

**Defining Sustainability:  
What to Look for in  
Forest Certification Systems and  
Sustainable Forestry Standards**

Daniel A. Hall

**ABSTRACT**

Provides tools to evaluate forest sustainability and certification systems (CSs) intended to help consumers and other decision-makers identify products from sustainably managed forests.

Identifies problems with “sustainable forestry” definitions, and provides an alternate definition to address tradeoffs between competing forest uses. Summarizes both elements consumers should look for in CSs’ institutions, and forest management practices that should be reflected in CSs’ standards for private commercial forests in the U.S., based on the literature, consultation with foresters, economists, and ecologists, and elements found in some CSs. Discusses the significance of certification and private forests, arguing that environmentally-responsible procurement of forest products can improve the management of these and other forests where regulatory systems are insufficient to protect ecological and social values.

## **Defining Sustainability: What to Look for in Forest Certification Systems and Sustainable Forestry Standards**

### **INTRODUCTION**

“Sustainable forestry.” “Third-party certified.” These two phrases are central to a roiling debate over management of the world’s forests and environmentally responsible purchasing of wood and paper products. Yet both concepts are often poorly understood or defined, despite their importance. This paper attempts to provide a more useful definition of sustainable forestry, and tools to help consumers and other decision-makers identify effective and credible certification systems for forests that are sustainably managed, or at least well-managed.

Most forest certification systems promise (explicitly or implicitly) to enable consumers to identify wood and paper products derived from sustainably managed forests.<sup>1</sup> Certification potentially gives consumers considerable power to promote the conservation and sustainable management of forests by purchasing certified forest products instead of non-certified products. Certification and other market-based conservation efforts will be particularly important where regulatory systems are insufficient to counter serious threats to forests’ ecological, social, and long-term economic values. Examples include private forests in the U.S., and probably also forests in the tropics and Canada.

With the growth in the number of certification systems, consumers must now decide which systems to trust. Thus I outline a number of important elements that consumers should look for in certification systems’ governance, structures, and procedures.

The robustness of a certification system’s institutions is only half of the picture. Certification systems must also adequately distinguish environmentally and socially acceptable forest management from unacceptable management—leading back to the question of what

constitutes sustainable forestry. Yet many prevalent definitions of sustainable forestry are so vague that almost any forest management practice could be deemed sustainable.

Thus I begin by providing an alternate definition of sustainable forestry—one that recognizes that forest ecosystems themselves must first be sustained (and in some cases restored) if humanity is to sustain the production of wood and paper products, wildlife, clean water, non-timber forest products, climate stabilization and other forest values. My definition acknowledges tradeoffs between competing forest uses and values, and begins to provide a framework for evaluating the relative sustainability of alternate management scenarios. Since full ecological sustainability will be difficult to reach in some situations, I also use the term “well-managed” forestry to recognize practices that are as sustainable as possible given social and economic contexts and limitations, and limitations in our knowledge of forest ecosystems.

I then summarize some of the basic forest management practices one should see in well-managed private commercial forests in the U.S.—the “bread-basket” of our nation’s production forests—and in certification standards for such forests. These practices take advantage of opportunities to better maintain and restore forest ecosystems while providing landowners with necessary revenues.

Additional resources and reading suggestions are provided in a bibliography.

## **THE SIGNIFICANCE OF FOREST CERTIFICATION AND PRIVATE, NON-FEDERAL FORESTS**

Most forest certification systems (CSs) promise (or are often assumed) to help wood and paper retailers, manufacturers, and other consumers identify wood and paper products derived from sustainably managed forests. Ideally, CSs do this by: establishing forest management standards, using organizations known as “certifiers” to verify whether forest managers follow the

standards, labeling products from forests that comply with the standards, verifying that labeled products actually originate from certified forests, and ensuring that the entire process is predominately independent from the influence of the landowners being certified.

In theory, by purchasing certified products instead of non-certified products, consumers can create market demand for sustainable forestry practices, and reduce demand for unsustainable practices. This can both create an important incentive for forest managers to adopt improved forest management practices, and provide economic support for landowners already committed to managing their forests well. It may also be possible that certification can help reduce the negative effects of globalization by compensating for weaknesses in some nations' social and environmental standards.<sup>2</sup>

Discussions over what legitimately comprises sustainable forestry and third-party certification are particularly critical for private forests in the U.S. Here, regulatory systems are likely to remain insufficient to protect and restore important ecological and social values. A similar situation may exist with forests in the tropics and Canada. In such forests, certification and other market-based conservation efforts may be among the best hopes for protecting remaining wild, heretofore unlogged forests while promoting sound practices in managed areas.<sup>3</sup>

The importance of private and other non-federal forests in the U.S. may be underestimated by consumers. The majority (73%) of the nation's forests are owned by timber and paper companies, other private landowners, and other non-federal landowners.<sup>4</sup> The ecological, social, and economic values of our nation's forests will only be realized if private timberlands and other non-federal forests are managed more sustainably. Private forests in particular comprise the nation's commercial forest "bread-basket," accounting for the majority of both domestic commercial timberland and timber harvest.<sup>5</sup> The extent and location<sup>6</sup> of these forests often makes them necessary participants not only in the production of timber and other

forest products, but also in the conservation of biodiversity and imperiled species, water quality and aquatic resources, and ecosystem services like the absorption of carbon dioxide, one of the gases responsible for global warming.

Threats to these forests may also be underestimated. Nearly all forests owned by wood and paper products companies are intensively managed for wood fiber (as are some family-owned private forests, state forests, and tribal forests). Most old-growth in private forests has long since been logged-off, and new generations of trees tend to be logged at relatively young ages and small sizes. This conversion of natural forests to industrial tree farms often comes at the expense of timber inventories found in past generations,<sup>7</sup> water quality, fish, wildlife, and plant species,<sup>8</sup> and even some entire forest ecosystems.<sup>9</sup> Today's prevailing industrial forestry practices are probably insufficient to substantially restore historic levels of timber stocking, imperiled species, and natural forest conditions. Remaining stands of intact forests also continue to be logged on non-federal forests. Various factors are also leading some timber companies and other private forest owners to convert portions of their forests to residential sprawl and other non-forest land uses, permanently eroding the resource base. Of course, this isn't to say that wood and paper companies should simply look to other forests. Indeed, controversy already exists over companies' procurement of wood and fiber from forests in tropical and boreal regions, and federal public forests in the U.S.

### **DEFINING SUSTAINABLE FORESTRY AND WELL-MANAGED FORESTS**

Many definitions of sustainable forestry are variations of the Brundtland Commission's definition of "sustainable development." This definition called for meeting "...the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). The Commission's definition expressly

recognizes two crucial elements of sustainability: intergenerational equity and the need to maintain long-term resource productivity.

Yet the Commission's definition leaves most other questions unanswered. What are different generations' needs? Do these needs include the level of demand for wood and paper products found in the U.S.? Do they include sustaining forests' other social and economic values, including wilderness, clean water, carbon sequestration, and traditional uses for indigenous peoples? Are the world's forests capable of meeting the desires or needs of future or even present generations given consumption of wood and paper patterned on the U.S.?<sup>10</sup> What population levels are compatible with sustaining the world's forests? How can forests sustain consumptive uses if they are not sustained ecologically? And how should tradeoffs be made between conflicting social and economic uses of forests, or even just competing economic uses? Even definitions that call for balancing economic, social, and environmental perspectives and forest uses still beg the questions of *which* balance is sustainable, and whether "balanced" forestry will truly sustain forest ecosystems and their productivity.<sup>11</sup>

More useful conceptions of forest sustainability must include, though not be limited to, a focus on whether forests and their resources are actually being sustained. Discussing which human uses of our forests to sustain will be moot if societies do not first sustain the forest resources that are the foundation for *any* forest use.<sup>12</sup> To sustain forests, we have to maintain—and in some cases, restore—their biodiversity, timber inventories, soil productivity, ecosystem processes, and other components. As noted by the World Bank's 1992 International Conference on the Definition and Measurement of Sustainability, "...sustaining the global life support system is a prerequisite for sustaining human societies..." and "maintaining biological productivity is the key to sustainability..."<sup>13</sup>

*Thus I define sustainable forestry as:*

1. *management that maintains and restores natural forest ecosystems<sup>14</sup> and their productivity across the area under consideration, including by: (a) protecting remaining wild areas,<sup>15</sup> (b) protecting and restoring clean water and abundant, well-distributed populations of all native species, (c) maintaining and restoring all other biological components and ecosystem processes of natural forests, and (d) maintaining and restoring the forest's potential to provide ecosystem services and forest products; with*
2. *any forest resource extraction and development that occurs being: (a) compatible with (1), and (b) socially equitable among present and future generations, and different economic beneficiaries; and while*
3. *accounting for: (a) short- and long-term management outcomes, and (b) reasonably foreseeable changes in social and environmental conditions.<sup>16</sup>*

Admittedly, this definition sets a standard unlikely to be fully met everywhere in today's world. In the U.S., wood and paper companies, as well as some non-industrial private forest owners, need to generate economic returns from their forests. Such owners may face limits on their ability to fully sustain all ecological and social values of their forests. While other sources of forest-based revenues are emerging, commercial timber harvesting is likely to remain important to these landowners for the foreseeable future.<sup>17</sup> Even the most "balanced" commercial timber operations are unlikely to sustain wilderness, species that are particularly sensitive to the presence of people, or species that need extensive intact and mature forests. Wilderness values and some ecological processes and components may also be difficult if not impossible to maintain within smaller forest ownerships.<sup>18</sup>

Even so, our definition should provide a starting-point for evaluating alternate forest management scenarios and their likely outcomes in terms of their *relative* sustainability, particularly in terms of whether they sustain forest ecosystems and their productive potential.<sup>19</sup>

Equally important, the (often large) gap between sustainable forestry and commercial forestry can be significantly reduced, including on private and other non-federal forests in the U.S. *With this in mind, I define well-managed forests as forests where management is as sustainable as practicable, relative to our definition of “sustainable forestry,” given: (a) overriding economic, social, and ecological objectives and limitations for the forest in question; (b) limitations in knowledge and data; and (c) opportunities to use more ecologically beneficial forest management practices, within the parameters of (a).*

In the U.S., the social and economic context for forestry differs most significantly amongst land ownership types. At one end of the spectrum, the public expects National Forests and other federal public lands to be managed in the public interest and provide, along with other goods, old-growth ecosystems, wilderness, recreational opportunities, and other values less realistic to expect from private ownerships.<sup>20</sup> Conversely, private forests are held to the owners’ objectives. Non-industrial private owners’ objectives tend to be diverse, while industry owners tend to focus first and foremost on revenue and fiber production. Of course all private owners should still protect their forests’ long-term productivity, and must still protect public trust resources such as wildlife and water.

### **WHAT TO LOOK FOR IN FOREST CERTIFICATION SYSTEMS**

Forest certification systems (CSs) typically include the following basic components:

- A group of stakeholders that establish and govern the CS.
- Standards for forest management and conservation.

- An organization that manages the CS.
- Certifiers, i.e., companies or other organizations that evaluate whether interested landowners meet the CS' standards.
- Accreditation standards used by the CS to ensure the certifiers are qualified and follow proper procedures.
- A label that informs consumers when forest products come from certified forests.

To be reliable, credible, and effective at helping consumers identify products from sustainably or even well-managed forests, forest CSs must possess many additional attributes. The following “short list” provides a summary of other important attributes to look for in CSs. Existing CSs exhibit these and other important attributes to varying degrees. Some of these attributes are identified and discussed in more detail in the literature on forest certification.<sup>21</sup> Important technical requirements have also been identified by the International Standards Organization (ISO) and others.<sup>22</sup>

### ***System Governance***

- The CS is established and governed at all levels by an inclusive and democratic stakeholder group that includes relevant expertise in forestry, ecology, and the social sciences, and a balance of ecological, social, and economic interests. While it may not be practical for large stakeholder groups to oversee day-to-day implementation of the CS, they should retain ultimate decision-making authority over the CS' standards, policies, and processes.
- The CS is independent from vested interests, at all levels of system development, governance, and implementation. The role of entities being certified—i.e., wood products companies, government forestry agencies, and other landowners—should be limited to that provided through balanced stakeholder governance.

- Decision-rules ensure that ecological, social, and economic stakeholder groups are given equal weight, and that decisions can not be taken in the absence of any of the three stakeholder groups.
- The CS is funded by predominately independent sources.

### ***Certification Standards***

- The CS has developed ecologically-protective, silviculturally-sound, and socially-sensitive standards that address all relevant forestry, environmental, and social concerns.
- The CS' standards are sufficient to achieve our definition of sustainable forestry or, where the private ownership of forests or other factors preclude full sustainability, our definition of well-managed forests.
- The CS' standards account for differences in the context for forest management, including differences among nations, regions, forest types, and types of forest ownerships. In the U.S., the standards for private forests should include (but not be limited to) indicators comparable to those listed in the following section. Standards for public forests will need to address public trust resources and public participation at levels beyond those expected for privately-owned forests. Standards for tropical countries may need to place even greater emphasis on land tenure issues, poverty alleviation, and illegal logging.
- The standards rely substantially on detailed, performance-based indicators for "on-the-ground" outcomes of forest management. More open-ended "system" indicators can also be useful in some areas. However, to provide assurances of forest management quality, the CS must emphasize standards for specific forest management objectives and outcomes.

- CS personnel consult with the scientific community and interested stakeholders during standards development.

### ***Certifiers***

- The CS consistently uses independent, third-party certification assessments of interested forest landowners. By definition, third-party certifiers must be completely independent from the entity being certified, and have no conflicts of interest. Certifiers do not contract with the entities being certified for other services.
- The certifiers' forest assessment teams have expertise in silviculture, ecology, social sciences, and other relevant disciplines, and knowledge of the forest types and regions under assessment.
- The CS accredits certifiers to ensure their competency in the fields of forestry, ecology, and the social sciences, and to ensure consistent implementation of the system's procedural and substantive requirements. The CS requires certification assessments to be consistently peer reviewed. The CS also monitors the certifiers' performance annually, for quality control, including by examining a sample of the forests that were certified, and by checking the certifiers' chain-of-custody assessments.

### ***Certification Process***

- The CS requires consistent use of all relevant certification standards.
- The CS requires evaluation of on-the-ground forest management and its outcomes (i.e., "field audits"), for all relevant standards.
- Landowners are required to certify their entire forest holdings. If the CS allows landowners to certify only a portion of their forests on a trial basis, substantial and representative portions of the forests must still be certified, and management of the landowner's remaining forests must be non-controversial.

- The CS restricts the influence of the entities being certified over the interpretation of standards and over certification decisions and reports.
- The CS requires certifiers to consult with the scientific community and interested stakeholders during certification assessments.
- The CS has established other careful procedural requirements for certification assessments. These should include parameters for sampling forestlands being assessed, guidelines for “weighting” the importance assigned to different indicators within a system’s certification standards, parameters for what level of forest management performance will be considered passing, clear procedures for the use of conditions to address areas of low performance, and criteria for certificate revocation.<sup>23</sup>
- The CS has adopted mechanisms to reduce the cost of certification for small forest properties, while maintaining the integrity of the certification standards.

### ***Product Monitoring and Marketing***

- The CS uses a chain-of-custody monitoring system to track certified products, from the forest to the point of sale.<sup>24</sup> Forest products’ origins are accounted for, regardless of whether they originate from the certified entities’ forests, or are procured from other forests. Chain-of-custody systems are assessed/certified by independent third-party certifiers.
- The CS requires product labels to indicate the percentage of the product which comes from certified forests, if the percentage is less than 100%.
- Non-certified product content does not originate from forests managed with highly controversial and/or irreversible practices, such as logging of imperiled species’ habitats, areas claimed by indigenous peoples, or old-growth and other previously unlogged (or “frontier”) forests.

- The CS has careful guidelines for how certified entities can market themselves with regard to their certification, to ensure accuracy and preclude unwarranted claims.
- The CS requires independent, third-party certification of wood and paper companies' chain-of-custody systems.

### ***Transparency and Accountability***

- The CS provides transparency with certification assessments and decisions. Reports should be produced for each certification assessment, and include detailed discussion of the forests and forest resources certified, the specific forest management practices used, the landowner's performance relative to the certification standards, and specific corrective actions required to bring management operations up to the relevant standards. Certification reports should be provided to CS officials, for quality control purposes.
- Procedures exist to limit the influence of the entities being certified over the content of certification reports and corrective actions.
- The CS requires summaries of certification reports to be made publicly available, preferably through being posted on a website.
- The CS provides transparency in its governance. Draft and final policies, meeting reports, and other documents are made available to interested stakeholders.
- The CS has an appeals process, in the event that stakeholders dispute a certification decision.

### **WHAT TO LOOK FOR IN WELL-MANAGED PRIVATE FORESTS**

The following indicators are a "short list" of forestry practices that should be used on private, commercially managed forests in the U.S., for those forests to be considered well-managed. As discussed at the end of this section, the list is intended to serve as an introduction,

is therefore somewhat simplified, and is neither exhaustive nor a substitute for more detailed indicators.

Overriding management objectives and contexts for commercially managed private forestlands in the U.S. include: generating landowner revenue from timber and non-timber forest products, and potentially the sale of ecosystem services; maintaining long-term forest productivity; conserving and restoring viable, well-distributed populations of native species; maintaining and restoring clean water and aquatic ecosystems; protecting communities' and workers' rights; and protecting forests from sprawl and other non-forest land uses. Some of these objectives may not fully apply to smaller, non-industrial private forests. For example, individual small forest properties will often not be capable, by themselves, of maintaining populations of wider-ranging wildlife species (though they may still be able to contribute towards' the species' habitat needs).

These indicators were derived from the literature on forest management and conservation, consideration of the economic viability of more sustainable practices, consideration of the indicators used by forest certification systems (CSs), and consultation with ecologists, foresters, economists, conservationists, and policy professionals. As discussed at the end of this section, our indicators reflect practices that are economically practicable in most circumstances. Additional financial support and incentives could also be established to help landowners adopt more sustainable practices.

### ***Landscape Analysis and Forest Allocation***

- The forest management unit's role within the broader forest landscape is examined.<sup>25</sup> Considerations include forest ecosystem restoration plans and opportunities, and the conservation needs of indicator species.<sup>26</sup>

- Reserves are established on larger properties,<sup>27</sup> particularly in regions and forest types lacking sufficient public forests and habitat reserves to help support species and ecosystem processes not likely to be sustained in commercially managed landscapes. Forest management in reserves is limited to activities that restore and maintain the habitat values for target species.
- Larger properties maintain intact forest zones to provide connectivity between habitat reserves on public lands and other properties. Connectivity zones are designed to provide for a range of species' dispersal needs. Forest management in connectivity zones is limited to activities that restore and maintain dispersal habitat values, including for species dependent upon reserves.
- Lands outside of habitat reserves and connectivity zones (i.e., the majority of most private forests) are to be managed to maintain landscape connectivity (including through the indicators in the following sections), for species that do not utilize corridors. The distribution of retained forest areas and habitat components within individual management units (see the following indicators for imperiled species, biodiversity, aquatics, and natural areas) should be determined partly through analyses of the conservation needs of species that rely on the broader forest landscape.<sup>28</sup>
- Plantations (i.e., forest areas managed intensively for wood and paper products that fail to fully meet the indicators in the following sections) may be established on small percentages of forest ownerships, to help defray the costs of establishing reserves beyond levels that would normally be required.<sup>29</sup> As a rule of thumb, an acre of reserve should be established for each acre of plantation—though plantations should be limited to no more than roughly one-third of a property. Forest management in plantations must still protect aquatic resources and threatened/endangered species, limit chemical applications,

obey relevant laws and policies, and respect workers' and communities' rights.

Plantations must be located to avoid imperiled species and ecological communities, natural areas, and other priority conservation areas. Nor should exotic species or genetically modified organisms be used in plantations.

- Natural disturbance regimes are used to help guide management plans.

### ***Timber and Silviculture***

- Normally, the volume of timber logged does not exceed the volume grown during the same period, within commercially managed portions of the property.<sup>30</sup>
- Even-aged silviculture (i.e., clearcutting and comparable practices) is normally used only where the tree species require larger openings for regeneration, or on a limited basis to provide structural diversity across landscapes.<sup>31</sup>
- For even-aged silviculture, rotations at least reach culmination of mean annual increment (CMAI), when measured in board feet, the traditional measure of timber volume.<sup>32</sup>
- For uneven-aged silviculture, timber stands are not high-graded, and older, biologically mature trees are among those produced.<sup>33</sup> Target tree ages should be no less than would be achieved at CMAI under even-aged regimes.
- Controlled burns are used where practicable and ecologically appropriate, to emulate natural fire regimes.

### ***Non-Timber Forest Products***

- Harvest of non-timber products (e.g., edible plants and fungi, floral plants, game species, etc.) maintains the resources' reproductive productivity and genetic diversity, and does not remove greater amounts than can be produced during the same time-frame.<sup>34</sup>

### ***Imperiled Fish and Wildlife***

- Prior to logging, database searches, surveys, and other methods are used to locate threatened, endangered, rare, endemic, and other imperiled species and their habitats, as well as areas important to their recovery.<sup>35</sup>
- Threatened and endangered species' populations and habitats are fully protected. Disturbances which may be unavoidable in the course of habitat restoration are limited and mitigated to provide a net benefit to the species.
- Habitats for other rare, endemic, or imperiled species are identified and maintained.
- On larger ownerships, threatened and endangered species' habitats are restored on a significant portion of the property, and a full range of habitat types and forest age classes are provided.

### ***Soils, Ecosystem Function, and Biodiversity (Generally)***

- Soil quality assessments are conducted.<sup>36</sup>
- All logging operations retain green trees, large "legacy" trees, snags, down logs, unlogged patches, etc., to carry-over soil communities, plant communities, key habitat features, and other ecosystem components.<sup>37</sup>
- Even-aged logging operations use "variable retention" and retain at least 15% of green tree volume until the next rotation.<sup>38</sup>
- A relatively natural diversity and distribution of native tree species is maintained. Seed sources for planted trees are from the same area and microclimate. Genetic diversity is maintained. Generally, exotic tree species are not planted.
- Rare forest types and plant communities are protected. Native berry patches, mast trees, caves, talus slopes and other special habitats are maintained/protected.

- Invasive exotic plants, pests, and pathogens are eradicated whenever feasible, unless the eradication methods would cause greater harm. Measures are established to prevent the establishment of invasives. Genetically modified organisms are not used.
- Logging and site preparation techniques minimize soil disruption and compaction.<sup>39</sup>

### ***Water Quality and Aquatic Resources***

- No-logging inner buffers and light-logging-only outer buffers are provided around all streams, seeps, springs, and wetlands. Buffer design and composition protects water temperatures and riparian habitat, provides inputs of nutrients and large woody debris, is resilient to windthrow, accounts for channel migration, and is sufficient to provide all native fish and aquatic species with a high probability of recovery.
- Road densities are limited to the minimum necessary for management. Roads and crossings are designed and maintained to prevent erosion and allow fish passage.
- Unstable slopes—including steep slopes and areas subject to both shallow and deep-seated movement—are protected from road construction and logging.
- Water quality standards for sediment, temperature, and chemical pollution are achieved, to the extent possible given ownership patterns within watersheds.
- Watershed analyses are conducted on larger ownerships, to identify specific resource management and restoration priorities.

### ***Chemicals***

- Natural pest management strategies are used. For example, forest management maintains populations of birds and other animals that normally feed upon and manage forest pest populations.
- Silvicultural practices are chosen to minimize and/or avoid the need for routine applications of chemical herbicides, pesticides, and fertilizers.

- The least toxic chemicals are used, when herbicides and other chemicals are applied.
- Aquatic and riparian areas, sensitive plant and animal species, neighboring landowners, and other sensitive sites are protected from the application of herbicides and other chemicals.
- Soils, water, and other resources are protected from contamination by fuel and oil from equipment.

### *Natural Areas*

- All old-growth forest stands and remnants, other primary forests, and significant roadless areas are protected. This does not preclude logging “new” older and/or larger trees produced through long rotations on managed sites.
- Other remaining examples of rare and imperiled forest communities are protected.<sup>40</sup>
- Wetlands, meadows, and other non-forest ecosystems are not converted to timber.
- Reserve areas encompassing landscape-limited forest types and age classes are established on larger ownerships (see the preceding indicators for landscape planning).

### *Cumulative Impacts*<sup>41</sup>

- Cumulative roading impacts are assessed and limited at or below the watershed level.<sup>42</sup>
- The extent of even-aged logging units (i.e., “openings”) is limited. Timber rotation targets (see the indicators for timber and silviculture) are met within each watershed and, in large watersheds, their subunits. In addition, either: (a) the total acreage of openings in each size class should be roughly equivalent,<sup>43</sup> starting with size classes as small as a few acres, and with the largest size class not exceeding the size of openings produced by natural non-catastrophic, stand-replacing disturbances,<sup>44</sup> or (b) opening sizes are generally no larger than roughly 40 acres.

### ***Economic Sustainability***

- The forest management regime can be continued indefinitely. Forest management does not deplete resources.
- A portion of revenues are reinvested in the forest, to support long-term productivity. Where needed, revenues are also set aside for forest restoration.
- Opportunities to produce a diversity of forest products are explored.
- Strategies are in place to deal with long-term threats, such as estate taxes (in the case of family ownerships).

### ***Labor and Community***

- Workers are paid competitive wages, and workers' rights to join unions and collectively bargain are respected.
- Workers are employed from local communities, where practical, and some profits are locally retained and reinvested.<sup>45</sup>
- Opportunities to support skilled labor and value-added processing are utilized.

### ***Indigenous Peoples***

- Sites of cultural significance for American Indians are protected.
- Reserved American Indian treaty rights are respected.

### ***Land Conservation***

- Forests are not converted to subdivisions, agriculture, or other non-forest land uses.

### ***Planning, Monitoring, Adaptive Management***

- Comprehensive, detailed, and long-term forest management plans are developed. Management plans address relevant elements of these indicators for well-managed forests.
- Monitoring addresses all resources of concern.

- Adaptive management is implemented to refine plans based upon monitoring results.

### ***Compliance with Laws***

- Forest management complies with all relevant domestic and international laws, treaties, policies, and best-management-practices (BMPs) relating to forestry, environmental, and social concerns.

### ***Discussion***

Our indicators reflect practices that are economically practicable in most circumstances. Some practices, such as the use of longer timber rotations, can even increase revenues under certain circumstances, by increasing timber yields and quality, and by reducing the frequency of logging, chemical applications, and other costly inputs—though financial accounting practices often seriously “discount” these benefits.<sup>46</sup> Use of natural pest management strategies can also reduce costly chemical inputs. Some desired practices, such as variable retention, can reduce the amount of timber logged, per acre. However, variable retention also promises to help sustain soil biota and productivity, and should thus offset the productivity losses that can eventually result from intensive plantation style forestry.<sup>47</sup>

Our indicators were written with consumers and other non-technical forestry audiences in mind. As a result, they do not address all concerns and objectives for forest management, and do not include a host of technical “best management practices” that should also be followed for road management, tree felling, reforestation, chemical applications, aquatic protection, and other specific operations and resources. Practicing foresters should also consider more specific recommendations found in independent forest CSs, and in the forest management and conservation literature.<sup>48</sup>

Managing forests and evaluating forest management also requires on-the-ground professional judgment regarding complex forest ecosystem and silvicultural dynamics. To fully

understand a forest's management, comprehensive, site-specific assessments should be conducted by qualified assessors using more detailed indicators and procedures. Some indicators' applicability will also vary with local conditions.

## CONCLUSION

Moving the world's forests towards greater sustainability is essential—and feasible. A growing number of wood and paper companies, other private forest landowners, and other non-federal forests already use more sustainable practices to varying extents. I hope the tools in this paper will enable consumers to help support these landowners and companies, and encourage more to join their ranks. By purchasing wood and paper products certified by credible independent certification systems that employ standards for “sustainable” and “well-managed” forests, consumers can play a crucial role in making more sustainable forest management economically attractive to forest landowners.

Additional financial support and incentives could also be established to help landowners adopt practices that are more sustainable. Possibilities include low-interest revolving loan funds or other means of helping landowners phase-in longer timber rotations, graduated timber yield taxes to support longer timber rotations, and funds to help support habitat restoration for imperiled species.<sup>49</sup> Potential sources of funding for landowners to establish habitat reserves may also include the federal Land Water Conservation Fund, emerging markets for carbon sequestration credits, and the sale or donation of conservation easements.

This paper also illustrates why certification systems need to develop different forest management standards for different social and ecological contexts. Private forests in the U.S., should be held to a standard that reflects our definition of well-managed forestry, i.e., forestry that is sustainable as possible given the landowners' economic imperatives and opportunities for

use of more ecologically benign forestry practices. Indeed, our definition of well-managed forests embodies the balancing of economic, environmental, and social concerns that are the focus of some useful, though insufficient, definitions of sustainable forestry. However, some forests should be held to a standard of full ecological sustainability, per our definition of sustainable forestry. Most conservation groups in the U.S. would probably agree that such forests include our National Forests and other federal public lands.

This paper focuses on forest management practices and their sustainability “in the forest.” In all likelihood, sustaining forest ecosystems and resources will require the U.S. and other major consuming nations not only to support improved forestry practices, but also to manage and reduce their demand on limited forest resource by reusing and recycling wood and paper products, by using products more efficiently, by considering wood substitutes, and by learning to live within their means, ecologically.

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### **AUTHOR NOTE**

Daniel A. Hall is a policy analyst and Director of the Forest Biodiversity Program of the American Lands Alliance, a non-profit forest conservation organization.

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Daniel Hall, Forest Biodiversity Program, American Lands Alliance, 917 SW Oak, #419, Portland, OR, 97205.

**FOOTNOTES**

1. For our purposes, the term “consumer” includes retail customers, wood and paper retail stores, manufacturers, and other purchasers of forest products.
2. Lindenmayer and Franklin (2002) are among those who suggest certification may help “level the playing field” among nations.
3. However, see Ozinga (2004) for a discussion of some limitations of certification as a conservation tool in tropical regions, and the continued importance of other conservation tools.
4. USDA Forest Service (2000).
5. USDA Forest Service (2000).
6. Forests in the Southern and Eastern U.S., coastal forests, and oak woodlands in the Western U.S. are especially likely to be privately owned.
7. See USDA Forest Service (2000) and Haynes, Adams, and Mills (1994).
8. Over 50% of endangered species in the U.S. are associated with forest ecosystems. Similarly, over 50% are associated with non-federal lands. See Noss, LaRoe, and Scott (1995) and National Research Council (1998).
9. Noss, LaRoe, and Scott (1995) and [www.natureserve.org](http://www.natureserve.org).
10. Amaranthus (1997) also asks whether current human needs are “realistic and sustainable.”
11. The 1992 Earth Summit in Rio De Janeiro called for such a balancing, and use of the Brundtland definition.
12. Vogt, Larson, Gordon, Vogt, and Fanzeres (2000) also note that ecosystems’ natural constraints fundamentally determine their sustainability.

13. World Bank (1992) (as cited in Vogt, Larson, Gordon, Vogt, and Fanzeres, 2000). Floyd, Vonhof, and Seyfang (2001) put it more succinctly: “humans need to ensure ecosystem functions to ensure the survival of their own and other species” (p. 9).
14. For our purposes, “natural” forests are those that mirror the forests in which most forest species and ecosystems evolved, i.e., pre-European settlement conditions. See DellaSala, Noss, and Perry (2000).
15. For our purposes, “wild” areas include forests that have not been previously logged or roaded, including “roadless” areas, “primary” forests, and “frontier” forests.
16. Such changes include the effects of climate change on forest ecosystems and their productivity. Amaranthus (1997) proposes a similar definition of sustainable forestry that focuses on the ecological conditions, processes, and components needed to maintain healthy forests that, in turn, can support at least some of society’s objectives.
17. Markets are emerging for carbon sequestration, edible mushrooms, floral greens, and other nontimber forest products and ecosystem services.
18. Examples of such processes and components include natural fire regimes that allow some areas to burn without suppression, and populations of large, wide-ranging species—though increased coordination among small landowners may help.
19. Vogt, Larson, Gordon, Vogt, and Fanzeres (2000) also favor definitions of sustainability that focus on measurable changes in ecosystems.
20. See DellaSala, Noss, and Perry (2000) for example.
21. See Nussbaum, Jennings, and Garforth (2002), International Forest Industry Roundtable (2001), and Vogt, Larson, Gordon, Vogt, and Fanzeres (2000), for example.
22. See, for example, World Bank and World Wildlife Fund (2003).

23. Nussbaum, Jennings, and Garforth (2002) also suggest that certification decisions be made by CS staff not involved in the assessment, to help ensure objectivity.

24. See Groves, Miller, and Donovan (1996).

25. Brown, Noss, Diamond, and Myers (2001) suggest that landscapes be identified at scales sufficient for species with large area requirements.

26. Indicator species should include species that: are ecologically pivotal (including “keystone” species like beaver, cavity-excavating birds, and carnivores); are habitat limited; have large area requirements; are process limited; are dispersal limited; are narrowly endemic; are locally-extirpated but can be re-established; or are considered special cases (such as grizzly bear and other megafauna). See Brown, Noss, Diamond, and Myers (2001), for example.

27. In this context, a suitable threshold for defining “larger” properties might be on the order of 5,000 to 10,000 acres.

28. Examples include species that do not disperse through corridors, and species and ecosystem processes important to forest productivity. See Lindenmayer and Franklin (2003).

29. The establishment of riparian buffers and protection zones for threatened or endangered species are examples of normally-required measures.

30. For very small properties, the time frame for this metric must be adjusted. For large properties, the objective should be met within all subunits of the property.

31. Even-aged regimes include clearcutting, seed tree, and shelterwood logging. Uneven aged regimes include single tree and group selection. In practice, a range of even to uneven aged regimes exists, with their suitability depending on site conditions and other factors.

32. Rotation refers to how often a site is logged with a final regeneration harvest, i.e., the age at which most trees in a stand are logged. CMAI is a measure of when a stand of trees has maximized its growth in timber volume, considering the time required to add additional volume.

33. “Highgrading” removes the most ecologically and economically valuable trees, leaving an impoverished stand.
34. Exceptions may be warranted in specific circumstances, e.g., increased deer populations due to lack of predators.
35. Examples would include species listed as “G1-3” and “S1-3” by NatureServe. See [www.natureserve.org](http://www.natureserve.org).
36. See Vogt, Larson, Gordon, Vogt, and Fanzeres (2000).
37. Exceptions will be warranted in areas managed as plantations per the indicators for landscape analysis and land allocation.
38. Retention goals will vary significantly depending on region and forest type. Inland Western forests, for example, need to focus more on retaining larger trees. Retention should not be limited to riparian buffers.
39. See, for example, Amaranthus (1994).
40. Examples include communities listed as “G1-3” or “S1-3” by NatureServe.
41. For our purposes, cumulative impacts can be understood as the aggregated environmental impact of multiple forest management operations over time and space.
42. The term “watershed” should be interpreted as fifth-field watersheds, i.e., the next smallest unit below US Geological Survey “sub-basins” (denoted by four sets of two digit numbers).
43. See Hunter (1990).
44. Examples of non-catastrophic disturbances include blowdown (but not tornadoes), bug kill (but not epidemic insect outbreaks), and fires that do not replace more than one timber stand. One possible method for identifying non-catastrophic disturbance sizes is to identify opening sizes that are within the 95<sup>th</sup> percentile of a forest’s range of natural variation.

45. In some cases, the most qualified workers may not be from local communities.

46. Longer rotations can yield more timber, per acre, per year, by allowing trees to reach their productive potential before being logged. However, the use of high discount rates and “net present value” calculations tend to severely undervalue long rotations and other long-term economic benefits. See American Lands Alliance and Coast Range Association (1999).

47. See Lindenmayer and Franklin (2003), and Perry (1994).

48. See, for example, Lindenmayer and Franklin (2002), Kohm and Franklin (1997), Noss and Cooperrider (1994), and other resources listed in the bibliography.

49. See Hall (1999) for more detail on these and other recommended incentives.