Criterion 2

Maintenance of Productive Capacity of Forest Ecosystems

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One objective of sustainable forest management is to manage forests to produce wood and nontimber forest products in a way that maintains the ecosystem's capacity for renewal. The capacity of the forest to produce a given product is influenced by the availability of sites suitable for production based on their inherent fertility, accessible water, and forest health. Land-use decisions affect the acreage available for production, and management choices affect short- and long-term yield potential.

Forest products include wood products such as sawlogs, veneer, pulpwood, and fuelwood, and nonwood products extracted from the forest ecosystem such as pinecones, berries, and mushrooms. Forests also provide environmental services and social benefits that are addressed under other criteria.

Land Available for Timber Production

- Ninety-three percent or 159 million acres of forest land in the Northern United States is classified as timberland, land capable of producing timber and not withdrawn from utilization (figure 13). An additional 8.2 million acres of forest land is reserved, withdrawn from timber utilization by statute or administrative action.

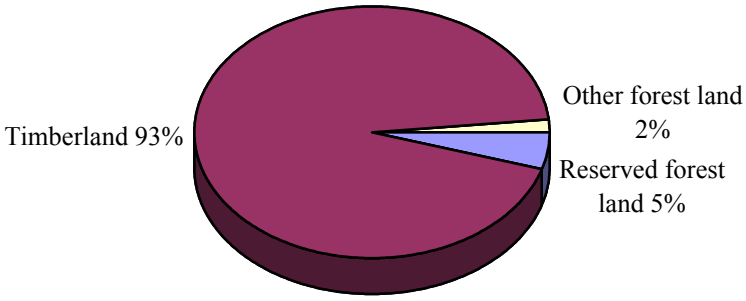

Figure 13. **Forest land use in the Northern United States**. Ninety-three percent of the 169 million acres of forest land in the Northern United States is suitable for timber production (USDA Forest Service 1999a[1]).

[1]Inventory follows methods in Hansen and others 1992.

- Not all land classified as timberland is actually available for harvest. Conditions may be present that limit the viability of harvest, including physical constraints such as steep slope or wetness that affect equipment operability, economic constraints such as poor sale value or costly access road construction, and social constraints such as landowner or local community objectives that preclude timber production.
- The amount of timberland in the Northern United States increased from 1977 to 1997 but appears to have begun to decrease (figure 14). Past increases in forest land were attributed to the conversion of agricultural land. Recent and projected losses of forest land may be due to development trends (USDA NRCS 2001).
- There were an estimated 3.9 million private forest landowners in the Northern United States responsible for 130 million acres of forest land in 1992 (Birch 1996).
- In 1992, the 35 percent of private forest landowners who stated they intended to harvest timber within 10 years owned 61 percent of the private acreage (Birch 1996). The

availability of timberland for harvest can be affected by parcel size and land tenure. Landowners with large parcels or long tenure are more likely to harvest their timber.

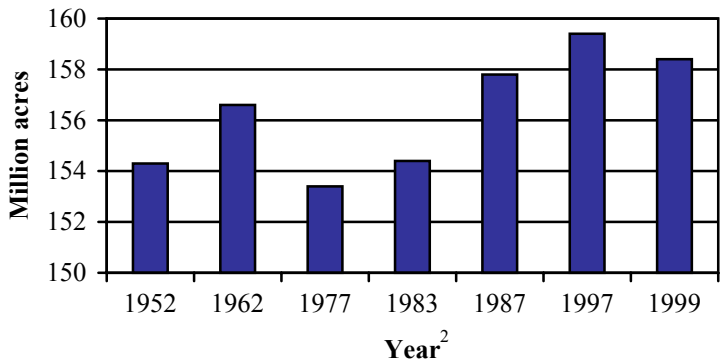

Figure 14. **Trends in timberland area in the Northern United States, 1952–1999**. Timberland area increased from 1977 to 1997, but has begun to decrease (Smith and others 2001, USDA Forest Service 1999a[1]).

[1]Inventory follows methods in Hansen and others 1992.

[2]Data collected for individual States on varying cycles. Data summarized as shown.

- Most small woodlot owners do not want to see the majority of their woods harvested at one time; therefore, landowners with less than 20 acres of timberland are more likely to use silvicultural systems such as single-tree selection or group selection than clearcuts or shelterwood cuts. In the New England and Mid-Atlantic States, 75 percent of all private landowners own less than 20 acres of timberland, compared with 67 percent in the Central States and 53 percent in the Lake States (Birch 1996).
- About 19 percent of the timberland in the Northern United States is on sites with excellent potential productivity, 34 percent is found on good sites, and the remaining 47 percent is on sites with average to low productivity (Hansen and others 1992).
- Extensive areas of timberland in the Northern United States are understocked or past an optimal age from economic or silvicultural perspectives. On many of the most productive sites, stocking levels can be enhanced to produce more wood and thereby lessen the harvesting pressure on sites with lower potential productivity and on physically or biologically sensitive sites.
- The Northern United States has relied more on natural regeneration than plantations to maintain and expand its areas of timberland. In 1992, there were only 3.5 million acres of timberland plantations in the Northern United States, the majority of which are located in the North Central States (Hansen and others 1992). This number had increased to 4.3 million acres by 1997 (Smith and others 2001).

Growing Stock Volume

- Growing stock volume on timberland more than doubled from 1952 to 1999, increasing from 104 billion cubic feet to 215 billion cubic feet (table 6, Smith and others 2001, USDA Forest Service 1999a). Net annual growth increased by 45 percent and removals by 54 percent during that time period, yielding a growth-to-removals ratio of 1.8:1. By 2040, total growing stock is projected to increase by 23 percent over 1999. Net annual growth is expected to decrease by 9 percent and removals to increase by 40 percent, yielding a growth-to-removals ratio of 1.2:1.
- This projected downward trend in the growth-to-removals ratio represents a substantial

Table 6. **Changes in inventory, growth, and removals on timberland in the Northern United States** (in million cubic feet) (Haynes 1990, Smith and others 2001, USDA Forest Service 1999a[1]).

	1952	1977	1987	1997	1999	2040 (projected)
Softwoods						
Inventory	27,053	43,850	47,618	49,376	49,568	62,033
Net annual growth	973	1,558	1,288	1,169	1,179	1,260
Removals	622	692	726	668	782	1,096
Growth-to-removals ratio[2]	1.6	2.3	1.8	1.8	1.5	1.1
Annual mortality	216	324	368	456	457	—
Hardwoods						
Inventory	76,695	119,158	142,420	164,874	165,202	202,343
Net annual growth	2,743	3,790	4,224	4,251	4,203	3,643
Removals	1,279	1,803	1,983	2,104	2,146	3,000
Growth-to-removals ratio[2]	2.1	2.1	2.1	2.0	2.0	1.2
Annual mortality	475	824	875	1,172	1,194	—
Total						
Inventory	103,748	163,008	190,038	214,251	214,771	264,376
Net annual growth	3,716	5,349	5,512	5,420	5,382	4,903
Removals	1,901	2,495	2,708	2,772	2,929	4,096
Growth-to-removals ratio[2]	2.0	2.1	2.0	2.0	1.8	1.2
Annual mortality	690	1,149	1,243	1,628	1,651	—

[1]Inventory follows methods in Hansen and others 1992.
[2]Represents a simple ratio; unit is not million cubic feet.

change in both the growth rate of trees and the intensity of management activities. The second- and third-growth forests of the Northern United States are reaching maturity. With this advance in age, growth rates have slowed while harvesting has increased.

- Net growth exceeds removals for hardwoods and softwoods in all Northern U.S. provinces except Province M212, where softwood removals exceed net growth (table 7).
- Hardwoods account for 77 percent of total growing stock volume and represent the majority of volume in all Northern U.S. provinces (figure 15). The Laurentian Mixed Forest Province 212 has 36 percent of the total growing stock volume and the largest shares of hardwood and softwood volume.

Table 7. **Growth-to-removals ratios by province in the Northern United States** (USDA Forest Service 1999a[1]).

Province	Softwoods	Hardwoods	Total
212	1.8	2	1.9
M212	0.7	2	1.3
221	1.8	2.2	2.1
M221	2.7	2.4	2.5
222N	2.2	1.3	1.4
222S	4.9	2.4	2.5
231	ns	ns	ns
232	1.3	1.2	1.2
234	ns	ns	2.3
251	4.7	2.5	2.5

[1]Inventory follows methods in Hansen and others 1992.
ns = not sufficient data for calculation

Nontimber Forest Products

- The economic importance and potential

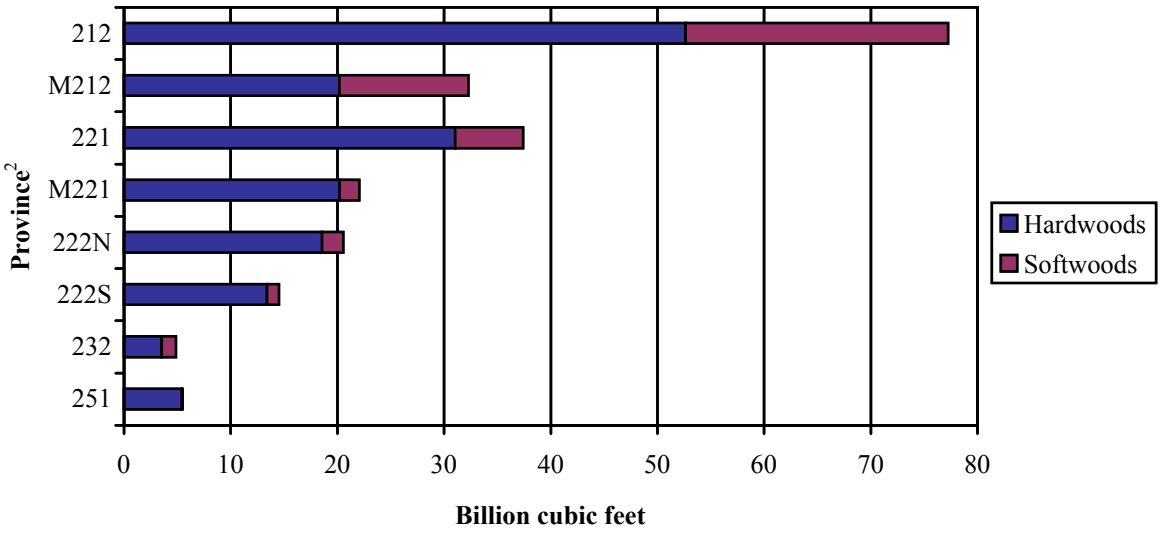

Figure 15. **Distribution of growing stock volumes on timberland in the Northern United States by province** (USDA Forest Service 1999a[1]).

[1]Inventory follows methods in Hansen and others 1992.

[2]Provinces 231 and 234 have been omitted because the amounts are too small to be evident on the graph.

impacts of nontimber harvest activities are not well known. The majority of nontimber products are not regulated and there is no systematic effort to collect data. Some trends can be gleaned, however, in areas where permits are issued and local studies have been conducted. For example, one study found that 138 different special forest products were collected in and around the Hiawatha National Forest in Michigan (Emery 1997).

- Ginseng has recently become scarce on national forests in the Northern United States and is now listed as threatened in many States (Padley 1997). Ginseng has been regulated in Wisconsin since 1975, where it is now cultivated to meet demand. It takes at least 100 ginseng roots to make a pound.
- Plant theft from national forests is a significant problem. For example, showy orchids have nearly vanished from national forests in the Central States since the 1960's (Padley 1997).