Forest Lands - Conservation of Biological Diversity

Indicator #8500

Note: This indicator includes four components that correspond to Montreal Process Criterion #1, Indicators 1, 2, 3, and 5.

Indicator #8500 Components:

Component (1) – Extent of area by forest type relative to total forest area
Component (2) – Extent of area by forest type and by age-class or successional stage
Component (3) – Extent of area by forest type in protected area categories
Component (4) – Extent of forest land conversion, parcelization, and fragmentation *(still under development for future analysis; data not presented in this report)*

Overall Assessment

Status:	**Mixed**
Trend:	**Undetermined**
Rationale:	**There is a moderate distribution of forest types in the Great Lakes basin by age-class and seral stage. Additional analysis is required by forestry professionals.**

Lake-by-Lake Assessment

Each lake was categorized with a Not Assessed *status and an* Undetermined *trend, since data by individual lake basin were not available for the U.S. at this time.*

Purpose

- To describe the extent, composition and structure of Great Lakes basin forests
- To address the capacity of forests to perform the hydrologic functions and host the organisms and processes that are essential to protecting the biological diversity, physical integrity and water quality of the watershed

Ecosystem Objective

To have a forest composition and structure that most efficiently conserves the natural biological diversity of the region

State of the Ecosystem

Component (1): Extent of area by forest type relative to total forest area

Forests cover over half (61%), of the land in the Great Lakes basin. The U.S. portion of the basin has forest coverage on 54% of its land, while the Canadian portion has coverage on 73% of its land.

In the U.S. portion of the basin, maple-beech-birch is the most extensive forest type, representing 7.8 million hectares (19.3 million acres), or 39% of total U.S. forest area in the basin. Aspen-birch forests constitute the 2nd largest forest type, covering 19% of the U.S. total. Complete data are available in Table 1 and are visually represented in Figure 1.

The entire Canadian portion of the basin is dominated by mixed forest, representing 39% of the total Canadian forest area, followed by hardwoods, covering 23% of the total Canadian forest area analyzed from satellite data (Table 2A). The most extensive provincial forest type is the upland mixed conifer, representing 23%

Forest Type	Area (ha)	% of Total Forest Area	Protected Area (ha)	% Protected
White-Red-Jack Pine	1,791,671	8.87%	168,737	9.42%
Spruce-Fir	2,866,777	14.19%	263,216	9.18%
Loblolly-Shortleaf Pine	4,305	0.02%	0	0.00%
Oak-Pine	72,675	0.36%	4,178	5.75%
Oak-Hickory	1,988,126	9.84%	129,431	6.51%
Oak-Gum-Cypress	50,589	0.25%	9,730	19.23%
Elm-Ash-Cottonwood	1,692,069	8.37%	45,564	2.69%
Maple-Beech-Birch	7,828,700	38.75%	692,600	8.85%
Aspen-Birch	3,821,272	18.91%	252,443	6.61%
Nonstocked	88,443	0.44%	4,677	5.29%
Totals	**20,204,626**		**1,570,576**	**7.77%**

Table 1. Total forest area and protected area by forest type in U.S. Great Lakes basin counties

Non-stocked = timberland less than 10% stocked with live trees

Source: USDA Forest Service, Forest Inventory and Analysis National Program, 2002 Resource Planning Act (RPA) Assessment Database

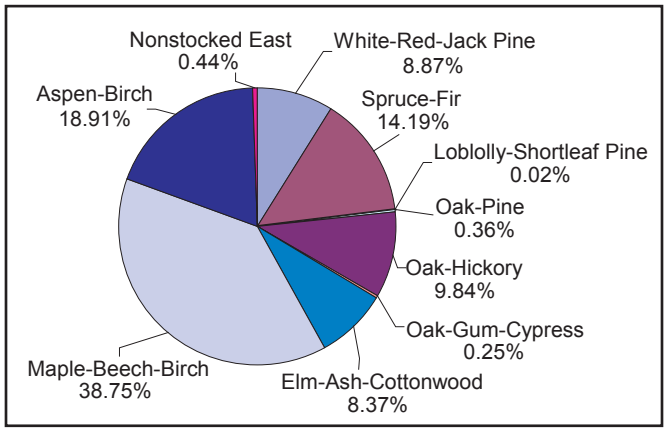

Figure 1. Proportion of forested area by forest type in U.S. Great Lakes basin

Source: USDA Forest Service, Forest Inventory and Analysis National Program, 2002 Resource Planning Act (RPA) Assessment Database

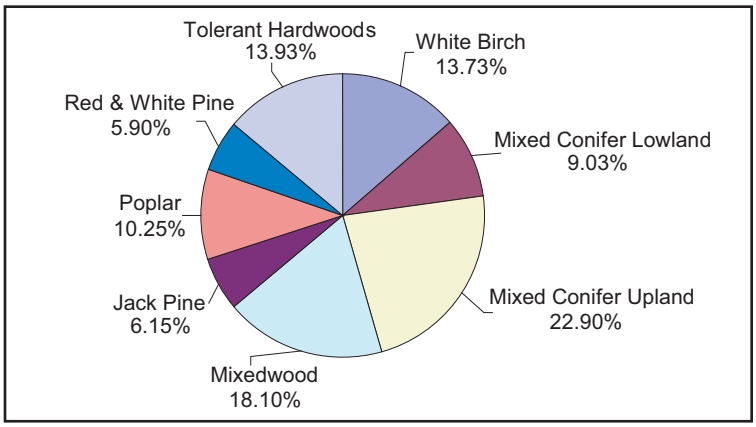

Figure 2. Proportion of forested area by provincial forest type in AOU* portion of Canadian Great Lakes basin

* The Area of the Undertaking (AOU) land area represents 72% of the total land area analyzed in Ontario's portion of the Great Lakes basin.

Source: Ontario Ministry of Natural Resources, Forest Standards and Evaluation Section

of the forested area available for analysis, followed by the mixedwoods, tolerant hardwoods, white birch, and poplars (Table 2B, Figure 2).

Implications for the health of Great Lakes forests and the basin ecosystem are difficult to establish. There is no consensus on how much land in the basin should be forested, or on how much land should be covered by each forest type. Generally speaking, maintenance of the variety of forest types is important in species preservation, and long-term changes in forest type proportions are indicative of changes in forest biodiversity patterns (OMNR 2002).

Comparisons to historical forest cover, although of limited utility in developing landscape goals, can illustrate the range of variation experienced within the basin since the time of European settlement. (See supplemental section entitled "Historical Range of Variation in the Great Lakes Forests of Minnesota, Wisconsin and Michigan" in Indicator #8500, Canada and United States (2005) for more information). Analysis of similar historical forest cover data for the entire Great Lakes basin over the past several years would be useful in establishing current trends to help assess potential changes to ecosystem function and community diversity.

Component (2): Extent of area by forest type and by age-class or successional stage

In the U.S. portion of the basin, the 41 to 60 and 61 to 80 year age-classes are dominant and together represent about 41% of total forest area. Forests 40 years of age and under make up a further 30%, while those in the 100-plus year age-classes constitute 7% of total forest area. Table 3 contains complete U.S.

A) Canadian Great Lakes Basin

Satellite Classes	Area (ha)	% of Total Forest Area	Protected Area (ha)	% Protected
Forest - Sparse	2,053,869	13.78%	245,118	11.93%
Forest - Hardwood	3,468,513	23.27%	361,147	10.41%
Forest - Mixed	5,750,313	38.57%	649,342	11.29%
Forest - Softwood	2,407,729	16.15%	268,753	11.16%
Swamp - Treed	49,933	0.33%	1,413	2.83%
Fen - Treed	30,197	0.20%	3,726	12.34%
Bog - Treed	436,083	2.93%	28,128	6.45%
Disturbed Forest - cuts	578,450	3.88%	8,973	1.55%
Disturbed Forest - burns	97,545	0.65%	18,628	19.10%
Disturbed Forest - regenerating	35,987	0.24%	381	1.06%
Totals	**14,908,617**		**1,585,608**	**10.64%**

B) AOU* Portion of Ontario

Provincial Forest Type	Area (ha)	% of Total Forest Area	Protected Area (ha)	% Protected
White Birch	1,593,114	13.73%	175,261	11.00%
Mixed Conifer Lowland	1,048,126	9.03%	60,192	5.74%
Mixed Conifer Upland	2,657,086	22.90%	239,194	9.00%
Mixedwood	2,099,760	18.10%	194,682	9.27%
Jack Pine	714,165	6.15%	54,991	7.70%
Poplar	1,189,573	10.25%	75,538	6.35%
Red & White Pine	685,124	5.90%	105,682	15.43%
Tolerant Hardwoods	1,616,502	13.93%	108,993	6.74%
Totals	**11,603,450**		**1,014,533**	**8.74%**

Table 2. Total forest area and protected area by forest type in, A) Canadian Great Lakes basin, B) AOU* portion of Ontario

* The Area of the Undertaking (AOU) land area represents 72% of the total land area analyzed in Ontario's portion of the Great Lakes basin.

Source: Ontario Ministry of Natural Resources, Forest Standards and Evaluation Section

data for age-class distribution as a percentage of U.S. forested area within each forest type.

Because forests are dynamic and different tree species have different growth patterns, age distribution varies by forest type. In the U.S. portion of the basin, aspen-birch forests tend to be younger, being more concentrated than other forest types in age classes under 40 years, while the Oak-Pine forests are more concentrated in the 41 to 60 and 61 to 80 year age classes, comparatively. Spruce-fir and Oak-Hickory forests have a general distribution centered around 41 to 80 years, but they also have the highest amount of oldest trees, representing about 10% each of total U.S. forest area in the 100-plus year age class (Figure 3).

These age-class data can serve as a coarse surrogate for the vegetative structure (height and diameter) of a forest, and they can be combined with data from other indicators to provide insight on forest sustainability.

U.S data on the extent of forest area by successional or seral stage are not available. Although certain tree species can be associated with the various successional stages, a standard and quantifiable protocol for identifying successional stage has not yet been developed. It is expected, however, that in the absence of disturbance, the area covered by early-successional forest types, such as aspen-birch, is likely to decline as forests convert to late-successional types, such as maple-beech-birch.

Forest Type	Age Class (in years)							
	0-20	21-40	41-60	61-80	81-100	100+	Mixed	not measured
White-Red-Jack Pine	13.86%	27.04%	25.41%	11.63%	7.47%	4.32%	2.40%	7.87%
Spruce-Fir	8.84%	18.55%	21.84%	17.96%	9.57%	10.23%	0.33%	12.69%
Loblolly-Shortleaf Pine	0.00%	47.96%	0.00%	52.04%	0.00%	0.00%	0.00%	0.00%
Oak-Pine	7.08%	14.58%	47.30%	18.29%	3.02%	6.49%	3.18%	0.07%
Oak-Hickory	9.43%	10.13%	18.14%	21.49%	14.14%	10.06%	11.38%	5.22%
Oak-Gum-Cypress	4.47%	36.37%	19.84%	8.75%	4.08%	0.00%	5.73%	20.76%
Elm-Ash-Cottonwood	14.03%	24.29%	23.21%	15.95%	8.58%	6.17%	5.21%	2.56%
Maple-Beech-Birch	9.25%	12.38%	21.96%	20.87%	12.31%	8.75%	6.21%	8.27%
Aspen-Birch	25.40%	19.91%	26.15%	16.64%	3.85%	1.36%	0.45%	6.25%
Nonstocked	63.98%	16.73%	2.97%	1.71%	0.00%	1.14%	0.00%	13.47%
Total	**13.29%**	**16.85%**	**22.77%**	**18.37%**	**9.65%**	**7.02%**	**4.33%**	**7.72%**

Table 3. Age-class distribution as a percentage of area within forest type for U.S. Great Lakes basin counties

Non-stocked = timberland less than 10% stocked with live trees

Source: USDA Forest Service, Forest Inventory and Analysis National Program, 2002 Resource Planning Act (RPA) Assessment Database

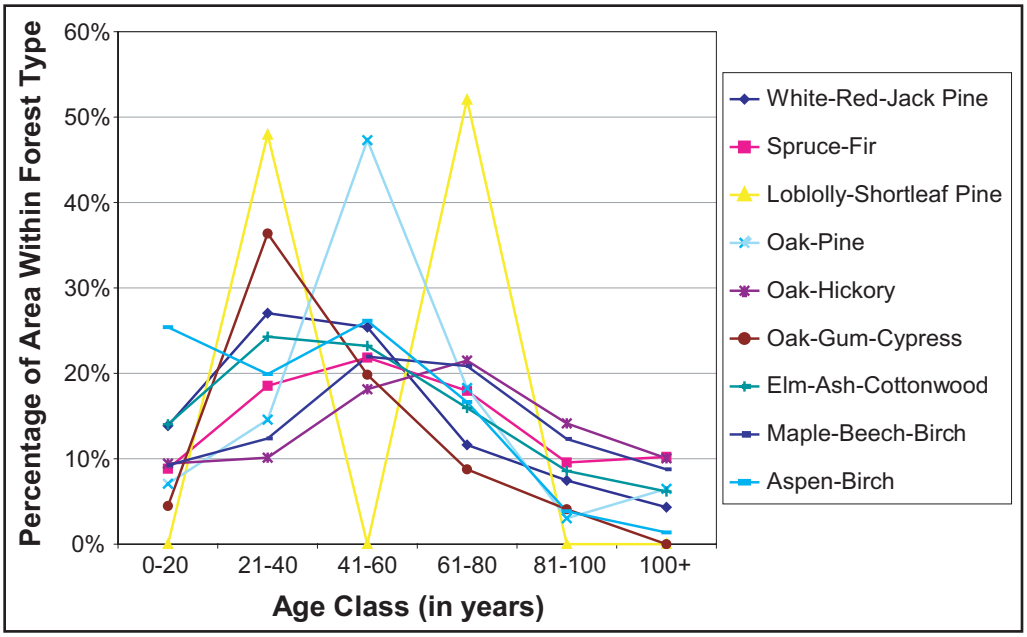

Figure 3. Age-class distribution as a percentage of forested area within forest type for U.S. Great Lakes basin counties

Source: USDA Forest Service, Forest Inventory and Analysis National Program, 2002 Resource Planning Act (RPA) Assessment Database

Canadian forest data for this component are available by seral (successional) stage. Ontario's forests have a distribution leaning towards mature stages, representing about 50% of the total forest area analyzed. Forests in the immature stage make up the next largest group with 20% of the total, followed by those in late successional with 14%. Every Canadian forest type distribution follows this general trend except for jack pine. Complete available data for Ontario can be viewed in Table 4 and are visually

represented in Figure 4.

Although the implications of this age-class and seral stage data for forest and basin health overall are unclear, some conclusions can be made. In general, water quality is most affected during the early successional stages after a disturbance to forest habitats. Nutrient levels in streams can increase during these times until the surrounding forest is able to mature (Swank 2000). The trend towards mature forests in Canada would therefore mean that area of the Great Lakes basin has improved water quality. Alternately, forests with balanced forest type distributions and diverse successional stages are generally considered more sustainable, (USDA Forest Service and Northeast Forest Resource Planners Association 2003). The combined effect on ecosystem health resulting from the balance of these opposing forces would need to be determined.

Provincial Forest Type	Seral Stage				
	Presapling	Sapling	Immature	Mature	Late Successional
White Birch	3.49%	4.52%	15.55%	63.58%	12.87%
Mixed Conifer Lowland	13.81%	9.31%	13.38%	47.00%	16.50%
Mixed Conifer Upland	5.91%	13.12%	22.51%	42.11%	16.36%
Mixedwood	4.60%	7.92%	26.06%	51.03%	10.39%
Jack Pine	8.60%	31.96%	29.24%	27.51%	2.69%
Poplar	6.60%	10.45%	18.97%	52.55%	11.43%
Red & White Pine	4.94%	3.77%	23.28%	62.95%	5.06%
Tolerant Hardwoods	1.23%	0.87%	6.40%	60.13%	31.37%
Totals	**6.00%**	**10.14%**	**20.12%**	**49.84%**	**13.91%**

Table 4. Seral stage distribution as a percentage of area within provincial forest type in AOU* portion of Canadian Great Lakes Basin

* The Area of the Undertaking (AOU) land area represents 72% of the total land area analyzed in Ontario's portion of the Great Lakes basin.

Source: Ontario Ministry of Natural Resources, Forest Standards and Evaluation Section

Component (3): Extent of area by forest type in protected area categories

In the U.S. basin, 7.8% of forested land is in a protected area category. Among major forest types, 8.9% of maple-beech-birch, 6.6% of aspen-birch and 9.2% of spruce-fir forests are considered to have protected status. The oak-gum-cypress category has the highest protection rate, with 19.2% of its forest area protected from harvest. Please refer to Table 1 for complete U.S. data.

In the entire Canadian portion of the basin, 10.6% of forest area, or 1.6 million hectares (4.0 million acres), are protected (Table 2A). For the region of Ontario that has available forest type data, protection rates range from 15.4% for red and white pine and 11% for white birch, to 6.4% for poplar and 5.7% for mixed conifer lowland forests (Table 2B).

It is difficult to assess the implications of the extent of protected forest area, since there is no consensus on what the actual proportion should be. National forest protection rates are estimated to be 8.4% in Canada (WWF 1999) and 14% in the U.S. (USDA Forest Service 2004). Despite the fact that updated trend data for protected status are not available at this time for the Great Lakes basin, earlier analyses have shown a recent general increase in protected areas (indicator report #8500 in Canada and the United States 2005).

As for the range of variation in protection rates by forest types, protected areas should be

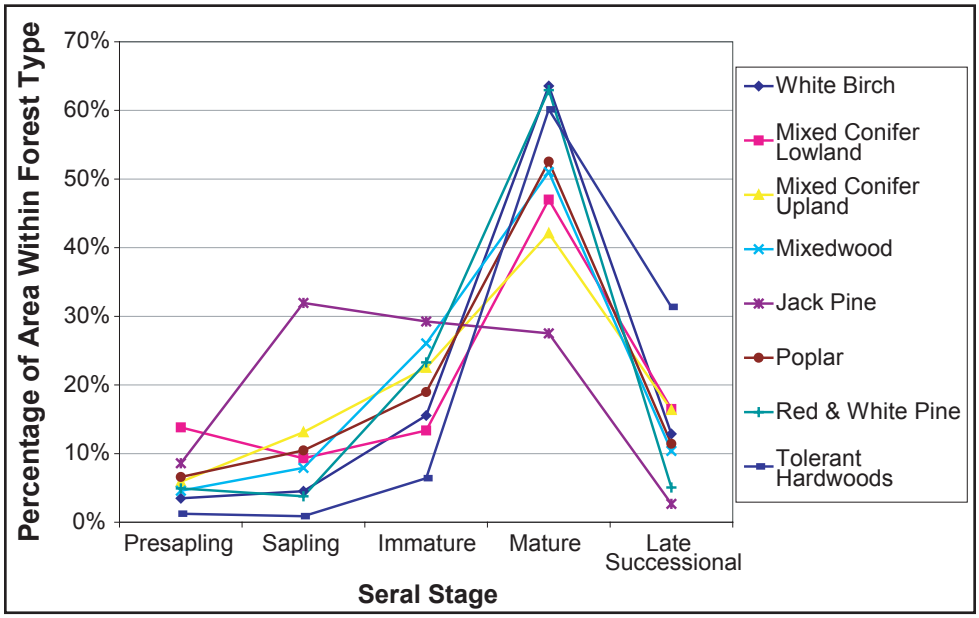

Figure 4. Seral stage distribution as a percentage of forested area within provincial forest type in AOU* portion of Canadian Great Lakes Basin

* The Area of the Undertaking (AOU) land area represents 72% of total land area analyzed in Ontario's portion of the Great Lakes basin.

Source: Ontario Ministry of Natural Resources, Forest Standards and Evaluation Section

representative of the diversity in forest composition within a larger area. However, defining what constitutes this "larger area" is problematic. Policymakers often have a different jurisdiction than the Great Lakes basin in mind when deciding where to locate protected areas. Also, the tree species and forest types found on an individual plot of protected land can change over time due to successional processes.

Differences among the U.S., Canadian, and International Union for the Conservation of Nature (IUCN) definitions of protected areas should also be noted. The IUCN standard contains six categories of protected areas – strict nature reserves/wilderness areas, national parks, natural monuments, habitat/species management areas, protected landscapes/seascapes, and managed resource protection areas. The U.S. defines protected areas as forests "reserved from harvest by law or administrative regulation," including designated Federal Wilderness areas, National Parks and Lakeshores, and state designated areas (Smith 2004). Ontario defines protected areas as national parks, conservation reserves, and its six classes of provincial parks – wilderness, natural environment, waterway, nature reserve, historical and recreational (OMNR 2002). There is substantial overlap among the specific U.S., Ontario and IUCN definitions, and a more consistent classification system would ensure proper accounting of protected areas.

Common to the U.S., Ontario and IUCN definitions is that they only include forests in the public domain. However, there are privately-owned forests similarly reserved from harvest by land trusts, conservation easements and other initiatives. Inclusion of these forests under this indicator would provide a more complete definition of protected forest areas.

Moreover, there is debate on how protected status relates to forest sustainability, water quality, and ecosystem health. In many cases, protected status was bestowed onto forests for their scenic or recreational value, which may not contribute significantly to conservation or watershed management goals. On the other hand, forests available for harvest, whether controlled by the national forest system, state or local governments, tribal governments, industry or private landowners, can be managed with the stated purpose of conserving forest and basin health through the implementation of Best Management Practices and certification under sustainable forestry programs. (For more information, refer to Indicator #8503, Forest Lands – Conservation and Maintenance of Soil and Water Resources).

Component (4): Extent of forest land conversion, parcelization, and fragmentation

This component is still under development, as consensus has not been reached on definitions of forest fragmentation metrics and which ones are therefore suitable for reporting. The proposed structure is split into the forces that drive fragmentation, (land conversion and parcelization) and a series of forest spatial pattern descriptions based on (as yet to be agreed upon) fragmentation metrics.

Conversion of forest land to other land-use classes is considered to be a major cause of fragmentation. Proposed metrics to describe this include the percent of forest lands converted to and from developed, agricultural, and pasture land uses. Both Canadian and U.S. data are available and can be obtained from the Ontario Ministry of Natural Resources and the USDA Natural Resources Conservation Service, Natural Resources Inventory, respectively.

Parcelization of forest lands into smaller privately owned tracks of land can lead to a disruption of continuous ecosystems and habitats and, therefore, increased fragmentation. A proposed metric is the average size of land holdings. Canada does not have available data for this metric, while the U.S. data should be available through the USDA Forest Service, Forest Inventory and Analysis Program and the National Woodland Owner Survey.

Data for various fragmentation metrics exists for both Canada and the U.S., but the way these metrics are viewed is drastically different. According to sources that have compiled U.S. data, fragmentation, ". . . is viewed as a property of the landscape that contains forest… [as opposed to] a property of the forest itself." (Riitters *et. al* 2002). Ontario data is compiled according the latter view of fragmentation and exist for the following metrics: area, patch density and size, edge, shape, diversity and interspersion, and core area. U.S. data exist for patchiness, perforation, connectivity, edge, and interior or core forest, and they are available from the USDA Forest Service. They are also being compiled by U.S. EPA. Substantial discussion is still required to refine these metrics before reporting and analysis of this component can continue on a basin-wide scale.

Pressures

Urbanization, seasonal home construction and increased recreational use (driven in part by the desire of an aging and more affluent population to spend time near natural settings) are among the general demands being placed on forest resources nationwide.

Additional disturbances caused by lumber removal and forest fires can also alter the structure of Great Lakes basin forests.

Management Implications

Increased communication and agreement regarding the definitions and reporting methods for forest type, successional stage, protected area category and fragmentation metrics between the United States and Canada would facilitate more effective basin-wide analyses.

Reporting of U.S. forest data according to watershed as opposed to county would enable analysis by individual lake basin, therefore increasing the data's value in relation to specific water quality and biodiversity objectives.

Canadian data by forest type and seral stage for the entire Great Lakes basin in Ontario, as opposed to just the Area of the Undertaking (AOU, see definition below in "Comments" section), would allow for a more complete analysis. This can only be accomplished if managers decide to extend forest planning inventories into the private lands in the southern regions of the province.

Managing forest lands in ways that protect the continuity of forest cover can allow for habitat protection and wildlife species mobility, therefore maintaining natural biodiversity.

Comments from the author(s)

Stakeholder discussion will be critical for identifying pressures and management implications, particularly those on a localized basis, that are specific to Great Lakes basin forests. These discussions will add to longstanding debates on strategies for sustainable forest management.

There are significant discrepancies within and between Canadian and U.S. data that made the analysis of data across the entire Great Lakes basin difficult. The most pervasive problems are related to the time frame, frequency and location of forest inventories and differences in metric definitions.

Canadian Great Lakes data for provincial forest type and seral stage are only available in areas of Ontario where Forest Resources Planning Inventories occur. This region is commonly referred to as the Area of the Undertaking (AOU) and only represents about 72% of Ontario's total Great Lakes basin land area. The remainder of Ontario's forests can only be analyzed using satellite data, which is meant for general land use/land cover analysis and does not have a fine enough resolution to allow for more detailed investigation.

Forest inventory time frames for the U.S. also have an effect on data consistency. Although the 2002 Resource Planning Act assessment was used as the data source for the U.S. portion of this report, it actually draws data from a compilation of numerous state inventory years as follows: Illinois (1998), Indiana (1998), Michigan (1993), Minnesota (1990), New York (1993), Ohio (1993), Pennsylvania (1989), and Wisconsin (1996). A re-analysis of U.S. Great Lakes basin forests with data from the same time frame would be useful.

Also, the U.S. data provided for this report was compiled by county and not by watershed, so the area of land analyzed is not necessarily completely within the Great Lakes basin and all related values are therefore skewed. This factor also made it impossible to represent the data by individual lake basin. Additional GIS analysis of the raw inventory data would be required to provide forest data by watershed.

Definition of forest type differs between the U.S. and Canada as well. In the U.S., forest cover type is defined according to the predominant tree species and is divided into the nine major groups represented in this report. The Canadian provincial forest type classifications (for

Provicial Forest Type	Description
White Birch	predominantly white birch stands
Upland Conifers	predominantly spruce and mixed jack pine/spruce stands on upland sites
Lowland Conifers	predominantly black spruce stands on low, poorly drained sites
Mixedwood	mixed stands made up mostly of spruce, jack pine, fir, poplar and white birch
Jack Pine	predominantly jack pine stands
Poplar	predominantly poplar stands
White and Red Pine	all red and white pine mixedwood stands
Tolerant Hardwoods	predominantly hardwoods such as maple and oak, found mostly in the Great Lakes forest region

Table 5. Description of Canadian provincial forest types

Source: *Forest Resources of Ontario 2001: State of the Forest Report, Appendix 1*, p. 41, (OMNR 2002)

which data were available for this report), however, are based on a combination of ecological factors including dominant tree species, understory vegetation, soil, and associated tree species (OMNR 2002). The definitions of each provincial forest type are available in Table 5. Standardization of forest type definitions between the U.S. and Ontario would be necessary for analysis across the entire Great Lakes basin.

As previously mentioned earlier in this report, the forest fragmentation component of this indicator needs additional refining before it can be included for analysis.

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Sources

Canadian Council of Forest Ministers. 2003. Defining Sustainable Forest Management in Canada: Criteria and Indicators, 2003. http://www.ccfm.org/current/ccitf_e.php

Carpenter, C., Giffen, C., and Miller-Weeks, M. 2003. Sustainability Assessment Highlights for the Northern United States. Newtown Square, PA: USDA Forest Service, Northeastern Area State and Private Forestry. NA-TP-05-03 http://www.na.fs.fed.us/sustainability/pubs/sus_assess/03/toc.pdf

Ontario Ministry of Natural Resources (OMNR). 2002. State of the Forest Report, 2001. Ontario, Canada: Queen's Printer for Ontario. http://ontariosforests.mnr.gov.on.ca/publications.cfm#reports

Ontario Ministry of Natural Resources, Forest Standards and Evaluation Section. Landsat Data based on Landcover 2002 (Landsat 7) classified imagery, Inventory data based on Forest Resources Planning Inventories, and several common NRVIS coverages such as watersheds, lakes and rivers etc. Data supplied by Larry Watkins, Ontario Ministry of Natural Resources.

Smith, W.B. 2004. United States 2003 Report on Sustainable Forests, Data Report: Criterion 2, Maintenance of Productive Capacity of Forest Ecosystems. USDA Forest Service. FS-766A. http://www.fs.fed.us/research/sustain/documents/Indicator%2010/indicators%2010_14.pdf

USDA Forest Service. 2004. National Report on Sustainable Forests – 2003. FS-766. http://www.fs.fed.us/research/sustain/documents/SustainableForests.pdf

USDA Forest Service. 2000. 2000 RPA Assessment of Forest and Range Lands. Washington DC: USDA Forest Service. FS-687. http://www.fs.fed.us/pl/rpa/rpaasses.pdf

USDA Forest Service and Northeastern Forest Resource Planners Association. 2003. Base Indicators of Forest Sustainability: Metrics and Data Sources for State and Regional Monitoring. Durham, NH: USDA Forest Service, Northeastern Area State and Private Forestry.

USDA Forest Service, Forest Inventory and Analysis National Program, 2002 Resource Planning Act (RPA) Assessment Database. http://ncrs.fs.fed.us/4801/tools-data/mapping-tools/.
Data supplied by Eric Wharton, Forest Inventory and Analysis, USDA Forest Service, NE Research Station. July, 2006.

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