plants. Nature is a mystery and may always be. And man develops different ways of looking at things. Certainly the three items mentioned seem comprehensive, at least on a somewhat superficial level.
3. Yes. I hope and trust that Criteria 6 and 7 include concern for cultural issues involving local people, including indigenous and minority groups.

SUB-CRITERION 1A. ECOSYSTEM DIVERSITY

The indicators in this group describe the variety of different forest ecosystems found in a region. Ecosystems are combinations of animals, plants, microorganisms, and the physical environment with which they are associated.

Indicator 1. Extent of area by forest type relative to total forest area.

Indicator 2. Extent of area by forest type and by age class or successional stage.

Indicator 3. Extent of area by forest type in protected area categories as defined by IUCN (also known as the World Conservation Union) or other classification systems.

Indicator 4. Extent of areas by forest type in protected areas defined by age class or successional stage.

Indicator 5. Fragmentation of forest type.

This group of indicators is designed to address ecosystem diversity. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (17 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. Yes, although FOREST TYPE needs to be defined. If it is too broadly defined (as a cover type for instance), this measure becomes less meaningful.
2. The term "forest type" is somewhat vague. How are forest types defined? By the presence of specific types of tree species? If so, then the term forest type needs to be broadened to include a variety of nontimber forest species, as well as trees conceptualized as "timber" species.
3. These are quantifications of forest type data that form the basis for the indicators that follow. It is important to define the extent of the area that makes up the forest resource and to also define the make up of that forest resource.
4. Very appropriate at national and regional scales in the U.S. Forest type is a good indicator of diversity if the scale is sufficiently broad to recognize the aggregate and compensating effects of age and type changes that occur because of natural or management actions.
5. For any of these indicators: what is the expected condition or reference condition to which the current condition is compared or evaluated?
6. Not adequate. An ecosystem includes people. Many forests exist as they do because of Native American traditions of burning for deer and elk habitat, or because of other kinds of natural resource management activities by Natives or subsequent populations.
7. Many forest types contain areas of grassland, wetland or shrubland which are not strictly speaking forest but which are very important for ecosystem function. Somehow, this concept needs to be included into the criterion of ecosystem diversity.
8. These indicators were proposed by countries worried about loss of forest cover and land area and wanting to pressure governments to increase forest area. Currently the EU has an afforestation policy, its only real EU policy regarding forests, and these supports for afforestation are often at the expense of other land uses, like meadows supported by grazing or wetlands. While monitoring forests by area, type, age class and so forth is traditional, it does not seem to me to necessarily

provide information regarding sustainability. There needs to be some consideration of the relationship of forests to people, wildlife, other aspects of ecological systems like watershed, and so on. This emphasis on area presupposes that the critical indicator is amount and forest type, not location or quality or linkages to other ecological elements.

9. To the extent that data was available, California did track these factors. Since forests and rangeland vegetation changes over time, the significance of such factors is hard to know. At least in California, ecosystem diversity is defined heavily by past and current management patterns. Hence much effort has been put into developing a detailed picture of management landscapes (mix of population density, vegetation, ownership, and other layers of information). This understanding is probably more relevant to measuring the chance of sustaining ecosystem diversity than the measures above.
10. The framework for this is appropriate. Data on forest types may not be consistently available at larger geographic scales.

COMMENTS ON INDICATOR 1

1. Indicator 1 is good.
2. Some of these are meaningless. Indicator 1 will vary tremendously depending, for example, on whether you are in a boreal or tropical forest. Does less diversity imply non-sustainability? Absolutely not! Is it expected that these indicators will change significantly over time? I really don't see the value in #1.
3. How do indicators 1 and 2 inform the question of relative ecosystem diversity? A nation or political unit may have only a small area of forest and only one or two forest types. Depending on the management objective of these forests, they may have limited age class distribution. Whereas a very large political area or one with great physiographic diversity could be capable of supporting a wide variety of forest types and age classes. Furthermore, scientists are beginning to realize that species diversity and the resulting variety of ecosystems is dependent the physiographic and climatic features of a landscape so any relative measure of diversity must include an assessment of variation in non-biological factors of climate, topography and position on the earth. I suggest that absolute measures be dropped in favor of an index of species richness in relation to the physical settings available for forest species to occupy.
4. Criterion [Indicator?] 1 is an important baseline indicator for measuring overall forest ecosystem functions.

COMMENTS ON INDICATOR 2

1. Indicator 2 separates forest area by type...how is type defined? "Type" implies a discrete classification of the landscape; boundaries of types are fixed by the particular modeling system used. Forest landscapes consist of overlapping species distributions and this fact should be incorporated into the classification system. Quantifying area of forested landscapes based on discrete classifications (types) will produce inaccuracies based on the concept itself. A system of classification that takes into account the continuous nature of species distributions and level of certainty should be addressed quickly because species ranges are changing and will continue given increasing atmospheric CO₂ and temperature.
2. A forest type need not be in a protected area to be conserved (indicators 2 & 3). Many forestry systems maintain natural forest types.

3. Only Indicator 2 has any true relevance.
4. #2 is more dynamic and might be of interest (for example, if no younger age classes are present, you have a forest heading for senescence).
5. See comment 3 under indicator 1 comments above.

COMMENTS ON INDICATOR 3

1. Indicator 3 may undersample the complexity of local forests pretty substantially. In the San Bernardino National Forest, next to which I live, there are dozens of plant community types, many of them quite undescribed in the literature, and some of them "impossible" if one reads textbooks (mixing of coastal and desert forest types, for instance). I hope someone is making sure that forest types are defined to include everything.
2. A forest type need not be in a protected area to be conserved (indicators 2 & 3). Many forestry systems maintain natural forest types.
3. I would rather the word "protected" be deleted and use "conserved or managed" instead. Protected means nothing done, and it would seem to be the best interest to maintain the forest through management.
4. As well, local definitions of protection will differ from the IUCN categories.
5. Yes, the use of the IUCN categories is problematic. Too much overlap in the definitions among categories.
6. Indicators 3 and 4 could be combined.
7. Indicators 3, 4, and 5 are also very important for measuring both change and sustainability in rapidly urbanizing situations.
8. Indicators 3 & 4 both describe [the] extent of forest area that is protected. There is a tendency to think that more protection is better. One indicator should be adequate to cover this issue.
9. In the broadest sense, the area and proportion of forest ecosystems reserved in some form of protected condition provides some indication of the emphasis a society places on preserving representative ecosystems as a strategy to conserve biodiversity. What does the term "protected" mean? The fact that a forest ecosystem is "protected" does not insure the system will survive over time. Perhaps a better status would be the ecosystem is managed for long term productivity. If "protection" insures the ecosystem will not be developed into another use, e.g. pavement, housing, etc., then I can agree with the term. If "protection" means that active management is forbidden, then I disagree with the statement.

COMMENTS ON INDICATOR 4

1. See comment 6 in the section on indicator 3 above.
2. See comment 7 in the section on indicator 3 above.
3. See comment 8 in the section on indicator 3 above.
4. See comment 9 in the section on indicator 3 above.
5. See comment 10 in the section on indicator 3 above.

COMMENTS ON INDICATOR 5

1. Fragmentation measurement should be a very high priority.
2. Fragmentation of TYPE will be a hard thing to quantify. All of these will entail collecting of good inventory data regularly.
3. Fragmentation of forest land is more easily measured and probably more meaningful. Another way to express it might be: Where is forest land the matrix and where is it the patches in another matrix?
4. Indicators are adequate, but "fragmentation" is not yet adequately defined. Should replace fragmentation by "extent of forest area by human population density class" - appropriate scale of analysis would need to be defined - perhaps a unit of analysis on the scale of a county in the United States.
5. We would be well-served to add some details to Indicator 5 that would better describe sprawl and changes in forest across all of the indicators. Landscape ecology has developed useful fragmentation metrics, but they can be difficult for laypeople to appreciate and apply. Some additional thought on that info gap would be helpful.
6. For indicator 5, I question the remote sensing data. If "edge" is defined by roads, clear-cut patches, and water bodies, then I can see how "62 percent is within 150 m of forest land edge" but these types of "edge" do not necessarily impact forest adversely like agricultural edge does. In the West and Boreal zones, most of the forest is interdigitated with clearings such as grassland, shrubland, meadow, talus slope, or bog, even in the purely natural state. Thus this computation gives a misleading sense of fragmentation. What is really relevant is how much non-native land use fragments forest and how fragmented forest would be in the absence of human intervention. Similarly, fragmentation by roads is not the same for forest dirt roads as it is for divided highways that have 24 hr traffic and fences alongside them.
7. Question what measure is being used for Indicator 5 Fragmentation. Is it the loss over some time frame or landstat photo coverage? It is difficult to measure.
8. Indicator 5 is a good indicator but is not currently well defined--needs further refinement.
9. Indicator 5 is also meaningless. How is fragmentation to be measured?
10. Indicator 5 should be expanded to include forest conversion to other uses.
11. See comment 7 in section on indicator 3 above.

SUGGESTED ADDITIONS

1. Native vs. non-native species. Also indicate rate of change. A snapshot in time doesn't tell you much especially in times of rapid change. I would focus more on the "leading" indicators of sustainable health vs. the "trailing" ones such as forest fragmentation. Leading means that they are some predictive ability (e.g. housing starts and the economy) vs. reporting results after the fact (e.g. gross domestic product). This comment applies to most all the indicators.
2. I think that both these criteria are useful and vital. I would hope that we could add measures of fragmentation and connectivity to these indicators ... arising from the data itself (variation of forest by type, age and class) or from some additional algorithms dealing with exchange of organisms from one stand to another.

3. I would add an indicator for amount of geographical fragmentation of the ecosystem due to human activities.
4. Perhaps something should be included to address native forests vs. exotic plantations.
5. There needs to be some consideration of the relationship of forests to people, wildlife, other aspects of ecological systems like watershed, and so on. This emphasis on area presupposes that the critical indicator is amount and forest type, not location or quality or linkages to other ecological elements.
6. To the extent that data was available, California did track these factors. Since forests and rangeland vegetation changes over time, the significance of such factors is hard to know. At least in California, ecosystem diversity is defined heavily by past and current management patterns. Hence much effort has been put into developing a detailed picture of management landscapes (mix of population density, vegetation, ownership, and other layers of information). This understanding is probably more relevant to measuring the chance of sustaining ecosystem diversity than the measures above.
7. Would like to see some acknowledgement of the importance of urbanized settings somehow.
8. Watersheds. How the water moves through the entire system should be considered. The movement of water through out the system will impact the diversity within the system.
9. Invasive Plants and Tree/shrub Species added.
10. Many forest types contain areas of grassland, wetland or shrubland which are not strictly speaking forest but which are very important for ecosystem function. Somehow, this concept needs to be included into the criterion of ecosystem diversity.
11. I think some type of indicator is needed to describe the relationship of existing tree cover to planned or potential tree cover. We could have areas that are classed as forest, but have no tree cover such as a clear-cut. On the other hand we could have areas covered with trees that are not considered forest - such as orchards. We need to be clear on what we are trying to describe. Is tree cover the most important or forest cover?
12. Forest use.

SUGGESTED DELETIONS

1. Delete Indicator 4.
2. Only Indicator 2 has any true relevance.
3. Indicators 3 and 4 could be combined.
4. Indicator 3 & 4 both describe extent of forest area that is protected. There is a tendency to think that more protection is better. One indicator should be adequate to cover this issue.
5. To the extent that data was available, California did track these factors. Since forests and rangeland vegetation changes over time, the significance of such factors is hard to know. At least in California, ecosystem diversity is defined heavily by past and current management patterns. Hence much effort has been put into developing a detailed picture of management landscapes (mix of population density, vegetation, ownership, and other layers of information). This understanding is probably more relevant to measuring the chance of sustaining ecosystem diversity than the measures above.
6. Some of these are meaningless. Indicator 1 will vary tremendously depending, for example, on whether you are in a boreal or tropical forest. Does less diversity imply non-sustainability? Absolutely not! Is it expected that these indicators will change significantly over time? I really

don't see the value in #1. #2 is more dynamic and might be of interest (for example, if no younger age classes are present, you have a forest heading for senescence. Indicator 5 is also meaningless. How is fragmentation to be measured?

7. How do indicators 1 and 2 inform the question of relative ecosystem diversity? A nation or political unit may have only a small area of forest and only one or two forest types. Depending on the management objective of these forests, they may have limited age class distribution. Whereas a very large political area or one with great physiographic diversity could be capable of supporting a wide variety of forest types and age classes. Furthermore, scientists are beginning to realize that species diversity and the resulting variety of ecosystems is dependent the physiographic and climatic features of a landscape so any relative measure of diversity must include an assessment of variation in non-biological factors of climate, topography and position on the earth. I suggest that absolute measures be dropped in favor of an index of species richness in relation to the physical settings available for forest species to occupy. Reference my earlier comments regarding ecosystems and species.

OTHER COMMENTS

1. As long as USDA Forest Service is able to continue uniform annualized inventory information it should be readily available for each state and the country overall.
2. I don't know much about science. Natural systems seem to escape quantification rather frequently: deserts turn into forests, and vice-versa. I think the picture here has to come from a larger framework, and perhaps trickle down to this condition as we now know it.

SUB-CRITERION 1B. SPECIES DIVERSITY

The indicators in this group describe trends in the number and variety of species in the United States.

Indicator 6. The number of forest dependent species.

Indicator 7. 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.

This group of indicators is designed to address species diversity. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (16 RESPONSES)

ADEQUATE: WITH COMMENT/QUALIFICATION

1. These are good question, but only if the measures are consistent across political boundaries. Wealthy nations with a shorter history of intensive human development and relatively good land stewardship are likely to be more aggressive and comprehensive in their attention to species status than poor nations. Thus the history of species diversity may be lost for nations or political subdivision with a very long history of human development making comparisons difficult. Some political entities are likely to be more aggressive and accurate in tallying threatened, rare, vulnerable, endangered and especially extinct species. Some standard for the beginning of assessment is necessary.

COMMENTS ON THE SUB-CRITERION OVERALL

1. Both of these seem to be based on social values and will likely always be promoted, whether right or wrong.
2. These are all positive based indicators. What about negative indicators like exotics and deer density?
3. Words like "dependent" and "at risk" are subjective. These indicators are necessary but should be used judiciously.

COMMENTS ABOUT "FOREST DEPENDENT SPECIES"

1. It is impractical to monitor all forest dependent species. Some subset of forest dependent species should be specified. This could be vascular plants, vertebrate wildlife, guild, etc.
2. I like these, although defining "Forest Dependant" is non trivial, and if you look at the Northwest Forest Plan and the Survey and Manage Program, you can see what can happen with poor definitions. Also, the NUMBER of forest Dependant species is not as good a measure as the "status of forest dependant species", and might be as easy to measure. For example, you could have a fairly common species with fairly serious declining trends (white headed woodpecker), which clearly represents a non-sustainable situation, but which is not addressed (until it becomes at risk).
3. Number of forest dependent species in too large of a group hence is a statistic that would require local extirpations of 10 to 100s of species to get a statistically significant change. Forest generalist

species make up the vast bulk of forest dependent species and they are fairly robust to degradation and a fair amount of habitat loss. I would focus on the more ecological and hence statistically sensitive statistic of forest specialist species (~interior species).

4. The number of forest dependent species must include species at all successional stages of a forest, not just mature forest species.
5. It needs to be explicitly stated that "forest dependent" species includes those species such as fish and estuarine species dependent on continuous annual river flow which depends on intact forest watersheds. Species need not reside in a forest to be dependent upon it.
6. This set of indicators is inadequate. The term "forest dependent" is too ambiguous / subjective and will remain so for the foreseeable future. Likewise, classifications of species as being "at risk" are also too subjective. It would be much better to focus on population trends for a few indicator species in each country (selected by the countries themselves).

COMMENTS ON INDICATOR 6

1. Indicator 6 suffers from bias in the data that people provide. There is a tendency among conservationists to call many species obligate old-growth sp. when they are not. For example, there is no evidence that forestry activities have ever caused the extinction of a species, but saying that species are forest-dependent implies that they must have a fence put around them, which is nonsensical.
2. Indicator 6 should be not the number of forest dependent species. It should be the "list of species with primary distribution ranges located in forested landscapes.
3. These indicators are useful descriptors for national and regional scales in the U.S. Because species numbers are enumerated inconsistently, indicator 6 can not be used to monitor change or to compare different regions. Indicator 7 illustrates the difficulty of measuring this attribute consistency. Unless these indicators can be greatly improved, they should be eliminated because to maintain them is misleading.
4. Indicator 6 should not be limited to forest dependent species. This category should be dropped and trends should be monitoring for groups of species in forested areas. Also what is the definition of forest? If a forest is cut is it still in the same category? What about land that could become forest?
5. Number of species by taxa would be very interesting rather than just number of species. Certain areas are "hotbeds" of diversity of specific taxa, for example, salamanders in the southern Appalachians. Since no one knows the species diversity of invertebrates and nonvascular plants (not really), these answers would only be "known species."

COMMENTS ON INDICATOR 7

1. We should strengthen the weight of objective, scientific assessment in Indicator 7. Policy makers are working to shift legislation away from species conservation and more towards record-keeping. In the not-so-distant future, ESA and other laws/regs could play only a minor role.
2. This set of indicators is inadequate. The term "forest dependent" is too ambiguous / subjective and will remain so for the foreseeable future. Likewise, classifications of species as being "at risk" are also too subjective. It would be much better to focus on population trends for a few indicator species in each country (selected by the countries themselves).
3. The status of a given species can be very subjective and can change instantly when crossing

political boundaries. Need more clarification for indicator 7.

4. Indicator 7 needs to be revised.
5. 6 without 7 doesn't mean anything. Combine the two.
6. See comment 3 under indicator 6 above.

SUGGESTED ADDITIONS

1. In terms of "population diversity", the status of forest dependent species populations may also be at risk of not maintaining viable reproduction.
2. Seems like we should be measuring those species who's population is on the upswing as well. Ecosystems are dynamic and species (including man) come and go. A species may be declining because of factors outside our control, like weather patterns.
3. Need to consider management impacts on species diversity and need to look at the hybridization through activities such as the broadcasting of non site specific seed stocks.
4. Rate of change is important.
5. Local populations and subspecies may need more concern.
6. Exotic and non native invasive plants and tree/shrubs. Long term effects on our native forests.
7. Again, a "healthy" level of diversity is dependent on biome. Defining forest-dependent may be difficult. A real indicator might be along the lines of maintaining viable populations of species in their normal range, but even that is fraught with measurement difficulties.
8. I believe that additional criteria regarding access to habitat should be included. This would include primary habitat, and migration routes. Also, I would include criteria regarding impact of adjacent human activities on species diversity. I would assume that an adjacent international airport would have a different impact than adjacent farmland on species diversity, both present and in the future.
9. Number of species by taxa would be very interesting rather than just number of species. Certain areas are "hotbeds" of diversity of specific taxa, for example, salamanders in the southern Appalachians. Since no one knows the species diversity of invertebrates and nonvascular plants (not really), these answers would only be "known species."
10. Number of species within a specific ecosystem type.
11. I would very much like to see some measure of diversity of species within functional roles and the adequacy of functional roles with systems. Extinction is still a normal process, even if we've caused it to accelerate. But can we maintain sufficient diversity within guilds and assemblages to ensure a stable and productive forested landscape? Diversity of species within critical guild might be a good indicator.
12. There are always questions regarding the impact of activities on species composition. These indicators describe the importance of the forest as habitat for various species and also the extent to which those species are threatened or endangered.
13. California used versions of the above criteria. Limited data makes use of these criteria difficult. To the extent possible, we used trends in some species (large mammals, bird species within cavity nesting groups, and amphibians) as measures. Trends were also use for T&E species. Given the wide range of habitat needs of species, tracking trends in major habitat types (such as hardwoods and the sub-categories within hardwoods) could be added as an indicator.

14. These are all positive based indicators. What about negative indicators like exotics and deer density?

SUGGESTED DELETIONS

1. Indicator 6 should not be limited to forest dependent species. This category should be dropped and trends should be monitoring for groups of species in forested areas. Also what is the definition of forest? If a forest is cut is it still in the same category? What about land that could become forest?
2. These indicators are useful descriptors for national and regional scales in the U.S. Because species numbers are enumerated inconsistently, indicator 6 can not be used to monitor change or to compare different regions. Indicator 7 illustrates the difficulty of measuring this attribute consistency. Unless these indicators can be greatly improved, they should be eliminated because to maintain them is misleading.
3. 6 without 7 doesn't mean anything. Combine the two.
4. Indicator 6 says it all, drop Indicator 7 as overly "wordy."
5. Numbers of species are likely a better indicator than rarity.

OTHER COMMENTS

1. Again as long as the USDA Forest Service can continue annualized Forest Inventory and Analysis this information is available.
2. Once again, local knowledge rather than scientific knowledge may be more valuable to assessments. A good example is the gentleman who lives next door to me. His life long generational connection with the system is excellent and far superior to a person who spends only a couple of weeks in the summer in the field. Also, nature works in cycles, long and short term. It is not possible to extract knowledge when timeframes and observations are not in tune with those cycles.
3. Sorry, there is too much mystery and unknown in nature for me, myself, to be comfortable quantifying it all this way, at least without a caveat.
4. Need to indicate why we should care about these.

SUB-CRITERION 1C. GENETIC DIVERSITY

The indicators in this group describe possible changes in the genetic characteristics found within a species and among different species.

Indicator 8. Number of forest dependent species that occupy a small portion of their former range.

Indicator 9. Population levels of representative species from diverse habitats monitored across their range.

This group of indicators is designed to address genetic diversity. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (13 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. Somebody likes complexity. Both Sub-Criterion [indicators] are too vague because they are too complex for reality.
2. If species are rare because most of their habitat has been lost does making an issue out of the status of that loss solve any problems? Especially when we continue to lose all sorts of habitat.
3. This indicator is probably not a repeatable and quantifiable measure that would be useful for policy or program applications. Its application is more descriptive than quantitative. The indicator is a good description of policy objectives.
4. These indicators are difficult and should not represent just species populations on the edge but rather major forest type changes over time.
5. To the extent possible, these criteria have been considered...but they require much data to be meaningfully interpreted. We focused on T&E status and sensitive plant and wildlife species. Measuring available habitat seems like a good alternative to focus on genetic diversity.
6. I find the analysis of these indicators (I clicked on the links) shocking. Clearly there is no area in the US which has not had a loss of forest species. Similarly, over half of the bird species in the US have been significantly affected. Yet the text reads as if all is fine. These indicators provide a linkage between trends and changes in forest lands (a social, political, economic variable) and affects upon genetic diversity. With many more young stands of trees, obviously the loss of species is in older forests. Why doesn't the text say that? If these indicators are to be of any use, the analysis needs to be clear and honest.
7. Within the area of genetic diversity the concept of "site specificity", especially among plants needs to be explicitly recognized. We have found many instances where revegetation with the same species as originally occupied the site failed because the replacement plants were not site adapted.

The concept of "genetic bottlenecks" needs to be included in the discussion. In instances where a species has undergone a drastic reduction in numbers so that only a few individuals survived but then the population rebounded the numbers and range of the species might seem to be in good shape but genetically the population is very homogeneous. A case in point is the American Bison.

COMMENTS ON INDICATOR 8

1. Seem like good indicators, especially No. 8
2. Indicator 8 needs to be reworded to better convey its meaning. Is a measure of possible genetic loss rate a measure of genetic diversity?
3. Tell me, would a "dependent" forest species include microbes and other life forms that are part of the system? As we try and dissect information we lose the whole...the analysis needs to be broad and somewhat abstract to factor in the "unknowns" of systems.
4. No Montreal Process country, that I am aware of, has demonstrated any capacity to deal effectively with either of these at the present time, and most indicate they would be difficult to acquire. Indicator 8 is reasonable to preserve in principal. However, considering current and anticipated problems with monitoring these indicators, the value of retaining indicator 9 seems highly questionable unless someone can devise a rigorous, unambiguous, and reasonably objective method for deciding what constitutes a representative species. In the absence of such methods, numerous alternative sets of "representative" species could be specified in principal, displaying radically different results, depending on the set used.
5. Again, the number of forest dependent species should be changed to the "list of forest species whose ranges are a fraction of their former range.
6. Question 8 may be the only cost effective inquiry to address this question across very large geographic areas. It perhaps should read: Number of forest dependent species that are restricted to a small portion of their former range by factors of human development.
7. Again the extent to which species are dependent on the forest resource and affected is important to consider.
8. I would change Indicator 8 to read: Number of forest dependent species that occupy their historic range.
9. Indicator 8 is less subjective than indicator 7 and may allow 7 to be deleted.
10. Indicator 8 should be dropped because "forest dependent" is too ambiguous and subjective; as is the term "a small portion."

COMMENTS ON INDICATOR 9

1. No Montreal Process country, that I am aware of, has demonstrated any capacity to deal effectively with either of these at the present time, and most indicate they would be difficult to acquire. Indicator 8 is reasonable to preserve in principal. However, considering current and anticipated problems with monitoring these indicators, the value of retaining indicator 9 seems highly questionable unless someone can devise a rigorous, unambiguous, and reasonably objective method for deciding what constitutes a representative species. In the absence of such methods, numerous alternative sets of "representative" species could be specified in principal, displaying radically different results, depending on the set used.
2. As a crude measure, this should work, but is no substitute for finding out about actual genetic diversity--a small population can have a surprising amount of diversity, while some large widespread populations are remarkably homogeneous.
3. Without standardization, Question 9 is highly subjective. It should be dropped in any case. The status of genetic diversity is highly complex and does not lend itself to simple analysis.

4. Indicator 9 is excellent and emphasized monitoring. Monitoring should be the paradigm under which all ecological research should be conducted. Without good monitoring we don't know what happened, what we had, how much was there, where it was etc....so too in the future looking back.

SUGGESTED ADDITIONS

1. Indicator 8.5: Species populations (ecotypes) monitored across their distribution.
2. These are good but I'd like to see some measure of genetic diversity within a few key species as well.
3. I would recommend an additional criterion here as well regarding isolation or separation of forest fragments.
4. These indicators are difficult and should not represent just species populations on the edge but rather major forest type changes over time.
5. To the extent possible, these criteria have been considered...but they require much data to be meaningfully interpreted. We focused on T&E status and sensitive plant and wildlife species. Measuring available habitat seems like a good alternative to focus on genetic diversity.
6. There should be some measure of diversity of varieties and subvarieties of cultivated, semi-cultivated and non-cultivated plants (and perhaps animals). This encourages diversified agriculture and adaptation to a specific place, rather than monoculture.
7. Genetic profiles of species throughout the US and their relationships.
8. How about number of distinct populations of representative species, when that number can be determined? This would seem to have substantial bearing on genetic diversity.

SUGGESTED DELETIONS

1. These two indicators should be eliminated.
2. Indicator 8 should be dropped because "forest dependent" is too ambiguous and subjective; as is the term "a small portion."
3. Indicator 8 is less subjective than indicator 7 and may allow 7 to be deleted.
4. Without standardization, Question 9 is highly subjective. It should be dropped in any case. The status of genetic diversity is highly complex and does not lend itself to simple analysis.

Question 8 may be the only cost effective inquiry to address this question across very large geographic areas. It perhaps should read: Number of forest dependent species that are restricted to a small portion of their former range by factors of human development.
5. I would give it up on genetic diversity. We lack good direct indicators and we do not have a precise idea about what these statistics would tell us in terms the genetic diversity.
6. Both should be part of 1B.

OTHER COMMENTS

1. Okay - but we also have invaders such as the Pinyon Juniper in the Southwest - creating both species and genetic diversity.

2. I don't understand this one.

CRITERION 2. MAINTENANCE OF PRODUCTIVE CAPACITY OF FOREST ECOSYSTEMS

There are no sub-criteria for this criterion. The indicators in criterion 2 measure how well the nation's forests are growing (a measure of forest health) and the wood and forest products potentially available.

Indicator 10. Area of forest land and net area of forest land available for timber production.

Indicator 11. Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production.

Indicator 12. The area and growing stock of plantations of native and exotic species.

Indicator 13. Annual removal of wood products compared to the volume determined to be sustainable.

Indicator 14. Annual removal of non-timber forest products (e.g., fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable.

This group of indicators is designed to address maintenance of productive capacity of forest ecosystems. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (12 RESPONSES)

COMMENTS ON THE CRITERION OVERALL

1. The question of commodity and non-commodity production sustainability is a good question. The indicators address that question, but they really don't address the criterion of ecosystem productivity. An ecosystem or ecological system produces energy for its own consumption in a series of interwoven cycles. Production of commodities for human use and in particular, off-site human use is not part of forest ecosystem productivity. The criteria emphasize naturally functioning ecosystems, but clearly, civilization is better at measuring commodity production. Although I already submitted my comments on the first 4 criteria, I would now suggest that the assessment of species diversity and ecosystem function be separated from commodity production assessment so that it is clear as to what the indicators mean. The combined indicators for these two areas should be directed at determining if a balance between ecological preservation and commodity production is being maintained.
2. As I said before, these (all of them) seem very much like Criterion 6 - Economic and Social factors. If one wanted to maintain productive CAPACITY, the amount of Forested Land would be the measure (not the amount of land available for timber production). These indicators all should be part of 6. Delete this Criterion.
3. I think that overall quality and diversity of commercially desirable tree species is a very good way to measure some aspects of forest productivity. Exotic and invasive species are going to encumber every aspect of predictability in terms of production and sustainability.
4. If you start with timber as the primary indicator of intended use, this will never work. Forests support life, they are our "genetic" banks, and approaching the system per the value of human economics does not capture the true values.
5. The indicators are timber centric. Expand productive indicators to the full suite of ecosystem services. See Rudolf S. de Groot, Matthew A. Wilson, Roelof M.J. Boumans. A typology for the

classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics* 41 (2002) 393408.

6. The current definitions for this criterion needs to be refined and improved. They were suitable for the first approximation and National Report but they are not well suited for monitoring program or management accomplishments. Better definitions of "availability", growing stock, sustainable productivity, measures of wood and forest products, and a better understanding of how these differ across regions is needed. With these improvements, these indicators will be useful for most applications.

COMMENTS ON INDICATOR 10

1. Okay, but need to define what is meant by "Forest Land." Also need to define "available." If push comes to shove, timber in wilderness areas is available if the need and demand become great enough.
2. Indicators 10, 11 and 13 are very traditional measures where significant baseline data exists in many cases back fifty years through FIA and other sources. Adding exotic species and non-timber forest products is important but data sources are much thinner and agreement on definitions will be important.

COMMENTS ON INDICATOR 11

1. Indicator 11 should also take into account total growing stock on nontimber forest land. This would allow the possibility of making an explicit linkage to indicators under criterion 5 dealing with carbon cycling (since those are typically estimated with formulae related to volume of growing stock). Providing for the possibility of such linkage among indicators under different criteria could be very helpful in the context of future policy analyses. Such analyses would be more realistic if this kind of dependency among criteria and indicators is accounted for.
2. Good, though good have done some combining (like 11 and 12).
3. See comment 1 in section on indicator 10 above.
4. See comment 2 in section on indicator 10 above.

COMMENTS ON INDICATOR 12

1. Indicator 12: Make mention of the acres going from monoculture agriculture fields to monoculture pine plantations, thus no net loss in biodiversity.
2. See comment 2 in section on indicator 10 above.
3. See comment 2 in section on indicator 11 above.

COMMENTS ON INDICATOR 13

1. The most relevant one seems to be #13, but it all rests on "the volume determined to be sustainable". How is this done? Sustainable under what management regimen? I could have sustainable volumes at many different harvest ages under area regulation.
2. The term "determined to be sustainable" has caused people problems. Perhaps better wording would be harvest levels versus planned levels. If a country did not have a planned ASQ, or it could

not be aggregated from local plans, then biological potential versus harvest would be reported. This point is measuring whether harvest exceeds any defined sustainable level.

3. For indicators 13 and 14, the "devil is in the details". Who determines what is sustainable? What are the criteria for making the determination of sustainability?
4. See comment 2 in section on indicator 10 above.

COMMENTS ON INDICATOR 14

1. There isn't a good way to measure Indicator 14. It adds little to this Criterion.
2. Indicator 14 (aside from the e.g., being incomplete), compared to the level and/or means determined to be sustainable or culturally appropriate (perhaps as required). This is a huge issue among indigenous people, i.e., removing sacred NTFPs inappropriately or indiscriminately.
3. The indicators are comprehensive. Indicator 14 is particularly important, even though we don't have data to address it except for specific and limited locations and species.
4. Indicator 14 is critical. Scientific studies from temperate forests world wide are beginning to show that the relative economic, social, and ecological (biodiversity) values of nontimber forest products dwarfs timber production. Not only is it critical to look at the removal of NTFPs but also the impacts of removing timber (especially clearcutting) on NTFPs. For example, harvesters are reporting tremendous loss of value of medicinal herbs, edible mushrooms, and other NTFPs due to timber harvests.
5. In indicator, No. 14, how will "level determined to be sustainable" be determined and sustainable over what period of time? That method will be key.
6. Again all are good, question how to determine Indicator 14 unless there are permits such as in Iowa for ginseng otherwise no way for us to measure.
7. With regard to indicator 14, the area where I work, I need to know who sets the "level determined to be sustainable". Depends on who and what agenda is being pushed at any given time, the word sustainable has no meaning. Ex. In order to sustain my view outside my condo window of the Cascade Mountains, I cannot allow any harvest of any product. If so, my criteria for all timber harvest, on a sustainable level are translated to forest management criteria of no harvesting.
8. Indicator 14 will remain difficult to measure and will therefore be of questionable value. Rarely is there enough information to know what levels are harvested, much less what levels of harvest would be sustainable.
9. Add firewood and Holiday Trees to Indicator 14.
10. Except for Indicator 14, these Indicators are useful. Indicator 14 is hard to use. At least in California data on many non-timber products is limited. Over time, the nature of the products changes and "sustainability" is ambiguous. At best, it may be necessary to choose a few specific non-timber products, determine their significance as measures to forest productivity, and measure these few over time.
11. See comment 2 under indicator 13 above.
12. See comment 3 under indicator 13 above.

SUGGESTED ADDITIONS

1. I would add forest land area converted to other land uses. Hypothetically one could envision a scenario where primary forest was being lost to ag. or residential land uses, ag. was being lost to secondary forest, and the balance of forest lands stayed constant. Conversion would be an excellent statistic to indicate real impacts.
2. One missing criteria relates to loss of timberland by site quality. Maintenance of areas of high site lands is a good indicator.
3. There are no indicators to measure productivity and sustainability of the forest over time and whether the harvesting methods are hindering forest productivity and sustainability.
4. In terms of timber production some recognition of the factors affecting quality of the timber produced needs to be recognized. For example, in hardwoods second growth timber is of superior quality while in conifers old growth timber is of the highest value and quality.
5. These are all fine. But I'd like to see some measure of the management costs to maintain these production levels. In some areas, these are minimal as management efforts aim to use natural ecosystem processes to minimize losses and maximize gains. In other areas, we have a heavy reliance on insecticides, herbicides and fertilizers. In the absence of these inputs these areas would likely crash and not be productive.
6. In either this criterion (or in 6a or 7) there should be a measure of the extent to which wood and forest products production in each region and/or the nation is sufficient to meet regional and/or national consumption of forest products (i.e. a measure of net importation).
7. One REALLY serious issue, underaddressed here, is potential value of product vs. value being realized. In Mexico I have seen trees that would be worth several thousand dollars per tree (sic) to American cabinetmakers and woodworkers cut down to make a couple of ten-dollar railroad ties. The reason was that the local people could sell the ties, but couldn't get their wood to a good kiln that would dry it adequately for cabinetmaker uses. This sort of extreme market failure is very, very, very common throughout the tropics. Most tropical forests are realizing something like 1% max of what they could realize. This goes for the NTFP's too. Medicinal herbs for instance realize a tiny fraction of their potential value.
8. Some estimation of forest land of the correct age and species type for timber production (or other forest products) but at high risk to pests or disease.
9. No. Some measure of the losses of volume due to fire, disease, insects, and weather (wind, ice, etc.) should be entered in order to judge whether forest health is being maintained.
10. There needs to be some sub-criteria as to risk or hazard from Insects and diseases.
11. It seems to me that you have to somehow measure the commitment of landowners to a sustainable land ethic, when possible, in perpetuity. I was involved with the donation of a 160 acre piece of land on Washington Island in Wisconsin. It is a working forest and the land transfer had attached to it an FSC forest management plan. It is currently owned by the local land trust...a plan so that this forest would remain undeveloped forever. I believe, that we thought of just about everything. Maybe. I note that Gathering Waters of Wisconsin is considering a program of working landscapes. Once you know what management plan is on a property and how long into the future the plan is assured, you will do better with the indicators that follow.
12. Annual regeneration/reforestation of forested areas vs. removal.
13. I expect age class distribution projected by year is covered. That would be important to me.

14. Related to fragmentation, proximity of areas (organized by forest type) that are near roads, human development, etc. Fragmentation statistics can capture this to some degree, but I am thinking specifically about proximity as it might be relevant to susceptibility of invasion by forest pests.
15. The indicators are timber centric. Expand productive indicators to the full suite of ecosystem services. See Rudolf S. de Groot, Matthew A. Wilson, Roelof M.J. Boumans. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics* 41 (2002) 393408.

SUGGESTED DELETIONS

1. Good, though good have done some combining (like 11 and 12).
2. As I said before, these (all of them) seem very much like Criterion 6 - Economic and Social factors. If one wanted to maintain productive CAPACITY, the amount of Forested Land would be the measure (not the amount of land available for timber production). These indicators all should be part of 6. Delete this Criterion.

OTHER COMMENTS

1. Is this a trick question?

CRITERION 3. MAINTENANCE OF FOREST ECOSYSTEM HEALTH

There are no sub-criteria for this criterion. The indicators are worded to measure what is unusual, since all forests have insects, natural flooding, or temporary changes in soil that can affect forest ecosystem health.

Indicator 15. 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).

Indicator 16. Area and percent of forest land subjected to levels of specific air pollutants (e.g. sulfates, nitrate ozone) or ultraviolet B that may cause negative impacts on the forest ecosystem.

Indicator 17. Area and percent of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g. soil, nutrient cycling, seed dispersion, pollination) and/or ecological continuity (monitoring of functionally important species such as fungi, arboreal epiphytes, nematodes, beetles, wasps, etc.).

This group of indicators is designed to address maintenance of forest ecosystem health. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (10 RESPONSES)

COMMENTS ON THE CRITERION OVERALL

1. Indicators are by and large subjective and unmeasurable.
2. More on my reason for finding this problematic. None of these indicators can be measured in any but the most subjective way. What is the historic variation in of natural agents? How far back are we going - pre-European settlement? Before human disturbance? What is the base for "subject to a specific pollutant"? Would this be visible morphological impact? How about physiological change that can only be detected by very expensive testing if at all?
3. There are several potential sub-indicators listed for indicators 15, 16, and 17. How is a potential user of these indicators to determine which of these sub-indicators are most important to measure? More conceptual work is needed on these three indicators.
4. These seem to be relevant scientifically, but necessarily are measured against current knowledge: "range of historic variation", "may cause negative impacts", "indicative of changes in fundamental ecological processes". Therefore, as scientific knowledge changes, the reported values for these indicators might be expected to change. Thus, we may be measuring not a change in sustainability, but a change in the state of our knowledge. That's OK by me!
5. These indicators are too technical for management applications. They may be useful for developing national programs but are not sufficiently quantifiable for monitoring the effectiveness of programs or measuring trends. Defining the range of historic variation sufficiently for monitoring purposes is probably not possible.
6. Criterion 2 takes care of this issue, particularly as the term "forest ecosystem health" has no generally accepted definition.
7. These stressors work interactively, so considering the area of forest affected or at risk individually is not truly informative. Another indicator should be added to evaluate the cumulative stress

8. The criteria for forests dedicated to or expected to produce commodities should be subjected to different criteria than forest expected to function in an independent ecological manner. Commodity production forests should be subjected to indicator 15 and 16 but not 17. Forests, native or introduced, intensively managed for commodity production are inevitably dependent on continued human inputs. Perhaps the health of these forests should be measured by the non-target or off-site impacts of the human inputs that are necessary to maintain these intensively managed forests. Indicators should also take into account the broad, region or world-wide value of intensive commodity production in reducing human dependence on native naturally functioning forest managed for ecological preservation.

COMMENTS ON INDICATOR 15

1. Historic variation needs to have a better definition. However, the problem with the definition may actually be based in ideological differences among people asked to use the concept. In that case, the definition may be fine. The idea is to monitor variation from conditions that provided many wildlife, scenic or environmental services that came from former forest conditions, for example less intense forest fires.
2. These are fine although I think its really hard to say that any insect/storm/fire events are necessarily outside the range of natural variation as in Indicator 15 ... we really only have recent historical data for the past 100-150 years (maybe more for fire) ... much likely occurred before then. Basically, Indicator 15 works for exotics and effects of human encroachment.
3. Range of historic variation is problematic since little data are actually available, there are few resources to analyze the available data, and the results will be inaccurate. Nonetheless, with good monitoring TODAY we can get a handle on the current range of variability which quickly becomes the historic range of variability with the setting of the sun. Indicator 17 could be combined into indicator 15 since both rely on some knowledge of past conditions. "Diminished biological components" implies change which has to be detected. Without adequate monitoring no detection can accurately be made.
4. This is very important. Fire for instance is a very different thing from the old days. Fires now tend to be started by arson during extremely hot dry periods, instead of being started by lightning during rainy periods. The result is total holocaust that destroys normally "fireproof" trees and bushes, wipes out all wildlife over hundreds of square miles, etc., unlike natural fires.
5. I think these are GREAT! In Oregon, there is much debate about 15, since many in the industry think that the "historic range of variability" may not be applicable any longer, but I think it is the only reasonable measure.
6. Would like to see more coordinated effort to identify historic variation. I don't understand how to use that concept as well as I could.
7. Does this include the effect of fires beyond historic variations?
8. Indicator 15 should include severity of wildfires. Present trends indicate the severity of wildfires is increasing. They are burning hotter, faster, and are more difficult to control.
9. To further define the state of the forest resource it is imperative to illustrate the damage agents that have affected the growth and mortality of the various tree species. Indicator 15 can encompass all of the pests that have affected the forest and also those that have recently been introduced and are causing concern, and can be provided on an annual basis. The introduced pests can cause the greatest impacts, when there are no natural enemies and the tree species have no natural resistance.
10. Impacting agents are highly variable and differ greatly in importance from region to region and

even between one physiographic province and another. Indicator 15 may be most useful at the regional scale.

11. Indicators 15 and 17 suffer from vagueness that that will cause arbitrary assignment of forests to diminished biological components or processes beyond historic range of variation. By one measure, with the loss of the American chestnut 100 yrs ago, all eastern forests are suffering from diminished biological components or are beyond historic range of variation. These two indicators can not be made precise. They are fundamentally vague, and will reflect personal views on what is an extreme event or condition to be reported.
12. Hydrologic changes are important to forest health and sustainability in areas of the US. What is "historic" baseline?
13. Flooding and watershed, that is an important factor in how the system functions and the role the forest plays in transeaporation and water in the whole region.
14. Indicators that refer to area and percent are actually two separate indicators. Percent is a measure that requires a well defined base and can not be aggregated or disaggregated. It should be avoided as an indicator.
15. Indicator 15 considers at least 9 different processes and agents, representing very diverse effects. Some thought might be given to identification of sub-criteria under criterion 3. For example, insects, disease, fires, and storms might be distinguished as a set from exotics, land conversion, domestic animals. The former set represents effects that have naturally occurring baselines (and departures can be exacerbated by human influence). On the other hand, the second set, at least predominantly, is indicative of uniquely human influences. Moreover indicator 16 is comparable to the second set I mention under indicator 15. Overall, organization of measurement endpoints under this criterion might benefit from reorganization.

COMMENTS ON INDICATOR 16

1. Indicator 16. Some air pollutants (mercury for example) move internationally. This needs to be addressed.
2. To further define the state of the forest resource it is imperative to illustrate the damage agents that have affected the growth and mortality of the various tree species . . . The extent that air pollutants impact the resource is also important as human activities provide toxic chemicals that are detrimental to tree growth and survival.
3. Airshed data is important but still highly generalized and often very difficult to correlate locally. This is changing with more monitoring stations.
4. Not adequate. Why is indicator 16 only interested in air pollutants? All relevant pollutants should be considered.

COMMENTS ON INDICATOR 17

1. Good, but 17 must be absurdly difficult to measure with any degree of accuracy or confidence.
2. It is not as easy to quantify the changes in biological components; this is an indicator that would rely on more basic research and perhaps not as readily reportable.
3. Indicator 17 is highly important, but the "fundamental ecological processes" that are measured will once again differ from region to region and even site to site. Picking the right processes to measure in the right place is of great importance.

4. I recommend dropping indicator 17 in the interest of parsimony. Direct measures of the processes considered are obviously problematic, and the proxies used in the report are substantially redundant to data provided by other indicators (e.g., fire).
5. Indicator 17: haven't gone very far with this, and not nearly as far as would be needed. Yet to go much farther seems like a hopeless task, except with specific species or taxa or processes, in specific places, at specific times, that people just happen to be studying.
6. All of these are valid. Indicator 17 is hard to use.
7. Any way to measure the effects of invasive species on forest ecosystem health? It is somewhat covered under Indicator 17, but not quite.
8. See comment 8 in the section on overall comments above.
9. See comment 3 in the section on indicator 15 above.
10. See comment 11 in the section on indicator 16 above.

SUGGESTED ADDITIONS

1. These stressors work interactively, so considering the area of forest affected or at risk individually is not truly informative. Another indicator should be added to evaluate the cumulative stress.
2. Climate change is and will continue to affect forests on a worldwide basis. While is not an indicator in and of itself it needs to be included in the discussion.
3. There is no classification for land that has returned to forest cover after abandonment from agricultural use.
4. How about area and percent of forest in proximity to roads, human development, etc.? I suggest this because this type of proximity has substantial bearing on the vulnerability of forests to insects, disease, invasive species, and similar agents. I suggest that proximity to human access points is one of the most significant factors in the spread of forest health threats, and can be measured fairly easily depending on the scale of the analysis. This is related to the issue of forest fragmentation, but forest roads, trails, etc., are often overlooked in examination of fragmentation, and so the proximity indicator I propose might indicate something different.
5. I would add an indicator for adjacent land use planning, both current and future, to determine current impacts of adjacent land uses on forest ecosystem health, as well as potential future impacts.
6. There needs to be a section on Risks or Hazards from insects and diseases.
7. A more meaningful indicator would be related to ecosystem size, function, and fragmentation.
8. Forests, native or introduced, intensively managed for commodity production are inevitably dependent on continued human inputs. Perhaps the health of these forests should be measured by the non-target or off-site impacts of the human inputs that are necessary to maintain these intensively managed forests. Indicators should also take into account the broad, region or world-wide value of intensive commodity production in reducing human dependence on native naturally functioning forest managed for ecological preservation.
9. Any way to measure the effects of invasive species on forest ecosystem health? It is somewhat covered under Indicator 17, but not quite.

SUGGESTED DELETIONS

1. I recommend dropping indicator 17 in the interest of parsimony. Direct measures of the processes considered are obviously problematic, and the proxies used in the report are substantially redundant to data provided by other indicators (e.g., fire).
2. Indicator 17 could be combined into indicator 15 since both rely on some knowledge of past conditions.
3. Indicators that refer to area and percent are actually two separate indicators. Percent is a measure that requires a well defined base and can not be aggregated or disaggregated. It should be avoided as an indicator.
4. Criterion 2 takes care of this issue, particularly as the term "forest ecosystem health" has no generally accepted definition.

OTHER COMMENTS

1. As a friend, John Moore, said to me recently as I decried spotted knapweed, well, it's a native now. We must legislate known hazards ... and put those things on the books as a part of the human ethic as it proceeds towards a "friendship" with our environment. They must be part of our "every consideration" as we go forward in to the future of the human race. The Native americans and other ancients knew about this, we have lost a sense of it.

CRITERION 4. CONSERVATION AND MAINTENANCE OF SOIL AND WATER RESOURCES

There are no sub-criteria for this criterion although there are two obvious groups, soil and water indicators. The water indicators are used to monitor the health of aquatic ecosystems and as an indirect but integrated measure for how well forests are managed.

Indicator 18. Area and percent of forest land with significant soil erosion.

Indicator 19. Area and percent of forest land managed primarily for protective functions (e.g. watersheds, flood protection, avalanche protection, riparian zones).

Indicator 20. Percent of stream kilometers in forested catchments in which stream flow and timing has significantly deviated from the historic range of variation.

Indicator 21. Area and percent of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties.

Indicator 22. Area and percent of forest land with significant compaction or change in soil physical properties resulting from human activities.

Indicator 23. Percent of water bodies in forest areas (e.g. stream kilometers, lake hectares) with significant variance of biological diversity from the historic range of variability.

Indicator 24. 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.

Indicator 25. Area and percent of forest land experiencing an accumulation of persistent toxic substances.

This group of indicators is designed to address conservation and maintenance of soil and water resources. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (14 RESPONSES)

COMMENTS ON THE CRITERION OVERALL

1. Will there be baseline data available for these so we know what is historically significant? The danger is this baseline perspective will be known only when it is too late for recovery.
2. Most of these indicators are subjective and unmeasurable.
3. It is difficult to measure these adequately.
4. Criterion 2 takes care of this issue if one accepts that a "forest" is made up of more than trees.
5. Estimating "reference" condition, however it is described is not trivial. A major effort to get organizations on the same page is underway in the west but it is far from complete nor is it non-controversial.
6. Indicators 18 and 20-24 all include either the word "significant" or "significantly". How is significance determined? Who determines it?
7. There needs to be better agreement among scientists and the management community on efficient

and meaningful ways these could be measured. The indicators are fine, how to measuring them been coordinated. For example, for soil loss, what is wrong with measuring compliance with BMPs? It is more useful for management and gets to the point of how well the soil resource is being managed.

8. I believe the overall content of these indicators are well placed, I would change their tenor, i.e., rephrase them toward the positive: Area and percent of forest land without significant soil erosion.
9. These are good descriptors of soil and water resources but percent (indicators 18-24) is not a suitable unit of measure. Percent raises the question "what is the base" and can not be aggregated across different locations. Indicator 18,20,21,22 and 23 use the word "significant" which requires complex and subjective assumptions. Consequently, these indicators probable would not be an accurate measure of change.
10. These are land use and watershed indicators that are extremely useful in diagnosing problems within a watershed and developing programs to address these problems or negative trends. These types of indicators are particularly useful for state and local governments. Finer data is needed however before these indicators can serve the important role of decision support.
11. This suite of indicators is weak for four reasons: 1) the focus on soil erosion is only on what exists and ignores indicators of potential erosion; 2) there is no measure of the quality for in-stream habitat; 3) there is no measure of how factors interact to affect water quality (cumulative effects) and 4) data requirements for the indicators (especially 21 and 22) tends to be insufficient. The California Forest and Rangeland Assessment developed indicators as follows: land use in watersheds (percentages of areas of management landscape classes by selected watershed basins); TMDL status (including reasons for listing waters as impaired); trends in salmon population; monitoring results in private timber management practices; and the status of cumulative effects analysis. A system to estimate erosion hazard sensitivity following wildfire was also developed. I think that one indicator related to trend in quality of in-stream habitat and one for cumulative effects need to be added.

COMMENTS ON INDICATOR 18

1. These are all useful indicators for the criterion. Individually: Indicator 18, what is the time frame? Do areas of past serious erosion that are recovering and productive count?
2. Indicator 18 suffers from lack of a baseline and lack of consideration of local conditions (mountains will erode more than flat land under any conditions).

COMMENTS ON INDICATOR 19

1. Indicator 19 speaks to land MANAGED for protective functions while other indicators, such as 18 speak to the results of management. Should not Indicator 19 also speak to outcomes rather than methodology? For example, rewording Indicator 19: Area and percent of forest land functioning primarily for protective purposes (watersheds, flood protection, avalanche protection, riparian zones).
2. Indicator 19. Most forests are managed with many objectives, including protecting water quality. We could interpret this question broadly.
3. Indicator 19, it is sometimes difficult to separate management objective when ecological protection and physical protection applied on the same land area.
4. Indicator 19 has no entry in the prior report precisely because it has no meaning. Let us assume

that good forestry practice produces watersheds that do not need any special protection measures (especially compared to agricultural watersheds). Then the measure would be 0 because none are in place even though none are needed. Similarly, the measure assumes that more riparian protection (stream-side buffers, etc.) is better, but this may not be the case. A managed forest provides excellent flood control without any special protection activities. The measure fundamentally suffers from trying to quantify the "protective measures" rather than the adequacy of protection achieved.

5. There might be some measure of percent of stream km in forested catchments with "natural riparian habitats", that would be more meaningful than measure 19. In Oregon, all streams have a 50 foot buffer by law, except for federal lands, which have larger buffers 300 feet, or larger. This however, is NOT a good indicator of what the streams or riparian habitat actually looks like, in spite of the management intent.
6. Indicator 19 is more of a measurement of forest land area where management options have been reduced do to the encroachment or establishment of human populations in close proximity to the forest. Management tools such as fire can also be limited in these areas. Is it a positive or negative indicator?

COMMENTS ON INDICATOR 20

1. Some of these indicators require substantial (and in my view, unnecessary) monitoring. For example, #20 sounds like it would require extensive networks of stream gauging stations to count these kilometers of streams. Wouldn't it be just as well to look for morphological evidence that extreme stream flow events are altering ecosystem functions?
2. Indicator 20, 23, 24: Our Southern landscapes have been so manipulated by man that it is next to impossible to find reference sites or near historic references.

COMMENTS ON INDICATOR 21

1. We are now more aware that timber harvests from some very infertile geologies will be such an impoverishment that the site may not grow to completion of a new crop. Timber is not everywhere then a renewable resource. The Monongahela [National Forest] has identified low nutrient capitol as a concern.
2. Indicator 21, the reference to chemical properties should specify changes in chemical properties that result in physical loss of soil or loss of soil productivity. Some management techniques change chemical properties of soils to improve productivity.

COMMENTS ON INDICATOR 22

1. Indicator 22 should include area impacted by rutting from logging equipment.
2. Indicator 22, a similar comment in regard to physical properties (see comment 2 in the section immediately above).
3. Yes. Indicator 22 bears close watch and explanation however. When forest areas become heavily used recreation sites, it is commonly accepted practice to do site modifications to armor the site against erosion and compaction by construction of trails, roads and construction of impervious surfaces (paving or other covering of the soil mantle). A measure of the proportion of heavily used sites that required some form of modification or armoring should be included.

COMMENTS ON INDICATOR 23

1. 23 seems like it doesn't fit here; is redundant with part of Criterion 1. All good, but huge task to quantify.
2. See comment 2 under indicator 20 comments.
3. I'd be curious as to the source of the indicator 23 background. Our group in aquatic monitoring is the only program I'm aware of that is providing tools to states to do surveys of condition on a regional basis of biological condition. The statement that 30 states are developing tests and 5 are using such tests in regulating water quality is news to me and we are presently supporting EPA's OW in the first national survey of condition.

COMMENTS ON INDICATOR 24

1. Similar to comments I made under criterion 3, I fail to see the reasoning behind indicator 24, which covers a variety of chemical and physical measures about water bodies. It is a hodge-podge, and would tend to invite inconsistent approaches among countries. Why not identify chemical and physical sub-criteria and then enumerate specific indicators for pH, dissolved oxygen, etc. Again, adding this sort of organization to the structure of information would seem to have some potential for more usefully informing policy. Other than this criticism of 24, the measures defined under the other indicators are adequate.
2. See comment 2 under indicator 20 comments.

SUGGESTED ADDITIONS

1. Ways to measure improvements in soil and water quality
2. This criterion needs an indicator for the biological health and diversity of forest water bodies, both streams and lakes/ponds. Determining the number and diversity of aquatic organisms would be a far better indicator of aquatic ecosystem health than the current indicators. It is also easily measured, and allows for step-down analysis at a regional and local level. The absence of a measurement of the biological diversity of aquatic organisms to determine health of aquatic ecosystems in forest habitats is the single most serious shortcoming of the Montreal Process Criteria and Indicators.
3. Yes. Indicator 22 bears close watch and explanation however. When forest areas become heavily used recreation sites, it is commonly accepted practice to do site modifications to armor the site against erosion and compaction by construction of trails, roads and construction of impervious surfaces (paving or other covering of the soil mantle). A measure of the proportion of heavily used sites that required some form of modification or armoring should be included.
4. Conceptually, and related to potential policy implications, it would be useful to sort the indicators into two sets of sub-criteria for soil (18, 21, 22, 25) and water (20, 23, 24) with 19 standing alone as it tends to span the two.
5. This suite of indicators is weak for four reasons: 1) the focus on soil erosion is only on what exists and ignores indicators of potential erosion; 2) there is no measure of the quality for in-stream habitat; 3) there is no measure of how factors interact to affect water quality (cumulative effects) and 4) data requirements for the indicators (especially 21 and 22) tends to be insufficient. The California Forest and Rangeland Assessment developed indicators as follows: land use in

watersheds (percentages of areas of management landscape classes by selected watershed basins); TMDL status (including reasons for listing waters as impaired); trends in salmon population; monitoring results in private timber management practices; and the status of cumulative effects analysis. A system to estimate erosion hazard sensitivity following wildfire was also developed. I think that one indicator related to trend in quality of in-stream habitat and one for cumulative effects need to be added.

6. These are adequate, and there are a lot of them. In the northwest, wood in the stream is a good indicator of forest hydrological function, although this might be addressed by Indicator 20. There might be some measure of percent of stream km in forested catchments with "natural riparian habitats", that would be more meaningful than measure 19. In Oregon, all streams have a 50 foot buffer by law, except for federal lands, which have larger buffers 300 feet, or larger. This however, is NOT a good indicator of what the streams or riparian habitat actually looks like, in spite of the management intent.
7. Some of these indicators require substantial (and in my view, unnecessary) monitoring. For example, #20 sounds like it would require extensive networks of stream gauging stations to count these kilometers of streams. Wouldn't it be just as well to look for morphological evidence that extreme stream flow events are altering ecosystem functions?

These are heavily weighted to hydrologic issues. Soil fertility indicators are perhaps incidentally included in #21; should receive more weight.

8. The soil aspects it addresses are: soil erosion, soil organic matter, soil chemical properties, soil compaction and physical properties, and toxic substances. It does not address the biological aspect of soil, specifically soil macrofauna and microbes. The soil biology is key in determining soil and ecosystem health and should be included in the indicators.
9. It is nice to see summary information. The information may be more useful if it was broken down by physiographic region and listed the major no point source pollutants and contributing factors for that region. This would allow professionals to use their best judgment when developing best management practices for the region, especially when designing BMP function as related to a particular area. The rate of change would also be a nice addition.
10. There needs to be better agreement among scientists and the management community on efficient and meaningful ways these could be measured. The indicators are fine, how to measuring them been coordinated. For example, for soil loss, what is wrong with measuring compliance with BMPs? It is more useful for management and gets to the point of how well the soil resource is being managed.
11. There is a need to monitor the BMP implementation rather than the water quality to insure that BMPs are being used.
12. I would think that road density or stream crossing density would be good as would percent of forested watersheds with > 20% area in forest =<40 yrs old or in non-forest.
13. Areas and percent of watersheds with approved management plans/programs in place.

SUGGESTED DELETIONS

1. Indicator 19 has no entry in the prior report precisely because it has no meaning. Let us assume that good forestry practice produces watersheds that do not need any special protection measures (especially compared to agricultural watersheds). Then the measure would be 0 because none are in place even though none are needed. Similarly, the measure assumes that more riparian

protection (stream-side buffers, etc.) is better, but this may not be the case. A managed forest provides excellent flood control without any special protection activities. The measure fundamentally suffers from trying to quantify the "protective measures" rather than the adequacy of protection achieved.

2. Some of these indicators require substantial (and in my view, unnecessary) monitoring. For example, #20 sounds like it would require extensive networks of stream gauging stations to count these kilometers of streams. Wouldn't it be just as well to look for morphological evidence that extreme stream flow events are altering ecosystem functions?
3. Criterion 2 takes care of this issue if one accepts that a "forest" is made up of more than trees.

OTHER COMMENTS

1. In areas where forests are a minor landcover, such as Midwestern or central plains region of the country - where do riparian buffers come in? We measure the # and miles of riparian buffers in cooperation with USDA NRCS.

CRITERION 5. MAINTENANCE OF FOREST CONTRIBUTION TO GLOBAL CARBON CYCLES

The relationship between forests and the carbon captured or released into the atmosphere has become very important. Carbon sequestration is considered a major environmental service of forests and a domestic and international issue. These indicators are informed by the data generated by reporting on the indicators in Criteria 1 and 2.

Indicator 26. Total forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age class, and successional stages.

Indicator 27. Contribution of forest ecosystems to be the total carbon budget, including absorption and release of carbon (standing biomass, coarse wood debris, peat and soil carbon).

Indicator 28. Contribution of forest products to the global carbon budget.

This group of indicators is designed to address maintenance of forest contribution to global carbon cycles. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (18 RESPONSES)

ADEQUATE: WITH COMMENT/QUALIFICATION

1. These are fine. I love the idea of carbon credits, although I do wonder about the real significance in addressing potential climate change. So generally, this seems less significant to me than Criterion 1 or 4.
2. These indicators are adequate. There is need for a system of computing carbon content of forest species more accurately than what is currently available. Research should be conducted that allows more precise and accurate calculation of carbon content in all forest ecosystem components including the soil.
3. Yep although I guess most of this is done by modelers?

COMMENTS ON THE CRITERION OVERALL

1. Again, this depends on definition of forest. Are we interested in forest per se or any tree covered lands? If the former, how do we separate and where are other tree covered lands accounted for?
2. Criterion 5 is too narrowly framed, as indicated earlier.
3. I think mathematics has something to offer here and I know nothing about that subject. It is important that we maintain homeostasis; we can choose to ignore it to our peril. I do think that science can help us with this.
4. We are now in the age of Kyoto and carbon credits will be traded in a market system. There is still apparently limited agreement on definitions for key parameters impacting carbon budgets. Carbon incentives offer tremendous hope for providing dollars for future ecosystem protection, reforestation and ecosystem restoration. This will require better measures, more agreement on definitions, better data and a greater understanding of these issues by the public. We need to make an extremely complex issue seem a little simpler.

COMMENTS ON INDICATOR 26

1. A complete answer to #26 would indicate answers to #27 and #28. If a complete carbon balance is developed at two points in time, and carbon in products is adequately accounted for, then you have all the answers you need.
2. Indicator 26 may be useful but indicators 27 and 28 are not repeatable or comparable over time-- requires a complex definition and assumptions about global carbon budget. Although they may have application for national policy, they are certainly not useful for management applications.

COMMENTS ON INDICATOR 27

1. See comments on indicator 26 immediately above.

COMMENTS ON INDICATOR 28

1. See comments on indicator 26 above.

SUGGESTED ADDITIONS

1. All indicators are fine - would suggest adding an indicator on number of acres or hectares of tree planted.
2. An indicator needs to be added more meaningful to forest managers. The existing indicators, although important, perhaps more interested to global warming negotiators.
3. This is a big one. Internationally valid carbon credits are coming, and US forest stakeholders can play an active role or sit back and accept the results. Montreal Process revision could mean a significant step forward in terms of quantifying forest carbon sinks, sources, and flux. I would really like to see some additional quantitative detail under all three indicators -- especially related to baselines, accuracy, and uncertainty -- and a fourth Indicator that measures the amount of knowledge we have and are developing. We need to acknowledge scientists and policy experts who are contributing to this and encourage them to invest even more time and effort.
4. A general summary of the information we currently know and where the big gaps in information are would be helpful.
5. If carbon sequestration is the only impact of possible global climate change measured in indicators, then Criterion 5 could be more complete. Examples of indicators are: alteration of extent and composition of forest and range ecosystems; impact on frequency and intensity of wildfire, especially near wildland urban-interface areas; impact on insect and disease damage to forests; impact on movement of exotic species.
6. If wood is harvested for bioenergy and thereby offsets fossil emissions, this should be tabulated as a positive indicator of forest contributions to global carbon cycles.

SUGGESTED DELETIONS

1. Perhaps indicator 26 and 27 could be combined.

OTHER COMMENTS

1. Not needed in the Southern US. There is a surplus of carbon and the strict rules do not apply.

CRITERION 6. MAINTENANCE AND ENHANCEMENT OF LONG-TERM MULTIPLE SOCIO-ECONOMIC BENEFITS TO MEET THE NEEDS OF SOCIETIES

This criterion has been divided into five sub-criteria. Because of the importance of this criterion it has many indicators.

Sub-criterion 6A. Production and consumption

Sub-criterion 6B. Recreation and tourism

Sub-criterion 6C. Investment in the forest sector

Sub-criterion 6D. Cultural, social and spiritual needs and values

Sub-criterion 6E. Employment and community needs

These sub-criteria represent major aspects of the maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies. Do they do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (18 RESPONSES)

ADEQUATE: WITH COMMENT/QUALIFICATION

2. These sub criteria are fine, but I would like to see cultural traditions made into a separate criteria, rather than being a sub-criterion.
3. These are useful descriptors of context and will be helpful for policy and program applications. They are not especially useful for defining management objectives on private lands.
4. Yes they do. The ones that are difficult to place a dollar value on should be weighted on some type of scale. Public consultation by itself is not enough.
5. Yes. I would emphasize the importance of the cultural, social, and spiritual needs and values.
6. Yes - assuming they are weighed equally and are not listed in any competitive order.

COMMENTS ON THE SUB-CRITERION OVERALL

1. In my opinion the major criterion is misstated -- 6a, 6b, 6c, and 6e clearly address economic issues and probably drive the effort here, and I think that is a problem. People own their woods for many reasons and when they are asked the economics of owning is generally not at the top of the list. Instead, measures that are in part captured by 6d are often cited -- and these are not in the economic realm by any means. much more attention to this grouping is necessary to adequately address noneconomic drivers of sustainability.
2. A very important criterion. All sub-criteria must be considered in any "management" scheme. This criterion recognizes that humans are an integral and in most senses a superior part of the system.
3. There is the obvious problem that "money talks." Large scale economic interests bulk very large because of the amount of investment. Local poor people don't count because they don't have much investment. Subsistence activities, in particular, produce "no income" or very little--on paper. In Mexico, I work with the Maya, who are usually subsistence farmers. I have calculated that the

average Maya subsistence family gets from the forest goods that would cost them about \$3,000 US to buy. Multiply this by the number of subsistence-farming families--several hundred thousand--and it is a very large amount of money--yet it is totally uncounted in statistics. SO it looks like an economically good idea to eliminate the forests for a few dollars' worth of cattle or the like. This is doubly problematic in that it isn't just money to the Maya. Even in the United States, local small-scale use of forests, for everything from recreation to mushroom gathering, is often uncounted in statistics.

4. Need to account for how the forest sector fits in with the other needs of society such as the need for food and living space. We can make all kinds of plans for the forest but if a growing population of people need food, then the forest lands may be threatened unless we take actions to mitigate the potential impact. That may mean putting more resources in to improving agriculture as well as forest management.
5. Maintain on public lands but let private ownership dictate the need on their lands.
6. I am sorry; society needs to meet the needs of our environment. The environment will win every time. Given that as a preface it is possible to engage society and economics.
7. I suspect that the real reason there are so many indicators in this category is more related to the composition of the team that developed these and the propensity of economists to over-quantify than to the importance of this criterion!
8. These are general terms that do not mean much until their indicators are reviewed. Beneath these sub-criteria are things like investment in general infrastructure and changing social values. Such items are dealt with by later by institutional and economic indicators, but incorporation of indicators related to general institutional structure and public values might be an improvement. In addition, many socio-economic impacts combine to influence general economic well being. In the California Forest and Rangeland Assessment, a composite index of economic well being was developed. This could serve as a model for an additional criterion.
9. It is exciting to see these socio-economic parameters measured to parallel to ecological function and forest productivity. This will help us eventually truly nail down an accepted value for ecological services. We still need finer scale data.
10. Ecosystem stability is something that should be included under the heading of socio-economic benefits. This includes such things as water flows, flood protection, climate moderation and other factors derived from having a stable, resilient forest in place.

COMMENTS ON SUB-CRITERION 6A

1. No. Sub-criterion 6A should just acknowledge: "Commercial production and consumption" and be less "coy."

COMMENTS ON SUB-CRITERION 6C

1. Investment should be more refined to categories that could involve productivity, diversity or controlling invasives.

COMMENTS ON SUB-CRITERION 6D

1. Sub-criterion 6D should be revised: "Cultural, social and spiritual needs and values, including those of indigenous peoples."

SUGGESTED ADDITIONS

1. Please add something that deals with land tenure arrangements, stewardship practices, and co-management options.
2. I would include a criteria based on future adjacent community growth and it's impacts on the socio economic benefits of the forest. We need to plan ahead for impacts to our forests, and mitigate the negative impacts.
3. Not adequate. True local input should be a sub-criterion. By local input, I do not mean input by large companies who operate locally. I mean input by people from the community, including those who do not have any economic ties with large companies.
4. The integration of the socio-economic benefits to the various other categories would be helpful. There is often a disconnect between the basic research and application of the research in practical terms.
5. These sub criteria are fine, but I would like to see cultural traditions made into a separate criteria, rather than being a sub-criterion.
6. Private vs. public property ownership/rights. Role of regulation in this process is important.

SUGGESTED DELETIONS

1. Perhaps 6D and 6B could be combined. The rest are adequate.

OTHER COMMENTS

1. These seem more like categories of indicators rather than sub-criteria. Maybe there is no difference.
2. Could have many indicators because the designers were splitters instead of lumpers.
3. Historical

SUB-CRITERION 6A. PRODUCTION AND CONSUMPTION

This group of indicators describes trends in the production and consumption of forest products, including:

Indicator 29. Value and volume of wood and wood products production, including value added through downstream processing.

Indicator 30: Value and quantities of production of non-wood forest products.

Indicator 31. Supply and consumption of wood and wood products, including consumption per capita.

Indicator 32. Value of wood and non-wood products production as percentage of GDP.

Indicator 33. Degree of recycling of forest products.

Indicator 34. Supply and consumption/use of non-wood products.

This group of indicators is designed to address production and consumption. Do they do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (14 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. On what basis will these indicators be figured? For example how would degree of recycling of forest products for one national forest be determined?
2. Not adequate. Production and consumption should be focused on local production and consumption, with local ownership (not sharecropping or subcontracting) being an important component of determining whether something is locally produced or consumed.
3. These indicators are only measurable at regional or national scales and therefore are only applicable for policy or program applications.
4. Yes they do. These should be measured through time and as the value increases so should the weighted value on social and cultural concerns.
5. Okay. As long as there is an historical reference to changes over time, since wood production and consumption have radically changed over the last three decades in most areas. We now have areas where overharvesting was done in the past, but current rates are well below a sustainable harvest level for a variety of reasons.
6. The inclusion of nonwood products in this set of indicators is important, particularly in developed countries where the contribution of nonwood products to social well-being and to local and household economies tends to be discounted or ignored.

COMMENTS ON INDICATOR 30

1. No. Indicator 30: if commercial use is the only real measurable use, then Indicator 30 should specify "value and quantities of commercially harvested/produced NWFPs".
2. Difficult to measure Indicator #30 - worthy of continuing but how to consistently measure is a

question.

3. Indicators #30 and #32 (non-wood portion) and #34 will continue to be a challenge to measure. Until these products are traded in a market, taxed, counted, etc., there will be little data to support this indicator.
4. Indicator 30 is critical. As has been demonstrated in countries like Russia and China who are leaders in nontimber forest product research the value of NTFPs can often greatly exceed timber production. NTFPs and timber need to be managed together.
5. Non-wood forest products are difficult to quantify but the indicator should be retained.
6. Again, undervaluing of subsistence and of NTFPs is a major problem.
7. Reasonable set of indicators; value and volume of many non-wood products impractical to measure.
8. I suppose I would like to see a section in indicator 30 that looks at the value added jobs and total number of jobs generated by the harvest of special forest products. The problem is the values can be fairly low, but the number of people employed part time or full can be quite large.

COMMENTS ON INDICATOR 31

1. Indicator 31 perhaps be should be worded so the import aspect of supply is more evident.
2. Indicator 31 is vague. Does it speak to national domestic consumption? What categories does it track: primary products only? Do the oleoresins extracted from the pulping process that go into other chemical products count?
3. Regarding Indicator 31, the per capita consumption of wood, and Indicator 33, recycling, free market supply and demand should govern these factors, so the degree of free market that is present is a better indicator of social benefits (reference comments for sub-criterion 6C). If internal and external supply is limited by sustainability, the value or cost of wood products will govern consumption and along with energy costs, provide the appropriate incentive for recycling. I recommend removing the phrase "including per capita consumption from Indicator 31 and dropping Indicator 33.
4. Per capita consumption (indicator 31), because of the complexity of measuring exports and imports, is an example of an indicator that would not be meaningful even at the State level.

COMMENTS ON INDICATOR 32

1. See comment 3 in the section on indicator 30 above.
2. Indicator 32 is also very important and with anthropologists involved in the research design it is likely that informal and formal economic values can be properly assessed. The Institute for Culture and Ecology in Portland, Oregon conducts such research.

COMMENTS ON INDICATOR 33

1. See comment 3 in the section immediately above.

COMMENTS ON INDICATOR 34

1. An absolutely pressing aspect of Indicator 34 is what impacts other management activities like logging, grazing, recreation, and development have on nontimber forest product supplies and how in turn this impacts existing livelihoods and future economic opportunities.
2. The indicators are valid. Indicators 34 could be made more specific to goods such as forage, water, and open space.

SUGGESTED ADDITIONS

1. Levels of capital investment should be included as indicator of future production (may you include this in the last criterion) and as a socio-economic measure of confidence in the local wood production systems.
2. Missing from this list of indicators is some measure of the extent to which consumption of wood and wood products is provided from local, regional, or national sources (i.e. the extent to which a region or nation is a net importer of wood and wood products).

It is critical that this measure be added under criterion 6, and that a related indicator be added under criterion 1 that examines the impact of consumption in one region or nation on ecosystem values, including rare and endangered species, in other regions or nations.

3. Consider some indicator for US consumption of wood & wood products from other countries as compared from US forests. To this, add indicator of environmental costs to the land/resources in those other countries to produce the products for US. The same for non-wood forest products, but this isn't a high priority.

Indicator for use/consumption of small dia. trees & other woody biomass (from forest health activities/hazardous fuels reduction) from land in need of restoration and long-term intensive & sustainable mgmnt. Also an indicator of the value of the products/energy generated by this material & a different indicator of costs/losses "avoided" due to removal & use of material instead of occurrence of catastrophic (not ecologically-supported) wildfires. Another indicator of value of use of restoration by-products as compared to air quality impacts of the cheaper prescribed burning of material left in the forests where Rx burning is not ecologically necessary.

4. It would also be useful to know what percentage of would consumed in a particular area was imported vs. local and what percentage came from a tropical or boreal source.
5. Biomass utilization is on the horizon for US forests. As an industry, it has the potential to significantly impact production and consumption trends. An additional Indicator or some additional details under Indicators 29, 30, 32, and 34 are needed.
6. I would emphasize the importance of non-wood forest products, including value added through downstream processing.
7. I strongly feel like a forest land ownership indicator should be included, perhaps under this indicator. Who and how much forest land is owned by different groups (Gov., Private, Business) is critical to how we consider and address forest management, health, and policy.
8. We might want to take a look at markets outside the US as an indicator of consumptive use as well as inside the US. If consumption goes up and US supply goes down, are we headed to the same situation as oil today? Seems like we should want to know that information.

SUGGESTED DELETIONS

1. Regarding Indicator 31, the per capita consumption of wood and Indicator 33 recycling, free market supply and demand should govern these factors, so the degree of free market that is present is a better indicator of social benefits (reference comments for sub-criterion 6C). If internal and external supply is limited by sustainability, the value or cost of wood products will govern consumption and along with energy costs, provide the appropriate incentive for recycling. I recommend removing the phrase "including per capita consumption from Indicator 31 and dropping Indicator 33.

OTHER COMMENTS

1. Additional recognition of non-timber forest products value and assessment should be an important aspect to sustainable forestry.
2. Consumers have to be educated and know that there are limits.

SUB-CRITERION 6B. RECREATION AND TOURISM

This group of indicators describes trends in forest recreation and tourism, including:

Indicator 35. Area and percent of forest land managed for general recreation and tourism, in relation to the total area of forest land.

Indicator 36. Number and type of facilities available for general recreation and tourism, in relation to population and forest area.

Indicator 37. Number of visitor days attributed to recreation and tourism, in relation to population and forest area.

This group of indicators is designed to address recreation and tourism. Do they do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (10 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. These are basic statistics on public forest use. It should made clear in the indicator that this is a also measure of public involvement in forests, which leads to the political will to manage them well.
2. These are good descriptors, but not good indicators.
3. As with the previous set of indicators, many of these indicators are too vague or spacious in themselves. Even linked to a specific forest area they are unlikely to indicate whether sustainability is occurring.
4. Conceptually ok - may be impractical to measure some of the indicators objectively and affordably.
5. No. This is SO narrow and quantitative. It excludes "type of recreational activities experienced in relation to population and forest area" as well as obfuscating where "educational" or "service" activities (e.g., Passport in Time, other volunteer activities) might fall.
6. These numbers will be very hard to come up with in a reliable fashion I think. Who is to say a piece of forest land is or is not managed for recreation and tourism? All of it is to some extent (even if just as a scenic backdrop).
7. Recreation demand is related to economic status. The relative proportion of forest land devoted to recreation vs. commodity production must be considered in light of the demand for each of these forest outputs.
8. Here there is a problem in discerning the difference between high intensity recreation use and low intensity recreation use. They have different effects on the ecosystem, and they also have different economic impacts.
9. The indicators here give a limited and narrowly focused look at recreation benefits. They focus entirely on numeric measures of use and number of facilities while ignoring recreation values, both nonmarket economic values and social values. There has been a great deal of work done on valuing recreation activities and places, both from the standpoint of economic value and as a social benefit. In the U.S. National Report on Sustainable Forests 2003, recreation activity values were summarized in Indicator 30 because that type of approach was ignored otherwise. Social values

(sense of place values, benefits to individuals and communities, and so on) were not discussed.

10. The indicators are of partial value because of data limitations. While the indicators may be useful, it is necessary to understand the impact of population growth, demographic change, and shifting patterns of use. For example, with changing demographics, outdoor recreation patterns are shifting. This should lead to changing patterns of investment and changing roles for traditional public agencies that deal with recreation. Yet these factors at best are implicit in the indicators.
11. These also relate to the potential introduction of forest health threats -- in other words, the potential negative impacts of recreation and tourism should be strongly considered.

COMMENTS ON INDICATOR 35

1. Most forestland is managed for multiple objectives, including recreation.

COMMENTS ON INDICATOR 37

1. Visitor day measurement has a tradition of producing Voodoo numbers.
2. I am not sure that indicator 37 is needed or that it would provide relevant information. Other indicators, such as under criterion 2, consider the proportion of forest land available for various uses (such as for periodic timber harvest), but do not take into account the population. If the number of visitor days is high and the population low, is this good or bad, and how does this either inform management decisions or provide an indication one way or the other of forest or ecosystem health? Conversely, if the visitor days are low and the population high, what does this suggest? If this indicator is to be included at all, shouldn't the measure be the number of visitor days in relation to the number judged to be sustainable by recreation and biodiversity specialists?
2. Indicator 37 - US Forest Service has moved away from "Visitor Days" to "visits" and/or "Visitors".

SUGGESTED ADDITIONS

1. Capital invested in tourism and tourism compensation in relation to compensation in other portions of the service sector.
2. New Indicator - Visitor Expenditures to participate in recreation activities - US Forest Service now has information on every National Forest. Can calculate \$Expenditures by visit, trip, etc.
3. I suggest that the framers of the C & I begin to think about indexing the allocation of forest land to forest uses so that meaningful comparisons can be made among nations and other political subdivisions. It is clear to me that hungry people find it difficult to understand why they should be restricted from using land to meet their basic needs so that it can be set aside for recreation or ecological preservation. By the same token, it is logical that relatively wealth, well fed people have a hard time understanding why forest land should be used for commodity production when they are most interested in aesthetic and recreation values. Without indexing the forest use to the social and economic conditions it is impossible to make any judgment on socioeconomic benefits.
4. Maybe add diversity of recreational activities.
5. Expand to include reasons for visitor days. What are the forests being used for?
6. A couple of thoughts: Small-scale local hiking and walking tends to be undercounted. Maybe more serious is the destructive side of recreation, especially things like off-road vehicle use. The damage done by off-road vehicles (mostly illegal) to my next-door-neighbor San Bernardino

National Forest must be hundreds of thousands or millions of dollars per year. This should be counted somehow.

7. Dollar value of recreation/tourism.
8. These are fine and representative. Would consider a measure of number of miles or kilometers of recreational trails available.
9. Not adequate. Amount of trash produced at these facilities should also be an indicator.
10. An indicator is needed to measure the effect of timber harvesting activities on tourism and social and cultural concerns. This could be simply the amount of timber harvest land adjacent to culturally sensitive (archaeological and spiritual) sites or tourist use areas. Why isn't tourism given a dollar value and timber is?
11. Yes - and projections of the impact of these trends on the socio-cultural economies of the forest dependent and adjacent communities would be further enlightening.
12. I would like to see population trends in forested areas to get a feel of recreational demand.

OTHER COMMENTS

1. Public lands only.
2. Environment first. How many invasive species travel around on boats and undercarriages of cars, and show soles? I think that if the public is educated ... not simple, but possible, more of us would comply with limitations.

SUB-CRITERION 6C. INVESTMENT IN THE FOREST SECTOR

This group of indicators describes trends in investment in the forest sector, including:

Indicator 38. Value of investment, including investment in forest growing, forest health and management, planted forests, wood processing, recreation and tourism.

Indicator 39. Level of expenditure on research and development, and education.

Indicator 40. Extension and use of new and improved technologies.

Indicator 41. Rates of return on investment.

This group of indicators is designed to address investment in the forest sector. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (8 RESPONSES)

ADEQUATE: WITH COMMENT/QUALIFICATION

1. These are fine and representative of the category - a typical state forestry agency would have difficulty in acquiring this data.
2. Good indicator at national policy and program level.
3. Good indicator set; difficult to measure.
4. Okay as long as the investments are weighed against investments in other sectors. For example is it more important to invest in population control to reduce demands or investing in ways to increase timber production?

COMMENTS ON THE SUB-CRITERION OVERALL

1. What is the nature of research and investment in our forests? Is it to enhance and promote economic diversity from the woods, or simply to gain an additional 15 % MAI? Define emerging economic opportunities vs. recycling old.
2. Included in this section should be some reference to the negative value of not investing. Natural systems don't always follow the conventional rules of economics. Investing to prevent the deleterious effects of forest loss may be just as important as investing for a direct benefit, but the return will be much more difficult to quantify, especially in the short term.

COMMENTS ON INDICATOR 38

1. Will non-wood forest products be included in No. 38?
2. I don't understand Indicator 38. In a good sustainable forest with natural processes at work, you shouldn't need much investment. Are we saying that the more you spend on fertilizers and pesticides, the better the sustainability of these forested lands? This seems geared to production forestry as opposed to maintaining healthy productive forested ecosystems.

3. For indicator 38, I would add the value of plantings of non-wood forest products.
4. Indicator 38 is helpful. However, it does not necessarily capture the kind of entity making investments. For example, investment behavior can vary if investments are being made by insurance companies or non-profits as opposed to timber companies. Data for Indicator 39, at least in California, is limited. In addition, it is hard to know the significance of what it measures. Indicators 40 and 41 are helpful.
5. By focusing on wood processing rather than forest products, indicator 38 leaves out nontimber forest products.
6. "Rates of return on investment" in Indicator 38?
7. I would like to see indicator 38 expanded to include forest resources such as wildlife, soil protection, watershed protection and other amenities that forests produce.

COMMENTS ON INDICATOR 39

1. Data for Indicator 39, at least in California, is limited. In addition, it is hard to know the significance of what it measures.
2. Indicator 39 is critical. The Forest Service has been letting some of their best scientists go in critical areas like fungi research, nontimber forest products, etc., at a time when the demand for this information is greater than ever.
3. Indicator 39 - Suggest that this indicator be broken out into its sub parts - Biological, Social, & Economic. Much of our research is heavily weighted to the biological side with minimal focus on the important social and economic components...like recreation.

COMMENTS ON INDICATOR 40

1. With the increasing number of NIPFs and the diversity of management objectives and activity within their ranks, this sub-criterion is critical. We must develop programs, technologies, and tools that encourage SFM on NIFP lands. It would be good to expand Indicator 40 to include a metric for communication effectiveness -- how well are we selling the message? Who is listening? What changes have they made in forest management as a result?
2. . Indicators 40 and 41 are helpful.
3. How the heck does someone answer #40? Get rid of it.

COMMENTS ON INDICATOR 41

1. No. Indicator 41 is too vague.
2. Indicator 41 could be integrated with 38.
3. Calculating rates of return will, again, need to take subsistence and small-scale activities into account.
4. Not adequate. Rates of return on investment should be very low or slightly negative.
5. Okay. Rates of return will vary in forest types depending on the appropriate rotation age being used. The problem arises where forest types require longer rotation ages to maintain biological diversity and no allowance is made on behalf of the other species to make the longer rotation age

economically feasible.

6. And indicator #41 will likely be difficult to extract in many cases (e.g., integrated companies). Sure, you can look at an annual report and get ROI, but that may cover far more than the forest sector.
7. The relation of a positive rate of return to timber productivity bears little supportive connection to overall forest integrity and sustainability. At best, it is an indicator of non-sustainability.
8. See comment 2 in the section immediately above.

SUGGESTED ADDITIONS

1. One indicator that I've seen used is the number of new patents. I've seen this used to compare states' emphasis on research and new technology.
2. No it does not. A measure is needed that tracks public involvement and money spent on this and on public consultation. Is there a measure that tracks conservation programs?
3. The extent of private investment in forests should be added to the indicators. As an extension of comments on sub-criteria 6a, two additional indicators should be added

(1) The presence of a functional free market for establishing forest land and forest product values.

(2) Information availability and legal structure in place for buyers and sellers of forestland and forest products to be on an equal footing for transactions. And the degree to which the opportunity to participate in the free market is available to landowners, harvesters, manufacturers, wholesalers, retailers and consumers. Indicator 41 should specify rate of return on the growing of forest commodity products and avoid comparisons of return on investment of forest manufacturing facilities. It is the investment in trees that should be of interest to forest sustainability.

4. Important to specifically mention investment in non timber forest product management as a separate indicator entirely.
5. Yes for wood products in particular. Similar information needs to be added for non-timber forest products.
6. Lacks an indicator of investment in the industrial infrastructure necessary for managing healthy, sustainable forests.

Need some indicator of size, ownership, etc. of businesses or organizations either investing in or using investments of others to accomplish sustainable forest management objectives (locally-owned businesses as compared to multi-national corporations, for example).

Need an indicator of community-based investment (community foundations, local bonds, etc.) in the forestry sector.

Need an indicator that deals with investment in non-timber forest products; in addition to dollars, need to have method to determine educational efforts, etc. associated with this sector.

An indicator of investment in sustainable, community-based tourism that features products, cultures, etc. associated with the forestry sector.

An indicator that looks at nonmonetary "returns" from various sustainable investments.

SUGGESTED DELETIONS

1. How the heck does someone answer #40? Get rid of it.
2. These seem duplicative.

OTHER COMMENTS

1. Direct investment in the forest pays the best of all dividends.
2. Investors should do everything possible to assure a continued, sustainable resource on the "dynamic platform" of Mother Nature. The certification of paper mills is encouraging. If a single company, however, uses practices that are not in cadence with natural systems, destroy habitats and ecosystems for profit, they should be taken to court.
3. This is extremely important.

SUB-CRITERION 6D. CULTURAL, SOCIAL AND SPIRITUAL NEEDS AND VALUES

This group of indicators describes trends in the way forests meet cultural, social, and spiritual needs and values, including:

Indicator 42. Area and percent of forest land managed in relation to the total area of forest land to protect the range of cultural, social and spiritual needs and values.

Indicator 43. Non-consumptive-use forest values.

This group of indicators is designed to address cultural, social, and spiritual needs and values. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (10 RESPONSES)

ADEQUATE: WITH COMMENT/QUALIFICATION

1. Okay for now but this area needs to be flushed out more.

COMMENTS ON THE SUB-CRITERION OVERALL

1. It seems obvious that having only two indicators here is tantamount to ignoring this vital area. Much more work is necessary to adequately cover the sociocultural and sociodemographic dimensions.
2. Will need examples of these two. Very fuzzy.
3. These indicators can not be used for monitoring purposes because they are undefined and inconsistent.
4. There is a serious need for good measures to be developed here. Someone should be working with anthropologists who have a lot of experience in the area! This sort of thing is not easily measured by standard questionnaires. It is very important, especially for local minority groups who might be missed or little counted in broad-scale questionnaires.
5. Subjective and difficult to measure.
6. It is not clear if these indicators include needs and values of Native Americans, including communities of recognized tribes whose lands are typically outside of the federal government of the USA. If not, they need to be added or appropriately reflected in the definitions and categories.

COMMENTS ON INDICATOR 42

1. Forest protection was addressed in 2 earlier indicators. This topic seems to be heavily weighted.
2. This is an important indicator. I would clarify through examples of what is meant by cultural, social, and spiritual. Spiritual is really a part of cultural values. You also need to explain how protecting lands from economic interests provides for sociocultural values. Are you thinking protection for visual purposes? Do people still get to go and pick mushrooms and berries as long they don't sell them? What if they are traditional Native American gatherers collecting tree bark for baskets that will get sold in display shops?

3. Very important needs and values, yet seems like it will not be possible to measure this in a way that will be meaningful.
4. Indicator 42 is one an important indicator for tying all the rest of them together. Sustainable habits by people are what help preserve forest ecosystem integrity. Land that is heavily (rather than only) used for timber production does not serve much of a cultural and spiritual.
5. Add to indicator 42: "...needs and values, including those of indigenous peoples." What is meant by "the range of cultural, social and spiritual needs and values?" This is so broad and vague that it is not very meaningful.
6. Question: Does the management referred to in indicator 42 only refer to public management agencies? For example, non-timber forest products might be informally "managed" by a variety of groups for cultural/social/spiritual values. For example, cultural practices have a large impact on whether the harvesting of medicinal plants has a large or small impact on the forest or the species. Please take this issue into account in the indicators.
7. This is fine, but without relating it to the demand for these cultural, social and spiritual forest values and needs the Indicator 42 is not worth much.
8. What measures can address both Indicator 42 and 43 that would be available to a state forestry agency?
9. In theory, both Indicators are appropriate. In practice, Indicator 42 is hard to use. In the California Forest and Range Assessment, an indicator was developed to reflect the percent forest area in Special Management Zones. These were defined by regulatory requirements.
10. Indicator 42 should be eliminated.
11. Indicator 42 might be supplemented by some indication of the number of people who look to forests for such purposes.
12. I don't know how you measure addressing spiritual needs and values objectively. This is a valiant attempt.

COMMENTS ON INDICATOR 43

1. Indicator 43 is too unclear as too it meaning.
2. Regarding Indicator 43: It is becoming clear that human influence is sufficiently pervasive that the notion of non-consumptive use is becoming obsolete. Wilderness designation does not seem to consume the resource, but recreation use, limits on natural processes such as fire and invasive plant, disease and insects are felt across the landscape. I believe that we should move toward thinking of commodity production uses, ecological preservation uses and recreation/aesthetic uses rather than consumptive and non-consumptive.
3. In theory, both Indicators are appropriate. In practice, Indicator 42 is hard to use. In the California Forest and Range Assessment, an indicator was developed to reflect the percent forest area in Special Management Zones. These were defined by regulatory requirements. In the case of 43, data is limited and the scope of "non-consumptive uses" is not clear. In California, open space for recreation and purchase by non-profits of operating ranches and timberlands to prevent them from being developed are in effect "non-consumptive." However, the criterion as written does not seem to incorporate this kind of idea.
4. Indicator 43 is barely useful - doesn't define non-consumptive; is this the same or similar to what people are calling "ecosystem services", or is it aesthesis enjoyed while viewing scenery?

5. No. Indicator 43 is far too vague. "Non-consumptive" would exclude consumptive activities like harvesting sacred plants, which would actually fall under the sub-criterion as a whole. "Non-commercial, consumptive" and "Non-commercial, non-consumptive" would be clearer. And is the indicator referring to number of uses? Types of use? Frequency of use? Including all of these would be important clarifications.
6. See comment 8 in the section immediately above.

SUGGESTED ADDITIONS

1. Rates of change in harvest technology might be an indicator in changes of cultural values as is change in rural population size in forest-dependent communities or communities in heavily forested areas.
2. Need a whole new set of indicators is needed to fully address the entire community capitals framework - an integrated set of "resources" that can be invested by the residents to achieve a more sustainable community. Social capital is perhaps the one more people are familiar with due to work by Putnam, Flora, and others, but separating social & cultural, for example, from the rest of the capitals is not an effective means of looking at the way forests meet cultural, social & spiritual needs of society. How communities invest money (for forests or other things) is integrally connected to cultural & social values - not just economic. Spiritual needs can not be met without considering basic survival needs of individuals or communities (Maslow's pyramid).
3. No it does not. A measure is needed that tracks the number of concerned parties, who they are, and a breakdown of who these concerned parties. If American Indian Tribes are part of the concerned parties the tribes need to be mentioned and a breakdown on amount of public consultation. A measure is needed that breaksdown the specific concerns of these groups along with weighted values. (See also my earlier comments on location of timber managed land in relation to cultural concerns.
4. Area available for public use.

SUGGESTED DELETIONS

1. Indicator 42 should be eliminated.
2. These two should be combined.
3. These two are meaningless. Drop them.

OTHER COMMENTS

1. Too big a question.
2. This is the greatest shift on forested lands, the recognition of social values in particular. I'm not sure how to suggest additions, except that it needs to be thought through by social scientists.

SUB-CRITERION 6E. EMPLOYMENT AND COMMUNITY NEEDS

This group of indicators describes trends in employment in the forest sector, including:

Indicator 44. Direct and indirect employment in the forest sector and the forest sector employment as a proportion of total employment.

Indicator 45. Average wage rates and injury rates in major employment categories within the forest sector.

Indicator 46. Viability and adaptability to changing economic conditions, of forest dependent communities, including indigenous communities.

Indicator 47. Area and percent of forest land used for subsistence purposes.

This group of indicators is designed to address employment in the forest sector. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (16 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. You know what? To answer these questions we'd have to ask just how many cars, homes, children, designer clothing, etc. does an employee expect to accrue? This is a big societal question and cannot be answered here.
2. How is #46 measured, and what does it mean? And all these "area and percent of forest land" indicators (like #47) are troublesome as well. Forests are typically managed for multiple uses, so your tally of acres reported for these will be many times the total forest acreage. If I know that people use a national forest for subsistence hunting, how much of the forest acreage is counted. These don't appear to be well thought out.
3. Indicator 44 is actually three separate indicators. Other indicators are each two separate indicators making a total of 9 indicators instead of 4. This is really sloppy thinking.
4. On one hand - why are "employment" and "community needs" lumped together? On the other, why is this set of indicators separate from the last batch on social, cultural and spiritual? If they stay lumped, what other "community needs" should be considered besides Indicator 47 (land for subsistence purposes)? This whole set needs some deeper discussion about what we really want to know. Why is employment used instead of other more qualitative indicators of economic and human capital associated with forestry and forest-based communities?

COMMENTS ON INDICATOR 44

1. Indicator 44 - Needs to include break out info on recreation/tourism employment as well as the forest commodity components.
2. What do people think Indicator 44 tells us?
3. 44/45 misses the important portions of social benefits. The number of jobs does not speak to the quality or security of the job. There is absolutely no mention of distribution of benefits either

among classifications or as a function of value-added. If the productivity of workers increases and the wage rate remains unchanged relative to the productivity increase then a greater portion of wealth is extracted from the local communities and transferred to stockholders who for the most part are not rural residents nor workers (even including pension funds).

4. Any discussion of forest employment is associated with timber. Again separate out different types of forest employment. Building and maintain roads, and harvesting salal at a level you are putting your kids through collect. Same thing, way different products.
5. Indicators 44 and 45 need to include forest sector employment and wages in all forest product-related industries, including nonwood forest products. There are definite social issues surrounding employment structure, wages, and injury rates, and even our knowledge about them, among different employment categories. In nonwood forest product businesses, wages and employment reflect the social structure of the various industries, and the fact that they are often on the margin of the formal economy with its attendant protections. The informal economy usually does not have the protections of wage rates, insurance, and so on.
6. Indicators 44 and 45 are useful.

COMMENTS ON INDICATOR 45

1. The focus on wages misses the dynamic in the industry in terms of compensation. If wages rise but the employees contribution to health insurance rises more, then the workers will be worse off than before. Ignores globally accepted labor standards as the method to insure voice and social equity to forest dependent workforce. Forced informalization of work creates social costs is not addressed yet occurs regularly in this sector.
2. Adequate but would be improved by including factors for harvesters and gatherers of non-timber forest products in indicator #45.
3. See comment 3 in the section immediately above.
4. See comment 4 in the section immediately above.
5. See comment 5 in the section immediately above.
6. See comment 6 in the section immediately above.

COMMENTS ON INDICATOR 46

1. For indicator 46, I really question whether "viability and adaptability" of communities can be quantified, at all or in relation to forests.
2. Many of my earlier comments regarding the relative demand for various forest outputs and values apply here as well. Regarding Indicator 46, although this indicator asks for information on adaptability to changing economic conditions, it doesn't address the more important question of how well the overall economic and political system recognizes and responds to the forest sector impacts of economic policy. An example in the US is parcel fragmentation of eastern hardwood forest that results from loss of markets for hardwood logs because domestic furniture manufactures can no longer compete with off-shore producers. There may even be a further impact from the ecological consequences of using tropical hardwoods in products formerly manufactured from temperate hardwoods.
3. Indicator 46 is critical. A large percentage of people in rural communities use nontimber forest products as primary and secondary sources of household income. NTFPs are often the critical

lifeline that allows members of rural forest communities to hand on.

4. How is #46 measured, and what does it mean?
5. Indicator 46 has some usefulness but has data and interpretation issues. The California Forest and Range Assessment developed an Index of Well Being that is fairly comprehensive and gives a good picture into forested areas. However, even with this index, it is hard to estimate the adaptability of a community. This is especially true with rapid population growth and demographic change in forested areas.
6. What are people trying to measure with Indicator 46 and what are they currently using as data?
7. Indicator 46 should be just as much about adaptation TO local communities as it is about adaptation BY local communities.

COMMENTS ON INDICATOR 47

1. Subsistence activities should become a lessening activity
2. Indicator 47 is a useful but indirect proxy for the stability and health of subsistence activities. Hopefully the meaning of the analysis will be heard, as the primary issue underlying this indicator is access and property rights.
3. Indicator 47 is critical and a legal necessity. As Native Americans continue to assert on and off reservation treaty rights understanding subsistence patterns will be critical if land managers wish to keep lands in productivity. A tremendous amount of people gather nontimber forest products including plants and animals from American forests. Their livelihoods are directly impacted by management decisions yet they are left out of NEPA scoping processes. This is a very real and serious problem that will come back to haunt forest managers if science doesn't help provide them with the basic information (beyond public meetings).
4. OK, but special attention needed to #47.
5. Good indicators except 47, which is vague and probably not measurable.

SUGGESTED ADDITIONS

1. This is an area where perhaps a better community indicator could be added.
2. Significance of forest to local economy (which could address the economic contributions of non-consumptive uses, along with the contributions of consumptive uses of timber and other forest products).
3. Consider an indicator of jobs associated with forest restoration or the number held by loggers/foresters/others who have been trained to use more "ecologically-sensitive" methods for forest management.
4. These look okay - Somewhere, however, we need to consider the well-being of those whose livelihoods are threatened by establishing protected areas. For example, gold mining was allowed in forest areas in Costa Rica. Then the country established protected areas leaving the gold miners unemployed. So how are the needs of these displaced persons being met?
5. Contributions of forest products to "non-traditional" economies/products. Not just lumber, paper, etc.

CRITERION 7. LEGAL, INSTITUTIONAL AND ECONOMIC FRAMEWORK FOR FOREST CONSERVATION AND SUSTAINABLE MANAGEMENT

This criterion is divided into 5 sub-criteria. All countries possess a legal framework, which includes the body of laws and customary rules that direct the actions of their citizens and institutions. The conservation and sustainable management of forests can be facilitated if the national or appropriate sub-national, legal framework includes elements relating to forests and their use.

Sub-criterion 7A. Legal framework

Sub-criterion 7B. Institutional framework

Sub-criterion 7C. Economic framework

Sub-criterion 7D. Capacity to measure and monitor

Sub-criterion 7E. Capacity to conduct and apply research and development

These sub-criteria represent major aspects of the legal, institutional, and economic framework for forest conservation and sustainable management. Do they do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (16 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. Even at Rio it was recognized that social benefits require strong voices by the stakeholders without power. The internationally accepted legal process for this is the ILO's standards for decent work. The UNFF system has acknowledged the importance of these as well as addressing distributional issues by integrating MDG's into SFM. All internationally recognized forest certification systems have all adopted key ILO labor standards. Yet there is no mention of either distribution issues or labor standards in these processes. Eventually, the ability to trade internationally will be diminished by the failure of North America to recognize the importance of social benefits defined by the international community.
2. Okay, but these seem to indicate greater hindrance to management rather than support for sustainable forests. Isn't it possible to have an indicator related to the promotion of a forest ethic? Does a country with tons of rules and laws mean that they necessarily have more sustainable forests? Or is it merely political maneuvering?
3. These are adequate but largely ambiguous.
4. These indicators are too vaguely defined to be useful for anything.
5. Where does public consultation fall here?
6. Maybe you could answer this if you defined your BIG picture.
7. These are very general and are made more meaningful by the associated indicators.
8. The legal and institutional framework is extremely important. Gaining a detailed understanding of this while tracking sustainability will allow programs to be developed to maintain sustainability and increase the quality of ecosystems and peoples lives.

9. The list doesn't address the "politics" of forest conservation and sustainable management. This is a touchy subject and may not get very far, but is a reality - like the adult elephant sitting in the middle of the room that everyone pretends isn't there and isn't stinkin' up the place - and making it hard to negotiate with the rest of life.

COMMENTS ON SUB-CRITERION 7C

1. The economic framework has to include the full range of informal and formal economic considerations, especially in terms of the critical need for a better scientific understanding of nontimber forest products like floral greens, wild mushrooms, seeds, fuel wood, saps and resins, craft materials, medicinal plants, decoratives, etc.

COMMENTS ON SUB-CRITERION 7D

1. 7D and 7E are important and should include participatory research processes. The Institute for Culture and Ecology in Portland, Oregon received funding from the National Commission on Science for Sustainable Forestry to develop a national handbook for participatory biodiversity inventory and monitoring. This handbook is designed for managers and scientists to give them the tools to work with local communities to do better monitoring, save costs, and build positive relationships between communities, scientists, and managers.

COMMENTS ON SUB-CRITERION 7E

1. See comment for 7D immediately above.

SUGGESTED ADDITIONS

1. I would add the capacity to involve the public in the measuring and monitoring of biodiversity, as well as to disseminate research results to affected communities through appropriate educational activities--collaboration between public land managers (institutional/legal) and local communities is essential.

OTHER COMMENTS

1. I have no idea how to address it, but local political corruption is a huge factor and a huge problem in all this.
2. Allow the public lands to be managed and not "locked" up in a preserve so that the local economy will not suffer.

SUB-CRITERION 7A. LEGAL FRAMEWORK

The indicators in this sub-criterion are concerned with the extent to which the legal framework (laws, regulations, guidelines) supports the conservation and sustainable management of forests, including the extent to which it:

Indicator 48. Clarifies property rights, provides for appropriate land tenure arrangements, recognizes customary and traditional rights of indigenous people, and provides means of resolving property disputes by due process.

Indicator 49. Provides for periodic forest-related planning, assessment, and policy review that recognizes the range of forest values, including coordination with relevant sectors.

Indicator 50. Provides opportunities for public participation in public policy and decision making related to forests and public access to information.

Indicator 51. (MP-7.1.d) Encourages best practice codes for forest management.

Indicator 52. Provides for the management of forests to conserve special environmental, cultural, social and/or scientific values.

This group of indicators is designed to address the legal framework. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (15 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. Each of the indicators under this sub-criterion are of the general form, "Extent to Which the Legal Framework (Laws, Regulations, Guidelines) Supports the Conservation and Sustainable Management of Forests, Including the Extent to Which ..." On reviewing the text for each, the discussion is very anecdotal, and full of gross generalities. If the characterization under each can be expressed no better than this, I see little reason to retain them. They are simply not very informative. Because none of these indicators can be well characterized, the value of the sub-criterion as a whole is highly questionable.
2. Sounds good but are these possible to measure and can they be manipulated?
3. Most of these seem like they will be impossible to quantify objectively, and therefore the value of any data derived will be questionable.
4. Good concepts--bad indicators.
5. In general, a means of monitoring change in these indicators needs to be developed. What is reported is too open to the interests of the author at the time.
6. These are valid, but hard to use...especially without a description of how different values about forests manifest between segments of the population. The effectiveness of the indicators also depends on common understanding of "conservation and sustainable management." The California Forest and Range Assessment has a section entitled Governance. It has four indicators: regulatory jurisdictions over management activities; level of conflict; level of cooperation, information sharing, and education; and governmental resource investments. As part of the analysis, detailed listing of applicable state and federal laws to forestry was compiled. Litigation and recent ballot

propositions were reviewed. Numbers of watershed groups and Firesafe Councils were characterized. The budgets of California agencies that deal with the environment were tabulated. This led to a complex picture of the legal framework in California surrounding forest and rangelands. Thus it will be hard to find trends.

7. Indicators 49-52 - Not sure how these indicators fit with the new Forest Service Planning Rule (2004).
8. These are plenty extensive.
9. Lack of research and data on various issues needs to be stressed before legal measures are taken to fully understand a situation and assess "appropriate and practical" measures.

COMMENTS ON INDICATOR 48

1. Indicator 48 seems broad and confusing.

COMMENTS ON INDICATOR 49

1. Indicators 49 and 50 should have some attention to regularity of input, not just vague opportunities that are periodic.

COMMENTS ON INDICATOR 50

1. For indicator 50, it is implicit in this indicator that "more participation is better" but this may not be the case because it may bog down the ability to make plans or take action. Too much local involvement may thwart larger scale interests, such as national wood supply. This is an example of ideology becoming an indicator.
2. See comment in the section immediately above.

COMMENTS ON INDICATOR 51

1. Indicator 51 suffers from lack of quantitative basis and seems to imply that more rules are better, even though the cost-effectiveness of rules (and whether they actually protect anything) is also a big consideration.
2. Indicator 51: How many states REQUIRE best practices and is there a trend toward a more regulatory approach?
3. Not adequate. Best Practices, as in Indicator 51, are variable and depend on local conditions.
4. I'd dump Indicator 51, since BMPs or Best Practice Codes are difficult to agree on, and not very useful, while the other indicators deal with the concept.

COMMENTS ON INDICATOR 52

1. Again how is the value of indicator 52 measured? And who determines what the best practice code is i.e.: best for whom?

SUGGESTED ADDITIONS

1. A very important set -- the means of implementation for these indicators.
2. I would like to see added something about how well human ecological relationships are acknowledged and protected as an incentive for stewardship behavior. Different types of land tenure and labor relationships are known to relate to how people acquire indigenous knowledge about their environment and then form informal and formal rules to mitigate opportunists that might undermine stewardship. All of these indicators are critical.
3. A measure of accountability and recourse--ways to deal with local corruption, high-handed bureaucracies, local failures of law enforcement, etc.--is absolutely essential.
4. The environmental laws passed at the federal level have been prolific in the past 30 years. Sometimes the laws do not mesh well and are in conflict with each other. An indicator of appeals and litigation on lands would be a good source to evaluate the effectiveness of laws and regulations.

SUGGESTED DELETIONS

1. These are OK - but question why they need to be used. Would recommend that they all be dropped.
2. I'd dump Indicator 51, since BMPs or Best Practice Codes are difficult to agree on, and not very useful, while the other indicators deal with the concept.
3. Perhaps indicators 49 and 50 could be combined.

SUB-CRITERION 7B. INSTITUTIONAL FRAMEWORK

The indicators in this sub-criterion are concerned with the extent to which the institutional framework supports the conservation and sustainable management of forests, including the capacity to:

Indicator 53. Provide for public involvement activities and public education, awareness and extension programs, and make available forest related information.

Indicator 54. Undertake and implement periodic forest-related planning, assessment, and policy review including cross-sectoral planning and coordination.

Indicator 55. Develop and maintain human resource skills across relevant disciplines.

Indicator 56. Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services and support forest management.

Indicator 57. Enforce laws, regulations and guidelines.

This group of indicators is designed to address institutional capacity. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (11 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. Protocols need to be developed to make these indicators useful. They appear to be import to know information about since of the topics have been part of court actions or journal articles.
2. I'm not sure this sub-criterion is important.
3. Lots of questions here.
4. Again, seems to be a lot of rules and laws rather than education and commitment to a sound forest ethic.
5. These are adequate but ambiguous.
6. Most of these seem like they will be impossible to quantify objectively, and therefore the value of any data derived will be questionable.
7. Good concepts--bad indicators.
8. Indicators in this group are a bit vague and certainly difficult to measure objectively.

COMMENTS ON INDICATOR 53

1. This, especially #53 there, is the heart of the whole issue. More than involvement though--the public has to have a voice, and especially there has to be accountability and recourse.
2. Again, for indicator 53, I would also emphasize the importance of involving local communities in monitoring and management activities.
3. I think you are going to have to bring Mohammed to the Mountain. Landowners hardly know the questions to ask (I am talking about non-industrial landowners ... and please do not call them

"family forests" unless you are following the branded identification of Vermont Family Forests use of the term). You can have all sorts of resource people waiting in the wings, but if they are not out stompin, we're not going to know about them and what they have to offer. I am trying to establish Landowner Resource centers in local communities with books, materials and go-to people at the ready.

COMMENTS ON INDICATOR 54

1. Indicator 54: There is also private sector landscape scale forest-related planning and assessment taking place at various scales, for example TNC Ecosystems, and local watershed groups.
2. Including cross-sectoral and multicultural planning and coordination would be more inclusive.
3. Regarding Indicators 54 and 56, in a forest economy like the US where most of the forest land is in private ownership most the forest planning and planning for harvesting and manufacturing infrastructure is accomplished by market forces.
4. Indicator #54 is critical; perhaps more than all others. How does this relate to private sector forestry? Is the "institutional framework" inclusive of corporations? The presence of forest management plan (and the legal/policy/institutional framework to see that plans are followed) is the single most important indicator that a forest will be managed sustainably.

COMMENTS ON INDICATOR 55

1. What does Indicator 55 mean and what data is currently used for this? What are considered "relevant disciplines?"

COMMENTS ON INDICATOR 56

1. See comment 3 in the section about indicator 54 above.
2. Why is Indicator 56 part of Criteria #7? If it (physical infrastructure) fits here, so do some other Indicators from other criteria that have an element of "institutional framework."
3. No. Indicator 56 is too economic. ... to facilitate the supply and sustainability (maintenance?) of forest products and services. I'd like to see forest gates as well as forest roads maintained, for example!
4. All of these indicators use themes that were reflected in the California Forest and Range Assessment. Indicator 56 seems to cover physical infrastructure but is not clear about the provision of actual services associated with the infrastructure (such as police and fire protection). If these are not reflected elsewhere in the Protocols, they should be added here.

COMMENTS ON INDICATOR 57

1. Enforce and review laws would be more inclusive.
2. Indicator 57 needs to be changed to "periodically review and modify laws, regulations and guidelines to ensure that they foster sustainable management". No point in enforcing laws etc that aren't going to do that.

SUGGESTED ADDITIONS

1. I recommend that an indicator be added either here or in 7C for a legal and regulatory structure that enables market forces to operate efficiently to optimize planning for long-term investment in forest enterprise.
2. Area under forest certification.
3. All of these indicators use themes that were reflected in the California Forest and Range Assessment. Indicator 56 seems to cover physical infrastructure but is not clear about the provision of actual services associated with the infrastructure (such as police and fire protection). If these are not reflected elsewhere in the Protocols, they should be added here.
4. This is another possible place for using the Community Capitals Framework to help develop indicators that look at the "extent to which institutional framework supports the conservation and sustainable management of forests" since this should not be looked at without the consideration for that same institutional framework supporting the sustainability of communities.

SUGGESTED DELETIONS

1. Again - would recommend that these all be dropped. Believe measures are subjective.

SUB-CRITERION 7C. ECONOMIC FRAMEWORK

The indicators in this sub-criterion are concerned with the extent to which the economic framework (economic policies and measures) supports the conservation and sustainable management of forests through:

Indicator 58. Investment and taxation policies and a regulatory environment which recognize the long-term nature of investments and permit the flow of capital in and out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services.

Indicator 59. Non-discriminatory trade policies for forest products.

This group of indicators is designed to address the economic framework. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (15 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. These are important indicators for monitoring pressures on private forest land owners.
2. Good concepts--bad indicators.
3. These policies have to be set to specify the costs of ecological damage on the beneficiaries from the activities in question!!!!
4. Good indicator concept but a bit vague and certainly difficult to measure objectively.
5. Adequate. Long-term thinking is very important.
6. Yes, adequate. Again, I would point out that non-timber forest products have been overlooked in these equations.
7. CRITICAL!!!!
8. Perhaps this is the subcategory of indicators that should have the "physical infrastructure"? This is another place where economic/financial concerns have been divorced from the rest of the Community Capitals - need to be able to look at all of these in relation to each other as well as from the conventional economists' viewpoint.

COMMENTS ON INDICATOR 58

1. The write-up in the national report for indicator 58 says only that "laws exist" and does not venture to assess the positive or negative impact of tax and other law re: the long-term supply of forest products. Some of these laws create real disincentives to management and have led to the creation of REITS such as Plum Creek corp. which pay a different tax rate.
2. Both indicator 58 and 59 read as if written by an attorney, such that development of meaningful measures will be very difficult. I am not sure that these are useful.
3. "What Is the Indicator and Why Is It Important?" The sustainability of forests and the many benefits they are capable of providing requires high levels of sustained investment in their

management and protection. It is only through such investment conditions that a full range of products, values, and services provided by forests can be assured. If investment capital is lacking in the forest sector, sustainable management and expected economic, ecological, and social benefits may not transpire. Similarly, if investment capital is prevented from leaving the forest sector, inefficiencies can occur and over-exploitation of forests is a possibility. These conditions of investment are driven by a number of economy-wide factors, most notably product or service prices, forest land productivity, and discount rates as affected by risk." The construction of the above indicator is seriously flawed as applied to the broad category of the term "forests."

COMMENTS ON INDICATOR 59

1. Thank you for Indicator 59. Please show broad product classes and where trade occurs globally with discriminatory trade policies, or explain the lack of data in that area. Most agricultural commodities have data on the effects of trade policy, mad cow disease effects on trade, etc. and the US does little to no analysis on this.
2. These are sound as well. Indicator #59, for example, will show that the US estate taxes ("death taxes") and many local land taxes are directly responsible for considerable forest conversion and forest fragmentation.
3. See comment 2 in the section immediately above.

SUGGESTED ADDITIONS

1. I believe that what is needed here is an indicator that focuses on the extent to which local, regional, or national policies or regulations serve to discourage local or domestic production of forest-based raw materials and encourage importation. Examples of indicators that would measure this kind of thing are:

Indicator xx. Stringency of forest harvest and forest ecosystem protection laws in relation to other regions nationally and globally from which wood and wood products are imported.

Indicator xy. Degree to which local, regional, and national forest harvest and forest ecosystem protection laws increase the cost of raw material extraction in comparison to other regions nationally and globally from which wood and wood products are imported.

2. What is the economic value of environmental services produced by a sustained forest management policy? For example a good agroforestry program that prevents soil erosion which causes water pollution is worth how much in economic terms? Environmental services are gaining more notoriety in the forestry community.

SUB-CRITERION 7D. CAPACITY TO MEASURE AND MONITOR

The indicators in this sub-criterion are concerned with the capacity to measure and monitor changes in the conservation and sustainable management of forests, including:

Indicator 60. Availability and extent of up-to-date data, statistics and other information important to measuring or describing indicators associated with criteria 1-7.

Indicator 61. Scope, frequency and statistical reliability of forest inventories, assessments, monitoring and other relevant information.

Indicator 62. Compatibility with other countries in measuring, monitoring and reporting on indicators.

This group of indicators is designed to address the capacity to measure and monitor. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (17 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. These indicators illustrate the importance of defining the characteristics that good indicators should have and assessing our capability to supply quality information. They should be objectively measured and reported at every level. The National Report points out some glaring weaknesses in indicator concepts and data.
2. Adequate. However, numbers do not say it all. Ethnographic methods should also be employed.
3. This list seems to primarily consider measuring and monitoring bio-physical elements, although Indicator 60 mentions Criteria 6 and 7.
4. Okay, but need to be inventoried, monitored and measured in relation to the other sectors such as cropland, grazing lands, etc. Currently this is not done. Each sector inventories it's own resource often over lapping other sectors or creating gaps. See: Lund, H. Gyde; Iremonger, Susan. 2000. Omissions, commissions, and decisions: the need for integrated resource assessments. Forest Ecology and Management 128(1-2):3-10.

COMMENTS ON INDICATOR 60

1. These are important indicators. I think 60 might include "standards" somewhere, since the utility of information to anyone but the data collector is correlated with its use of standards.

COMMENTS ON INDICATOR 61

1. No. Indicator 61: scope, frequency, and historical or cultural authenticity as well as statistical reliability would be an improvement. Otherwise, qualitative data methods are excluded as indicator methods.
2. Indicator 61 - should include important socio/economic information.
3. Indicator 61 is of most interest to me. There is an effort in the Pacific Northwest to get Federal and State organizations on the same page where monitoring water quality is concerned. Meeting the

multiple objective across organizational boundaries is difficult but at least some progress is being made on the statistical designs and a core set of indicators - including biology. Perhaps a case study of a way to coordinate is in the making.

COMMENTS ON INDICATOR 62

1. Indicator 62: Long live the acre the mile and the board foot. At least until I no longer have to use measures to communicate professionally.
2. Good indicators, except 62 - "compatibility" is a bit vague and certainly a "moving target."

SUGGESTED ADDITIONS

1. These indicators are important, and I would recommend adding something in about participatory research processes.
2. Capacity to measure and monitor needs some indicators of the capacity in and the involvement of community forestry-based groups, rural communities, tribes, and others who have not generally been involved in natural resource monitoring and measuring.

Some indicator of the level of multi-party monitoring, with some attention to community involvement, not just special interest groups or organizations with substantial funding/lawyers/etc.

Need to have an indicator of our ability to include qualitative information in the measuring and monitoring - this lack of qualitative data/metrics applies across several C&I.

3. Data on conservation easements? Acres protected from conversion?
4. Additional criteria regarding human development adjacent to forests, and future planning for human development adjacent to forests should be included as a part of measurement and monitoring. This information will allow forest managers to anticipate future impacts on forests.
5. Increase the capability of the State Forestry agencies to monitor the health of the forests.

OTHER COMMENTS

1. Personally, I don't much like statistics. But that is just me. Are they relevant, are they up to date? Are they comprehensive?
2. Data is critical and needs to be coordinated, shared and used as effective tool in sustainable forest management.
3. Monitoring and measuring parameters associated with forest health is vital to understanding the changes taking place in our dynamic forest systems. Monitoring is one area that has received little attention in the past but needs to be raised to level of visibility commensurate with its importance.

SUB-CRITERION 7E. CAPACITY TO CONDUCT AND APPLY RESEARCH AND DEVELOPMENT

The indicators in this sub-criterion are concerned with the capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services, including:

Indicator 63. Development of scientific understanding of forest ecosystem characteristics and functions.

Indicator 64. Development of methodologies to measure and integrate environmental and social costs and benefits into markets and public policies, and to reflect forest related resource depletion or replenishment in national accounting systems.

Indicator 65. New technologies and the capacity to assess the socioeconomic consequences associated with the introduction of new technologies.

Indicator 66. Enhancement of ability to predict impacts of human intervention on forests.

Indicator 67. Ability to predict impacts on forests of possible climate change.

This group of indicators is designed to address the capacity to conduct and apply research and development. Does it do so adequately, and if not, what would you like to see added or deleted?

ADEQUATE: NO SUGGESTED MODIFICATIONS (9 RESPONSES)

COMMENTS ON THE SUB-CRITERION OVERALL

1. I'm not sure how important any of these are. Many US based researchers conduct research around the world. The same is true for researchers in many countries especially in hot topic areas like Amazonian rainforests. Its not based solely within individual countries.
2. These are subjective in my opinion - why not get figures on the governmental and private investments in Forest Research?
3. These indicators are vague and poorly defined.
4. This set is too complicated and ambiguous. Replace with something simpler like annual budgets for forestry research and / or numbers of scientists working in forestry research.
5. This will require a sound policy of funding directly useful research (not just "applied," but also relevant basic research). Commitment of funds for long-term projects seems the most critical and essential need right now.
6. It is hard to argue with the potential usefulness of Indicators 63-66. Indicators 63and 66 are still fairly theoretical. Indicators 64-65 were not used explicitly in the California Forest and Range Assessment. The Assessment combined considerations with carbon sequestration and climate change under one subject area. This area was especially significant because of the large Wildland Urban Interface Area in California and the potential impact of climate change on fuels and wildfire behavior.
7. Perhaps some of these indicators could be combined.
8. Yep, I guess these things are important if we think that science is up to the task. And I wonder

about that.

COMMENTS ON INDICATOR 63

1. Indicator 63 only shows research effort, not effectiveness, relevance to that needed, or progress in a particular field (do we know more now than 20 yrs ago). It is not likely that this indicator can be refined.
2. See comment 6 in section above.

COMMENTS ON INDICATOR 64

1. See comment 6 in comments about the sub-criterion overall.

COMMENTS ON INDICATOR 65

1. #65: unclear on what is meant by "socio-economic consequences associated with the introduction of new technologies". That sounds like a series of doctoral dissertations, not an indicator.
2. Dump 65.
3. See comment 6 in comments about the sub-criterion overall.

COMMENTS ON INDICATOR 66

1. Indicator 66 suffers from vagueness.
2. Adequate. Indicators 66 and 67 are important, but care should be taken to not over rely on number crunchers using (hermeneutic) models.
3. See comment 6 in comments about the sub-criterion overall.

COMMENTS ON INDICATOR 67

1. Indicator 67 has the problem that some people think they can predict effects of climate change on forests with confidence, but their methods are untested (they make assumptions that are not tested, and the projections themselves can only be tested hundreds of years from now).
2. #67: why is climate change singled out? Crisis of the moment? How about ability to predict impacts on forests of human population growth? Tsunamis? Earthquakes? Landslides? Overpopulation of protected wildlife (e.g., deer herbivory)? Tax policies? Changes in solar radiation? Get rid of this indicator!
3. See comment 2 in the section immediately above.

SUGGESTED ADDITIONS

1. A measure is needed that tracks the development of providing the results to the public in a manner in which it is easily understood by people without scientific backgrounds. Presenting the results is not enough. The public must understand them. If the public understands the science there will be more public involvement.
2. Applied research is an important event for sustained forestry. Is there a way to track how research

has made a difference in the actual practice of sustained forestry?

3. Need indicators that relate more directly to conducting and applying a broader range of social science research (not just economics) with forestry-related research. Lack indicator of ability to validate and use data/knowledge from other sources than conventional researchers (indigenous knowledge, community-based monitoring, adaptive management documentation, techniques used by forest practitioners, etc.).
4. Yes, adequate. However, I might add the development of methodologies/technologies to examine the interactions of the many variables that influence changes in the forest ecosystems, a more holistic view.
5. In both public and private sector.
6. This set is too complicated and ambiguous. Replace with something simpler like annual budgets for forestry research and / or numbers of scientists working in forestry research.

SUGGESTED DELETIONS

1. This set is too complicated and ambiguous. Replace with something simpler like annual budgets for forestry research and / or numbers of scientists working in forestry research.
2. #65: unclear on what is meant by "socio-economic consequences associated with the introduction of new technologies". That sounds like a series of doctoral dissertations, not an indicator.

#67: why is climate change singled out? Crisis of the moment? How about ability to predict impacts on forests of human population growth? Tsunamis? Earthquakes? Landslides? Overpopulation of protected wildlife (e.g., deer herbivory)? Tax policies? Changes in solar radiation? Get rid of this indicator!
3. Perhaps some of these indicators could be combined.

FINAL COMMENTS

If you have any other comments about the Montreal C&I that were not addressed elsewhere in this consultation, please provide them below.

COMMENTS ON THE C&I OVERALL

1. In general, a focus on indicators that can be measured, and a focus on clear definitions of terms, would improve the process and utility of these. However, you have done a ton of work, which is quite thoughtful.
2. I think the number of indicators in the National Report that are red coded (no data, no way to measure them) is a warning that some of the concepts are vague and not even measurable. There are also hidden value-judgments in some of the indicators that not everyone would agree with and that may hinder the very values supposedly being protected (whether economic or environmental).
3. This is an exciting step forward in sustainable forest management. I strongly encourage you to keep indicators related to nontimber forest products, community forestry, and participatory research processes. Keep up the great work!
4. Local cultural issues need to be surveyed and worked in, preferably in both quantified and "qualitative" forms.
5. The major problem as I see it is a weighting problem for social and cultural values. The only measure where value is given a dollar amount is in the timber management activities. If no weighting is given other values then the "best management" will be oil and gas, timber, snow mobiles and hunting. This is not a sustainable system and the remaining values will fall far behind. Maintaining a sustainable forest system means setting large areas of the forest aside and developing an emphasis on values that do not necessarily have a monetary value. The Forest Service needs much more public input and they need to start working closer with the Natural Resources Conservation Service who works entirely on private lands and has developed good conservation easement practices, something that the forest service has not.
6. The weakest part of the C&I is forest health.
7. The Montreal C&I process is an excellent tool to evaluate the status of our forests at a national level. We still have work to do to bring it to a local level that relates to the local land owner and manager.

COMMENTS ABOUT THE COMPLEXITY OF THE C&I

1. These are very well thought through indicators. Thanks to the many who have brought them forward. The fact that they are working to be an international set of standards is important, getting us all on the same sheet of music.

I fear there are too many of them to be effective for guiding a sustainable future. If all are equally important than none are. As indicated in my earlier comments, there needs to be some sorting of the driver and predictive indicators, the ones that either a) are the indicators of "keystone" health (to mix metaphors) and b) have a utility in predicting or foreshadowing future forest health, its native diversity and its sustainability for the generations to come.

This is a complex array of indicators, most of which are important. Is there a starting set of indicators that can be encouraged and trained on to get started on the right foot? Thank you for all the work on this important project and the opportunity for input.

2. Good attempt at characterizing what's important. Unfortunately, many things seems important to measure or characterize when you look at them one-at-a-time, yet when you consider the whole list, it seems like there's way too much to measure and keep track of. Some things can be roughly estimated, but the estimates could end up so rough that the results won't have much meaning. Also, this is just focused on forest sustainability. Is there any attempt to meld these efforts with people working on sustainability of systems that interface with forests, like ag lands and systems, rangelands, etc?
3. Data collection is expensive and complex at all scales. It is delusional to maintain the illusion that we can provide quality data for the Montreal Process indicators when this is not the case for more than two-thirds of them. A pragmatic evaluation of the MP indicators is needed to better define the indicators and to articulate a program of periodic remeasurement and reporting. I hope this is the reason for this inquiry.

"Indicators" that realistically can only be used to define general concepts should be identified and recognized as useful only for describing concept and context. Good indicators must be objective, measurable, consistent, relatively inexpensive, understandable, and scaleable--and they should be sensitive to change.

4. Too many indicators; need to focus on a smaller number that are both measurable and meaningful.
5. I have great difficulty understanding the intended value of all these indicators. Even if we could measure them all (which we can't), and even if we knew what all of them mean (which we don't), how then is our situation different? What more would we know about forest sustainability? In what ways would prudent managers change the way they manage forests? I would argue "very little".
6. Sustainability is a very difficult concept to address comprehensively given all the really fuzzy concepts that can be introduced. I hope the organization emphasizes those elements where truly quantitative indicators can be measured and reported upon. There are some hopeful signs that progress can be made in some areas; e.g., water quality. Perhaps these can be emphasized rather than to spend too much energy and resources on ill-defined indicators that are dependant upon individual value systems.

COMMENTS ABOUT DATA COLLECTION AND SHARING

1. The forest sector needs a broader set of available statistics important to the public's and decision makers understanding of forests. It is clear that this needs more forest management attention to make this information available through better alignment of federal and State data collecting, better interagency coordination, and in some cases more funding. This is not being done.
2. The C&I process is an excellent framework for monitoring forest sustainability through time. This process will only be as effective if quality and intensive monitoring systems are in place to iteratively measure each indicator at the appropriate temporal scale. Current monitoring systems are inadequate, however. Forest Inventory and Analysis program has undergone sampling design changes with each sampling occasion making the data more complex than necessary, confusing, and almost unusable for tracking some indicators. The success of the C&I system is dependent on robust and institutionalized monitoring systems.
3. Criteria needs to remain objective and scientific as well as be practical to acquire data in a timely

fashion. Sometimes USDA Forest Service FIA data is 1-2 years behind the reporting dates.

SUGGESTIONS FOR ADDITIONAL INDICATORS

1. I didn't see a place to make this comment, so I'll add it here. Energy policies vary greatly among countries and forest resources have a great deal to offer in this regard. I think it would interesting to document the amount and percent contribution of renewable bio-energy from forest resources (electricity, heat, steam, fuel, etc.) compared to the amount that would be possible on a sustainable basis and to the total amount of energy consumption. This data should be available.
2. The only real substantial comment that is on the top of my head is the one about needing an indicator that measures forest land ownership. I'm not sure if that is best placed under Criterion 1 or 6.

COMMENTS ABOUT PROCESS

1. Please continue to maintain an open process. Thank you.
2. This has been a difficult survey to respond to because I don't quite understand the context and policy implications. I appreciate the chance to give feedback!
3. I appreciate the opportunity to comment on the indicators. I hope the Roundtable does not change the Criteria and Indicators without international consensus. The Indicators most likely to be eliminated, if that were to happen, would seem to be the ones most difficult to measure. But the ones most difficult to measure are also the ones that make us examine our assumptions about the state of the world around us more thoroughly than we might otherwise.

OTHER COMMENTS

1. The forestry sector has been maneuvered or battered into a position of having to defend itself against concerns about ecological integrity. By far the biggest threat to biodiversity and ecological systems in the Northwest of North America is urban and rural commercial and residential development. The ecology of the Midwest and Central Planes of North America has been extirpated with little wailing and protest. Justifiably, society has extracted much from the forest owners for protection and preservation of environmental values. But it is well time that efforts and funds turn to urban runoff, wetland and marsh land retention, estuary preservation, invasive species, and the parcelization of forestland with the accompanying conversion to residential and recreational agriculture uses as causes for saving the planet.
2. Adequate public information and education at the lower grades of public schools, as well as an integrated education program covering ecosystem management and principles is an absolute necessity to the publics understanding and support of proper management of our forests. Unfortunately, this education has been sporadic, underfunded, and in recent years has included heavy funding from special interest groups that seek to influence policy to their benefit , sometimes to the detriment of the general public good. It is very important that the government and the school systems evaluate the education system and it's effectiveness in presenting a balanced and accurate set of education basic facts and a systematic way of judging the over-all public benefits of management.
3. For discussions of definitions of forest, see Lund, H. Gyde (coord.) 2004. Definitions of Forest, Deforestation, Afforestation, and Reforestation. [Online] Gainesville, VA: Forest Information Services. Available from the World Wide Web: <http://home.comcast.net/~gyde/DEFpaper.htm>.

Misc. pagination and Lund, H. Gyde. 2002. When is a forest not a forest? *Journal of Forestry* 100(8): 21-27.

4. In preparing the California Forest and Range Assessment, much effort went into trying to understand what the Montreal Process meant in a state context. Some Montreal Process indicators were easier to adapt to California than others. The idea was extended to include both forest and range resources. It was necessary to find indicators that could be measured and for which trends might be established. Data limitations often were severe and analysis was largely descriptive. Ultimately, chosen indicators provided a very complex, even contradictory picture, of California's forest and range resources. As such, it is a real challenge to explain this kind of picture to policy makers.

APPENDIX A. ORGANIZATIONAL AFFILIATIONS BY STAKEHOLDER GROUP AS PROVIDED BY CONSULTATION RESPONDENTS

Colleges and Universities¹

- Mississippi State University, College of Forest Resources
- North Carolina State University, Department of Forestry & Environmental Resources
- Oregon State University College of Forestry
- Oregon State University, Institute for Natural Resources
- The Pennsylvania State University, Dept. of Agricultural Economics and Rural Sociology
- The Pennsylvania State University, School of Forest Resources
- State University of New York Buffalo School of Law
- University of California, Berkeley, Dept. of Environmental Policy, Science, and Management
- University of California, Riverside, Department of Anthropology
- University of Minnesota, Department of Bio-Based Products
- University of Minnesota, Natural Resources Research Institute
- University of Montana, Department of Sociology
- University of North Carolina, Greensboro, Department of Anthropology
- University of Wisconsin, Department of Botany
- Utah State University, Department of Forest, Range, and Wildlife Sciences
- Virginia Tech, Department of Forestry
- Washington State University, Cooperative Extension

Community Development/Interest Organizations

- Sustainable Woods Network

County or Local Government Agencies

- Baltimore County, MD, Department of Environmental Protection & Resource Management

Federal Government Agencies²

- US Environmental Protection Agency
- US Fish and Wildlife Service
- US Geological Survey
- USDA Cooperative State Research Education and Extension Service
- USDA Forest Service, International Programs
- USDA Forest Service, National Forest System, Headquarters
- USDA Forest Service, National Forest System, Region 8 (Southern)
- USDA Forest Service, National Forest System, Region 10 (Alaska)
- USDA Forest Service, North Central Research Station
- USDA Forest Service, Northeastern Area State & Private Forestry
- USDA Forest Service, Pacific Northwest Research Station
- USDA Forest Service, Rocky Mountain Region
- USDA Forest Service, Southern Research Station
- USDA Forest Service, State and Private Forestry, Headquarters
- USDA Forest Service, State and Private Forestry, Southern Region
- USDA Natural Resources Conservation Service

¹ In many cases, respondents in this category provided the name of their college or university only. Meridian Institute conducted internet searches on each respondent in order to more accurately document the variety of disciplines represented in this group.

² Many respondents from the USDA Forest Service provided the agency name only. Meridian Institute attempted to identify each respondent in the agency's on-line personnel locator in order to more accurately document the variety within this group.

For Profit Forest Products Companies

- Goods From The Woods
- Healing Planet Herbs
- Midwest Forest Products Company

Forest Management Consultants

- Northern Development Consultants
- Timberline Forestry Consulting LLC

Foundations

- Foundation for Global Sustainability
- Southern Appalachian Man and Biosphere Foundation

Non-Profit Environmental or Conservation Organizations

- Coast Range Association
- Eastern Nevada Landscape Coalition
- Mackinaw Forest Council
- Manomet Center for Conservation Sciences
- National Forest Foundation
- Priest Community Forest Connection
- West Virginia Ginseng Growers Association

Private, Non-Industrial Forest Owners

- Wisconsin Family Forests, WI Timber Coop

State Government Agencies

- Alabama Forestry Commission
- California Department of Forestry and Fire Protection
- Iowa Department of Natural Resources, Forestry Bureau
- Kentucky Division of Forestry
- Maryland Department of Natural Resources, Forest Service
- Minnesota Forest Resources Council
- Minnesota Department of Natural Resources
- Oregon Department of Forestry
- Pennsylvania Department of Environmental Protection
- Puerto Rico Forest Service
- South Carolina Forestry Commission
- South Dakota Department of Agriculture
- Washington State Department of Natural Resources
- Western Governors' Association
- Wisconsin Department of Natural Resources

Tribal Government Agencies

- Coquille Indian Tribe

Other Organizations (category selected by respondent)

- S.J. Morse Company
- Institute for Culture and Ecology
- International Federation of Building and Wood Workers
- National Council for Air and Stream Improvement, Inc.
- National Network of Forest Practitioners
- Western Forestry Leadership Coalition

