

Table on Criterion 3 Refinements

This table shows recommendations for refinements to the Montreal Process indicators, the rationales for the indicators, and in selected cases, approaches to measurement. These recommendations were reached through discussion and general agreement at three technical workshops coordinated by the USDA Forest Service and the Roundtable on Sustainable Forests in April 2005 to obtain high-quality input from a diverse set of forest stakeholders. Column 1 shows the location of the text in the *Draft Document: Excerpts from the Montreal Process Technical Notes Modified for the Series of C&I Refinement Technical Workshops*. Column 2 presents the original language with any deleted text underlined and struck out; column 3 presents the refined text with any additional text underlined. Column 4 includes any comments made on the refinement.

Summary of Refinements
Indicators 15–17 are modified, and a substantially revised rationale for Indicator 16 is substituted for the original.
Other Cross-cutting Recommendations
<ol style="list-style-type: none">1. Changes in land cover, including land conversion and permanent flooding, were proposed in Indicator 16. With these changes, the group wants to make sure land cover is not lost from Criteria 1.2. The changes made to Indicator 17 complement Criteria 1, 2, 4, and 5. The results from this measure may be an impetus for more targeted monitoring, research, and management.
New Definition: Reference Condition
Participants in this breakout group recommended changes to the definition of Reference Condition in the Montreal Process Glossary to give people latitude to use spatial or temporal conditions as reference points. The changes proposed, underlined below, are in addition to those proposed by the breakout group on Criterion 4. The refined definition is: “The range of spatial, structural, compositional, or temporal variation of ecosystem elements (i.e., plants, soils, animals) specified to represent <u>reference or baseline conditions (e.g., historic period, desired future outcome, or geographic location).</u> ”

Breakout Group: Criterion 3 - Indicators 15 - 17:

Participants: Andrzej Bytnerowicz, USDA Forest Service, Pacific Southwest Research Station; Rob Hendricks, USDA Forest Service, International Forestry; Kenny McDaniel, Bureau of Land Management, U.S. Department of the Interior; David Morman, Department of Forestry, State of Oregon; Cornelius Pratt, U.S. Department of Agriculture; William Stewart, Department of Forestry and Fire Protection, State of California

Criterion Lead: Kenneth Stolte, USDA Forest Service, Southern Research Station

Facilitator: Jennie O'Connor, USDA Forest Service

Note Taker: Iral Ragenovich, USDA Forest Service

Text in the Montreal Process Technical Notes	Original Language with Recommended Deletions Underlined and Struck Out	Refined Language with Recommended Additions Underlined	Comments on Recommended Change
<p>Indicator 15 (3.a) Title</p>	<p>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, salinisation, and domestic animals</p>	<p>Area and percent of forest <u>land</u> affected by <u>biological</u> agents beyond the range of <u>reference conditions</u></p>	<p>The change differentiates between biological and the physical stressors (see Indicator 16 for physical stressors). “Historic variation” is changed to “reference condition” because baseline or reference conditions may vary (see recommendation to add a definition of reference condition to the glossary) according to the intent of the analysis. The examples are deleted to broaden the indicator; examples tend to steer people to measure or report on only those examples.</p>
<p>Indicator 15 (3.a) Rationale</p>	<p>This indicator identifies and monitors the effects that a variety of processes and agents, both natural and human induced, might have on basic ecological processes in forests. Impacts include land conversion, harvesting, species introductions, changes to natural fire cycles and floods, and the introduction of non-native species especially pathogens. Where these processes are altered beyond some critical threshold they may produce significant changes to the condition of the forest. By regularly examining specific indicators, it may be possible to detect deleterious changes and modify management strategies to reverse the change.</p>	<p>This indicator identifies and monitors the <u>unusual</u> effects that a variety of <u>biological</u> agents have on <u>the character, vigor, diversity and resilience of forests.</u> Where these <u>agents</u> are altered beyond critical <u>thresholds</u>, they may produce significant changes in the condition of forests. <u>These effects may be from natural or human-induced agents, and where possible categorized as such. Biological agents include invasive species introductions and exacerbated native species populations, e.g., pathogens, insects, plants and animals.</u> By regularly examining specific <u>biological agents</u>, it may be possible to detect deleterious changes and modify management strategies to <u>positively alter these changes.</u></p>	<p>The changes attempt to tease out the difference between expected normal native species populations and populations of native species that are out of control—e.g., deer browsing in the East, or Southern Pine Beetle because of fire suppression activities. All of these are intended to differentiate between stressors that result from human induced activities and natural forces that have co-evolved with forests and are a natural part of these ecosystems. ”Ecological processes” is changed to “character of the forest” because ecological processes are included in and are the basis of Indicator 17.</p>

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Indicator 16 (3.b)	Area and percent of forest land <u>subjected to levels of specific air pollutants (e.g., sulphates, nitrate, ozone) or ultraviolet B that may cause negative impacts on the forest ecosystem</u>	Area and percent of forest land <u>affected by physical agents beyond the range of reference conditions</u>	The change splits Indicators 15 and 16 to differentiate between biological and physical processes. Indicator 16 is expanded to include other physical indicators instead of just air pollution.
Indicator 16 (3.b) Rationale	<u>Air pollutants are considered to have a significant cumulative impact on forest ecosystems by affecting regeneration, productivity, and species composition. Correlating forest health measures with information of deposition or concentrations of these substances may provide more information on the effects of pollutants on forests. Increased ultraviolet radiation, caused by changes in the earth's atmosphere, also has been shown to damage plants.</u>	<u>This indicator identifies and monitors the unusual effects that a variety of physical agents have on the character, vigor, diversity and resilience of the forests. Where these agents are altered beyond critical thresholds, they may produce significant changes to the condition of the forest. These effects may be natural or human-induced, and where possible categorized as such. Examples of physical agents include air pollution; extreme climatic, weather, geologic, or hydrologic events; changes in natural fire regimes; harvesting methods; and salinization. Air pollution includes gases, particulates, atmospheric deposition, and enhanced radiation. By regularly examining specific physical agents, it may be possible to detect deleterious changes and modify management strategies to positively alter these changes.</u>	A specific sentence addressing air pollution is added to avoid losing or de-emphasizing the indicator's specific focus on air pollutants. "Geologic" and "hydrologic" events refer to extreme and unusual events outside of the range of the reference conditions. The primary focus is to highlight human-induced stressors, as opposed to natural events or forces that have co-evolved with forests and are a natural part of these ecosystems. "Historic variation" is changed to "reference condition" because baseline or reference conditions may vary (see recommendation to add to glossary definition for reference condition) according to the intent of the analysis. Changes in land cover, including land conversion and permanent flooding, have been removed, but the participants wanted to make sure they remained under Criterion 1.

Text in the Montreal Process Technical Notes	Original Language with Recommended Deletions Underlined and Struck Out	Refined Language with Recommended Additions Underlined	Comments on Recommended Change
Indicator 17 (3.c) Title	Area and percentage 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.)	Area and percent of forest land with diminished biological components indicative of changes in fundamental ecological processes	Some examples are deleted because they were misleading and conflicting with the attributes of a good indicator. “Ecological continuity” is dropped because it is based on normally-functioning ecological processes and, therefore, redundant.
Indicator 17 (3.c) Rationale	The indicator has the potential to provide a measure of the status of fundamental ecological processes that underpin the maintenance of ecosystem health and vitality. The indicator should be considered as an integrated measure of component influences and should not rely on only one component. The indicator demands <u>a fairly high level of understanding about</u> the linkages among individual components of ecosystems, that is often lacking, and research <u>is</u> required to fill knowledge gaps.	<u>The primary value of this indicator is to provide an early warning of potential problems with negatively affectin ecological processes in forest ecosystems.</u> The indicator can provide a measure of the status <u>and change</u> of fundamental ecological processes that underpin the maintenance of ecosystem health and vitality. <u>Ecological processes are very difficult to measure at landscapes scales. However, there are biological components closely related to underlying ecological processes that can be measured and monitored at these scales. Examples of components and associated ecological processes that could be monitored include crown condition and photosynthesis; soil nutrients and nutrient cycling; fuel loading and fire regime; snags/down wood, and succession; and seedlings and regeneration.</u> The indicator demands <u>an understanding of</u> the linkages among individual components <u>and associated processes</u> of ecosystems, and <u>additional</u> research <u>will be</u> required to fill knowledge gaps.	The changes to this indicator complement Criteria 1, 2, 4, and 5. The results from this measure may be an impetus for more targeted monitoring, research, and management. As written previously, this indicator was confusing because examples given were measures that were difficult to implement at landscape scales and were only possible to implement at local watershed scales. The examples are corrected and broadened from a local watershed scale. The new examples are currently being measured in the USDA Forest Service’s Forest Inventory and Analysis (FIA) and Forest Health Monitoring programs.