The Criteria and Indicators

The following listing of the criteria and indicators and explanation of why the criteria are important are provided for convenience in referencing the indicators' wide-ranging nature while reading the analyses.

Criterion 1: Conservation of Biological Diversity

Why Is This Criterion Important?

Biological diversity ("biodiversity") spans a spectrum from genetics to species to the ecosystem. In general, the biodiversity conservation criterion reflects the knowledge that biodiversity is a form of natural capital (along with other stocks of natural capital such as water, soil, timber, and minerals) that provides environmental services essential to the human economy. Each ecosystem has a capacity for biodiversity, and tropical forests typically have greater biodiversity capacity than boreal ecosystems. When the biodiversity capacity of a forest ecosystem is diminished, the forest's underlying ecosystem components and processes are threatened, as are the dependent economic sectors and communities.

Ecosystem Diversity

- 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 or other classification systems
- Indicator 4. Extent of areas by forest type in protected areas as defined by age-class or successional stage
- Indicator 5. Fragmentation of forest types

Species Diversity

- Indicator 6. 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

Genetic Diversity

- 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

Criterion 2: Maintenance of Productive Capacity of Forest Ecosystems

Why Is This Criterion Important?

Because "productive capacity" refers to the ability of forests to produce goods and services for humans, this criterion overlaps the environmental and economic spheres of sustainability. The productive capacity criterion is one of the most straightforward, as are its constituent indicators. Essentially, productive capacity is maintained as long as the harvesting of forest products does not exceed growth rates. If harvesting exceeds growth rates, then the natural capital stocks become depleted or "liquidated," and the amount of products flowing from these stocks must decline. For example, if timber or deer are harvested at too rapid a pace, then lumber or venison production will not be sustained.

- 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 nonmerchantable 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 nontimber forest products (e.g., fur bearers, berries, mushrooms, game) compared to the level determined to be sustainable

Criterion 3: Maintenance of Forest Ecosystem Health and Vitality

Why Is This Criterion Important?

Ecosystem health depends on the functionality of natural, nondegraded ecosystem components and processes. The underlying premise is that forest species and ecosystems have evolved to function within particular environmental conditions determined largely by geological and climatic forces. Humans, meanwhile, have historically (and prehistorically) adapted their economic and social activities to environmental conditions and to the resulting ecological processes. Substantial modification of environmental conditions therefore threatens species' adaptive capacities, ecosystems' functional capacities, and that of the associated human economies and societies. For example, many local and regional U.S. economies depend on forests. To the extent that exotic species, air pollution, or diseases threaten the forests, the associated economies and communities are likewise threatened.

- 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, salinisation, 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 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.)

Criterion 4: Conservation and Maintenance of Soil and Water Resources

Why Is This Criterion Important?

Soil and water are primary stocks of natural capital in all terrestrial ecosystems. They constitute the foundation for the human economy and for the "economy of nature" with its birds, mammals, fish, reptiles, amphibians, invertebrates, and plants. Forest ecosystems differ from other types of ecosystems in that the soil and water resources support the growth of trees (which themselves constitute a form of natural capital). The amount of soil and water and their characteristics determine the capacity of ecosystems to sustain forests, forest economies, and forest-dependent societies.

- 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 have deviated significantly 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

Criterion 5: Maintenance of Forest Contribution to Global Carbon Cycles

Why Is This Criterion Important?

More than any other criterion, this one reflects the fact that forests exist within a context of the global environment and the world's economic and social activities. Criterion 5 embodies a direct link between the environment and the economy, because carbon cycling concerns result from the fossil fuel combustion that powers the human economy. The capacity of forests to sequester carbon may be—or may become—a primary factor for determining the capacity of fossil-fueled economies. The global economy, in other words, may be a function not only of the global environment, but particularly of the forested environment.

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 the total global carbon budget (standing biomass, coarse woody debris, peat, and soil carbon)
Indicator 28. Contribution of forest products to the global carbon budget

Criterion 6: Maintenance and Enhancement of Long-Term Multiple Socioeconomic Benefits To Meet the Needs of Societies

Why Is This Criterion Important?

While the first five criteria are centered in the environmental sphere of sustainability (with the exception of criterion 2, which clearly overlaps the economic sphere), criterion 6 is centered firmly in the economic sphere. As the sole criterion with an economic focus, it has more (19) indicators than any of the environmental criteria. Its first two subcategories reflect the basic economic breakdown of goods (e.g., wood products) and services (e.g., tourism). The investment subcategory provides indicators of society's attention to forest maintenance. The cultural subcategory includes the most social of the socioeconomic indicators, and the employment subcategory provides indicators of the forests' capacity to provide work, wages, and subsistence.

Production and Consumption

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 nonwood forest products
Indicator 31. Supply and consumption of wood and wood products, including consumption per capita
Indicator 32. Value of wood and nonwood products production as a percentage of GDP
Indicator 33. Degree of recycling of forest products
Indicator 34. Supply and consumption/use of nonwood products

Recreation and Tourism

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

Investment in the Forest Sector

Indicator 38. Value of investment, including investment in forest growing, forest health management, planted forests, wood processing, recreation, and tourism
Indicator 39. Level of expenditure on research and development and on education
Indicator 40. Extension and use of new and improved technologies
Indicator 41. Rates of return on investment

Cultural, Social, and Spiritual Needs and Values

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. Nonconsumptive use forest values

Employment and Community Needs

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. The 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

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

Why Is This Criterion Important?

Although it overlaps with the economic sphere, this criterion is centered in the social sphere of sustainability. Its first three subcategories provide for the assessment of laws, regulations, policies, planning, and public involvement pertaining to sustainable forest management. The last two subcategories address the nature and levels of forest research, monitoring, and reporting. Together, they reflect society's propensity and capacity to sustain forested ecosystems and associated economies.

Extent to Which the Legal Framework (Laws, Regulations, and 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 a 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 decisionmaking related to forests and public access to information
- Indicator 51. 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

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 to support forest management
- Indicator 57. Enforce laws, regulations, and guidelines

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 that recognizes the long-term nature of investments and permits the flow of capital in and out of the forest sector in response to market signals, nonmarket economic valuations, and public policy decisions in order to meet long-term demands for forest products and services
- Indicator 59. Nondiscriminatory trade policies for forest products

Capacity To Measure and Monitor Changes in the Conservation and Sustainable Management of Forests

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

Capacity To Conduct and Apply Research and Development Aimed at Improving Forest Management and Delivery of Forest Goods and Services

- 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 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 the ability to predict impacts of human intervention on forests
- Indicator 67. Ability to predict effects on forests of possible climate change