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Non-wood goods and services of the forest

report of ECE/FAO team of specialists

by Linda L. Langner

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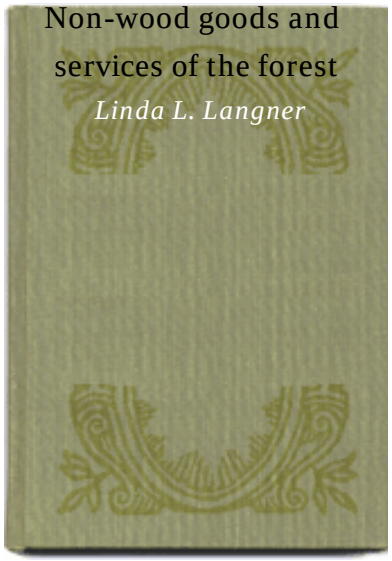

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ABSTRACT

The report is a synthesis of country reports on the status of non-wood goods and services in seven countries: Austria, Canada, the Czech Republic, Finland, Sweden, Switzerland and the United States, with quantitative information on non-wood goods (food, fodder, plant products etc.), environmental services (protection, water, global climatic effects, biodiversity, local environmental functions) and social and cultural services (hunting and fishing, leisure and tourism, aesthetic and scenic values, cultural and spiritual values, scientific and historical values).

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NON-WOOD GOODS AND SERVICES OF THE FOREST
(Report of ECE/FAO team of specialists)

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Preface by the secretariat

The "non-wood goods and services of the forest", include non-wood goods, such as berries and mushrooms, resins or Christmas trees, environmental services such as soil and water protection, biodiversity, or contribution to the global carbon balance and social and cultural services such as recreation and cultural or aesthetic values. The great importance of these goods and services, for policy makers and for forest managers, has long been recognised, in theory and in decision making practice. However the low availability and generally poor quality of quantitative information on these goods and services, especially when compared with the information quality for wood, has definitely hampered rational analysis and policy formulation.

The reasons for this unsatisfactory situation are many and include the following:

- conceptual problems, notably for many of the services
- technical difficulty and cost of measurement
- where measurement is possible at the local or stand level, it is frequently difficult or prohibitively expensive to expand the coverage to wider areas, notably whole countries
- wide variation in the relative importance of the various non-wood goods and services has meant that most measurement efforts have been very local in scope
- the non-market nature of many of the goods and services means not only that the value is difficult to estimate but that their importance, and thus the importance of measuring them, is underestimated.

These problems are of course compounded at the international level, despite the frequent expressions of concern by high-level policy bodies.

ECE/FAO has since 1952 carried out regular studies of European timber trends and prospects: the most recent, *European Timber Trends and Prospects: into the 21st century*, was published in 1996. It was considered desirable to devote a similar study to the structural trends and outlook for demand and supply of non-wood goods and services. The Joint ECE/FAO Working Party on Forest Economics and Statistics formed a team of specialists to carry out the study. However, it rapidly became clear that it was not realistic, given the data and methodology limitations, to aim at a comparable level of analysis for non-wood goods and services as for timber supply and demand. It was therefore decided to prepare country case studies, according to an agreed common format (see annex 2), and then to make a synthesis of results.

The present study has been written by Ms. Linda Langner (USA), team leader, on the basis of national reports by team members for 7 countries: Austria, Canada, the Czech republic, Finland Sweden, Switzerland and the United States, and shows that there are considerable amounts of data on non-wood goods and services available, often in sources which are not well known to conventional forest resource analysts. The quality and comparability of these data vary widely, but they are sufficient to give a good picture of non-wood goods and services in these countries.

One objective of this study was to prepare the way for the FAO/ECE Temperate and Boreal forest Resource Assessment 2000, which will be published in 1999. The experience of the team on non-wood goods and services was important input in the formulation of the TBFRA 2000 enquiry and will also be used in the process of analysing the replies received. A major conclusion of the team is that commitment, of time and resources, at the national level, is a necessary precondition to improving the international data set on non-wood goods and services.

The secretariat takes this opportunity to express its warm thanks to the members of the team and especially to the authors of the country reports, Messrs. Schwarzbauer (Austria), Williamson (Canada), Skoblik (Czech Republic), Naskali (Finland) and Merkell (Sweden), Ms. Coleman (Switzerland) and Ms. Langner (USA). Particular thanks are due to Ms. Langner who was team leader and undertook the arduous task of drafting the final synthesis report, thus making a major contribution to international understanding of non-wood goods and services. Thanks are also due to the governments and institutions of Ms. Langner and the other authors for making available their time for this international work.

REPORT OF THE TEAM OF SPECIALISTS ON NON-WOOD GOODS AND SERVICES OF FORESTS

BACKGROUND

The European Forestry Commission of the FAO (EFC), at its 25th session held in June 1991, agreed on the great and increasing importance of non-wood benefits of forests. It agreed to convene an *ad hoc* meeting of experts under the auspices of the Joint FAO/ECE Working Party on Forest Economics and Statistics. The 49th session of the ECE Timber Committee, held in January 1992, agreed to include the *ad hoc* meeting in the framework of its work program under programme element 02(B).1.4.

The *ad hoc* meeting to prepare a study on the outlook for the non-wood benefits of forests was held in Geneva in February 1993. Fourteen countries were represented, as well as two United Nations organizations. The *ad hoc* meeting had the following objectives:

a) examine the feasibility of carrying out a study on the outlook for these benefits, and

b) consider what work might be undertaken by ECE/FAO on the valuation of non-wood goods and services.

The participants all agreed upon the importance of non-wood goods and services for forest managers, policy makers, and the general public. An international study of the outlook for non-wood goods and services was considered highly desirable. It was recommended that such a study should cover the ECE region, and that priorities should be based on a) priorities assessed in the 1990 Forest Resource Assessment, b) data availability in member countries, c) regional differences among member countries, and d) internationally agreed priorities as a result of UNCED, Agenda 21, and other international agreements.

The secretariat was asked to assess the feasibility of the study by querying the national correspondents for Volume II of the Forest Resource Assessment 1990, which was done in May 1993. The results of the questionnaire and the recommendations of the *ad hoc* meeting were presented to the FAO/ECE Joint Working Party on Economics and Statistics in June 1993. The Joint Working Party endorsed the proposed study. The joint session of the ECE Timber Committee and FAO European Forestry Commission in October 1993 agreed that the study should take place.

The Team of Specialists on Non-wood Goods and Services of Forests (ToS) was convened for the first time in November 1994 in Geneva (Annex 3). The team agreed on the need for an international study which would

a) present the situation and trends at a national level, according to a standard format, drawing on existing work. Quantitative information should be provided wherever possible, and economic values where appropriate;

b) where possible to identify structural trends, draw readers' attention to likely future developments;

c) through the process of preparing national data in a standard format, encourage harmonization of methodology and dissemination of best practices; and

d) identify emerging international policy issues.

The main users of this information were to be governments for policy development and for participation in

international policy dialogues. The team agreed to a common list of goods and services to analyze (Annex 1).

The study approach was for each team member to submit a country report according to a common format (Annex 2). The country reports would then be summarized into a synthesis report that focused on the ability to aggregate information on non-wood goods and services (nwgs) across countries.

The team leader of the ToS attended the Joint Working Party for Economics and Statistics meeting in June 1995 to discuss the team's plans. The Joint Working Party approved the team's study plan, but changed the end date to 1997 to coincide with their next meeting. The ToS met in Edinburgh in June 1996 to discuss the team's progress. At the time only three draft country reports had been completed and delivered to the team leader. Six additional team members indicated that they expected to complete their drafts by the end of 1996.

The team leader presented a progress report at the 1997 Joint Working Party for Economics and Statistics meeting. The final report of the Team is based on seven country reports. Because of the small sample, it was not possible to generalize or develop representative trends across regions. Therefore, the conclusions and recommendations tend to be focused on steps necessary to increase participation and possible roles for the team of specialists.

CONCLUSIONS

1) Most countries do not have national level information on the quantity or value of the majority of non-wood goods and services. Much of this type of information is collected at a sub-national level, e.g., by provinces, cantons, states, or local municipalities. Aggregating such information creates problems of both format and consistency. Even if data is collected in comparable measures, collecting data across multiple government or other organizations can be difficult.

2) Non-wood goods and services cover a wide range of disciplines. Relevant information may reside with agencies or organizations not traditionally associated with forestry. As a result, an inquiry should be extended beyond traditional forestry sources, which can add to the difficulty in both data collection and interpretation.

3) The quantity and value of some of the non-wood goods and services are not necessarily separable by the "forestry" component. For example, reports of recreation or hunting are often provided in total, not for activities that take place in forest environments.

4) Success in reporting on non-wood goods and services requires commitment at the highest levels. Most team members for this undertaking attempted to complete their country reports in addition to usual duties. The exceptions were the Czech Republic, where a grant from the Ministry of Agriculture supported the work, and support from the Austrian Ministry for Agriculture and Forestry for translation of the Austrian report. Given the breadth and complexity of the assignment, it is not surprising that many team members were not able to complete reports.

5) The information from this effort provides useful information for evaluating the possibility of collecting data on non-wood goods and services. The preliminary results were used as input to developing the final questionnaire for the Temperate and Boreal Forest Resource Assessment (TBFRA).

6) The inquiry for the TBFRA is a further test of both data availability and countries' willingness to commit resources to collect information on non-wood goods and services. Another potential source of information is thereports being developed in many countries on the criteria and indicators for sustainable forest management.

RECOMMENDATIONS

1) Publish the team report after revisions based on comments from Team members, the Secretariat, and Joint Working Party on Economics and Statistics. The report could be expanded if additional country information is provided within a specified time-line.

2) Take no further action with the ToS until the results of the Forest Resource Assessment have been collected and evaluated.

3) Call upon team members to assist in the evaluation of the non-wood goods and services component of the TBFRA 2000. Consider recommendations for further actions on the basis of that response.

SUMMARY OF POTENTIAL FOR DATA COLLECTION

Based on the seven country reports, it was possible to draw some preliminary conclusions about the potential for collecting certain types of data on non-wood goods and services.

Non-wood Goods

A number of non-wood goods were commonly reported. National significance is difficult to evaluate without further information. However, goods collected throughout the country, and/or goods whose quantity or value is considered nationally important regardless of geographic scope would be likely candidates. Mushrooms, berries, fuelwood/firewood, and decorative materials (e.g. greens and pine cones) seem to be likely candidates for consideration. These items tend to be commonly measured by weight, and can sometimes be valued using market prices. Other possible goods are furs and game harvest. Fur harvest is tracked in several countries by number of pelts and/or value of pelts. Similarly, game harvest by numbers or weight tends to be available in most countries. Data are generally limited about the quantity of non-wood goods collected for personal consumption. In some cases, it is also difficult to determine if the goods were collected solely from forest areas. For example, some game and fur species are not limited to forest environments.

Environmental Services

In this category, the most promising areas for national reporting seem to be global climate effects and biodiversity. Most countries can provide information on carbon budgets related to forest resources, using the common measure of million tons or teragrams. Biodiversity is a complex subject with numerous potential measures. At the national level four categories of information emerged. First was an accounting of networks of protected areas. Definitions and designations tend to vary by country, but comparability can be established by translating country categories into a common measure such as the definitions of the International Union for Conservation of Nature and Natural Resources (IUCN). The second category focused on measures of species diversity of forest vegetation. Possible reporting measures included stand or forest type distribution by age class, area of plantations or exotic species, and distribution of species mixes by forest type. These measures require additional context for interpretative purposes. The third category was disturbances to forest ecosystems, including fire, insect and disease damage, air pollution, and timber harvesting. Finally, the status of threatened species seems widely available. Again, the definitions and categories by country may vary, but using IUCN definitions can provide a common framework.

The protective functions of forests can be displayed in the context of area of protected forest. However, there is considerable variation between countries in terminology and designation. In addition, different property rights affect whether private forest lands can be included in these designations, even where they perform such functions. Local environmental functions are not good candidates for national reporting. These effects are very site-specific and variable. Attempting to aggregate such information would impose considerable burdens for data collection.

Social and Cultural Services

Most countries had some data on hunting and fishing activities, tracking either the number and/or weight of game animals and fish harvested. Several countries also tracked the number of people participating in hunting and fishing. Separating the "forest" component from all hunting and fishing activities remain problematic, as does distinguishing between sport, subsistence, and commercial activities.

Data on leisure and tourism was relatively limited. Some countries collected data on visitation, primarily to public lands. In some cases, it is difficult to separate data on leisure activities that take place on forests as opposed to other environments. Similarly, data on tourism is seldom available based on the tourism activity, such as recreation on forests. Leisure activities on private lands are also important in many countries, but they remain largely undocumented.

Information on aesthetic, scenic, cultural, scientific, and historic values was limited primarily to special land designations to protect these values. The cultural values of aboriginal groups that are traditionally tied to forests can be described to some extent.

SUMMARY OF COUNTRY REPORT RESULTS

The following summary is based on country reports from Austria, Canada, the Czech Republic, Finland, Sweden, Switzerland, and the United States. These seven countries provided numerous examples of both similarities and differences among countries that affect their ability to report on nwgs. This summary is organized following the format in Annex 2. The information drawn from the more detailed individual country reports was chosen to provide support for drawing conclusions and recommendations about future steps on nwgs.

A. FOREST OWNERSHIP

Forest land is an important component of the natural landscape of all six countries, accounting for one-third to two-thirds of the land area. The pattern of ownership of forest land varies dramatically between the countries (Table 1). Private ownership dominates in Austria, Finland, Sweden, and the United States, while public ownership dominates in Canada, the Czech Republic, and Switzerland. The ownership pattern in the Czech Republic is in a state of transition. Over half (58%) of the lands were privately held in 1937, before the transfer of 810,000 ha of private forest land to the state in 1945. The restitution of state lands to private owners was 83% complete at the end of 1995.

Table 1. Forest Land and Ownership

COUNTRY	TOTAL FOREST LAND (000 ha)	Percent of Total Land Area	Percent Private	Percent Public	Number of Private Owners
Austria	3,878	46%	80%	20%	214,000
Canada	417,600	45%	6%	94%	425,000
Czech Republic	2,641	33%	22%	78%	200,000
Finland	20,032	66%	70%	30%	439,056
Sweden	24,400	60%	87%	13%	360,000
Switzerland	1,206	33%	27%	73%	250,000
United States	298,135	33%	57%	43%	9,300,000

Some countries have lost forest cover to various forms of development. The Czech Republic was once three-

quarters forested. The United States once had about one-half the land area in forest land. Since the 1920s, total forest area has stabilized. In most European countries forest area has been expanding since the 1950s. For instance, forest land area has increased 40% in Switzerland since the turn of the last century.

The percentage of public ownership varies considerably between countries. Canada has the greatest percentage of forest land in public ownership, while the Czech Republic and Switzerland both have about three-quarters of their forest land publicly owned. There is also great variation within the public ownership category. In Canada, provincial governments control 76% of the public forest land. In Switzerland, cantons, local municipalities, and public corporations control most of the public lands. In the United States, the federal government controls 80% of the public forest land. The distribution in the Czech Republic is changing. Since 1990, the enterprises of state-owned forests have been transformed into the Forests of the Czech Republic, state enterprises, joint-stock companies, and other business entities.

Private forest land in Finland, Sweden and the United States are owned primarily by private individuals. In Sweden, private forest owners own half of the total forest area, while forest companies own thirty-seven percent. In the United States, private individuals own 48% of total forest area, while forest companies own about 10%.

The degree of government control over forest management and the coordination among different levels of forest management also varies among countries. In both Canada and Switzerland, most forests are managed by non-federal units of government. In Canada, federal authority over management of non-federal public lands is limited. By contrast, although the 26 Swiss cantons have a high degree of autonomy in legislation and administration, national policy and regulations are determined by the federal level Swiss Forest Agency. The Swiss Law on Forests of 1991 is the framework law that delegates a large number of responsibilities to the cantons, but cantonal forest laws have to be adapted to the federal law. Other important laws affecting forest management are the Law on the Protection of Nature and Landscape, the Law on Hunting, and the Law on Land-Use Planning. Any felling in Switzerland is subject to authorization; management of all forests is the responsibility of the canton's forestry service, regardless of ownership.

Switzerland's Law on Forests includes the right of free access to all Swiss forests, regardless of ownership. Certain limitations can be made to avoid activities that would harm the ecosystem or hinder the fulfillment of other forest functions. Landowners are also required to be reimbursed for uncovered costs in providing services for the society and for the upkeep of ecological and protective functions of their forests. Financial support is also offered for the improvement of management conditions.

Austria, Finland , Sweden and the Czech Republic also guarantee the common right of access to forests. Everyone is free to visit the forest and collect forest products for personal consumption, with the condition that no damage is done and the owner is not disturbed. The Czech Republic's 1995 Act on Forests sets up a central authority for state administration of forest management. The duties of both private and public owners in managing forests are clearly described; provision is also made for the compensation of owners for production of non-wood functions and for any damages resulting from state restrictions. Although there is a right of common access, there is also a list of prohibited actions.

In the United States, the federal forest lands are managed and regulated by federal agencies, as directed by numerous laws and regulations from the Congress. There are virtually no federal regulations on forest management for non-federal lands whether they are in other public or private ownership. Land managers do have to comply with federal laws such as the Clean Water Act when harvesting timber. Federal incentive programs exist to encourage certain management practices on private lands, but private management is affected primarily by state forest practice laws and local regulations on zoning and environmental protection. Private property in the United States is protected from trespass, so any use of private forest land is by permission of the owner.

B. NON-WOOD GOODS

The category of non-wood goods includes food, fodder, and other goods from the forest. Although a great variety of non-wood goods is available from forests, little data are collected on most of them. Collection of goods for personal use is widespread in many countries, but limited attempts have been made at quantification. Commercial use of non-wood goods is measured in some cases, particularly if the goods are collected under a permit system.

The availability of trend data varied greatly between countries, particularly at the national level. For instance, a survey was conducted in 1996 in Switzerland that was the first of its kind. Therefore, only one data point was available. Other countries have decades of data for a limited set of outputs. In many cases, the data are sums of data from several local areas. Therefore, the data do not reflect national totals. Tables 2-4 list the non-wood goods quantified in the country reports. If data from multiple years were provided, data from the most recent year was included in the table. The reporting year varies by country, and is not included in the table.

B.1. Food

Food products reported from the countries included game meat, mushrooms, honey, berries, chestnuts, and maple syrup (Table 2). Austria provided data from a sample of markets . The quantity of mushrooms (*Boletus edulis* and chanterelles) is a sum from three wholesale markets using 1996 data. The data on berries is a sample from wholesale markets of Vienna. Because the quantity of berries dropped significantly in 1996, the 1995 data were used as more representative of recent trends.

Canada quantified maple syrup production, which fluctuates considerably from year to year. For example, 1992 production was 18.2 million litres, one-third greater than the 1993 production shown in Table 2.

The Czech Republic was able to estimate collecting of mushrooms and berries for personal consumption, which is an important family activity. The total quantity collected by households is estimated in Table 2. Game species are also an important source of meat. In 1993, 7,292 tons of meat were harvested from game species. The most important species were red deer, roe deer, fallow deer, wild boar and hare. Finally, fishing in the Czech Republic resulted in a catch of almost 3 million kg in 1992.

Finland has extensive data on berry production from forests, including trend data from 1977 for three species. Estimates of annual yields under both good and poor conditions for numerous species of berries are available. Three species of berries (lingonberry, crowberry, and blueberry) account for over 80% of the estimated average weight. The quantities in Table 2 are based on 1995 data for the market supply of berries and edible mushrooms.

Sweden inventoried the production of wild berries from 1975-1980 as part of the National Forest Inventory. The most important species were bilberry (*Vaccinium myrtillus*) , cowberry (*Vaccinium vitisidaea*), cloudberry (*Rubus chamaemorus*), cranberry (*Vaccinium oxycoccus*), and raspberry (*Rubus idaeus*). The results showed a total production of about 500 million kilos annually, of which 75-80% were available for collection. However, only 5-7% of total`production was actually picked. The yield of mushrooms was inventoried from 1974-1977. Mushroom production was estimated at 100 kilos/hectare, of which 40% were edible species. About 13 million kilos were picked in 1977. These figures are dated, and the condition of the vegetation, as well as harvest, has probably changed. Statistics Sweden conducted a survey in 1995 inquiring about personal harvest of berries and mushrooms. It was estimated that 31 million litres of berries were picked and 14 million litres of mushrooms. The decline in berry harvest could be a result of urbanised living and changes in the vegetation. Reindeer husbandry is important for the native people in the northern part of Sweden. The number of reindeer is estimated to be nearly 300,000 animals, with an annual production of approximately 2,600 tons of meat.

Non-wood good data for Switzerland were based on existing literature and a survey conducted in 1996. The quantity of game meat was based on total harvest in 1994. Total weight was based on average weight statistics by species harvested. The data on mushrooms are rough estimates based on quantities voluntarily brought to canton mushroom controllers, and represent primarily private consumption. Honey statistics are estimated based

on data on total hives and average production per hive. Roughly 17% of the pollen in Swiss honey is estimated to come from forest vegetation. Chestnuts were once an important source of food for local populations in southern Switzerland, and are still consumed in large quantities. However, no data exist for individual use. About 12,000 kilograms were commercially used in 1996. Although commercial use has dropped significantly because of imports from Italy (3,050 tonnes were imported in 1996), a programme has been undertaken to reactivate the commercial use of chestnuts.

The United States has very limited data on food products. The data for mushrooms presented in Table 2 are based on a special study conducted in three states of the Pacific Northwest region. Approximately 25-30 species of wild edible mushrooms are harvested in this region on a commercial scale. The four most important species are morels (*Morcella* spp.) , chanterelles (*Canthrellus* spp.), matsutake (*Tricholoma* spp.) And boletus (*Boletus* spp.). No estimate of harvest for personal consumption is available. No data was available on harvest of berries, although several species are collected from forests. Maple syrup is an important product from the forest, particularly in the northeastern United States. National data exist on the harvest of fish for commercial use. The species most closely associated with forestland are the salmon species. Forested headwater provide critical spawning habitat for salmon. Total harvest of salmon has increased dramatically since the early 1970s, although the average value per pound has decreased in real dollars. The total in Table 2 is from 1995. Recreational fishing also provides food, but is covered in the section on hunting and fishing.

Table 2. Estimates of Annual Production of Foods from the Forest

COUNTRY	GAME MEAT[1]	MUSHROOMS[1]	HONEY[1]	BERRIES[1]	MAPLE SYRUP[2]	COMMERCIAL FISH CATCH[1]
Austria		66		1,900		
Canada					12,282	
Czech Republic	7,292	23,806		22,935		3,000
Finland		395		9,188		
Sweden	2,600	14,000 [2]		31,000 [2]		
Switzerland	1,597	735	500			
United States		1,787			6,240	515,815

[1] Thousand Kilograms
[2]Thousand Litres

B.2. Fodder

Data on fodder was provided only by Switzerland and the United States. In Switzerland, about 150,000 hectares of forest provide about 42.5 million kilograms of fodder. About 115 million kilograms of fodder were estimated to be consumed by wildlife (deer and wild boar) in Switzerland. The Swiss once gathered large quantities of leaves for bedding and food for cattle or sheep and pigs fed on nuts and roots in the forest. This activity has lost all importance these days. The limited data available are based on studies conducted by various institutions more for political purposes than for economic interest.

A large area of forest in the United States, about 34 million hectares, is used for grazing of domestic livestock. Forest areas in the southern U.S. yield about 6 billion kilograms of forage annually. These areas also provide forage for wildlife. In addition, livestock forage is produced on the extensive pinyon-juniper forest land in the west. However, almost 90% of the forage comes from the southern forests.

B.3. Plant Products

Numerous plant products are collected from forests, including medicinal plants, Christmas trees, fuelwood and firewood, seeds for forest plants, forest plants, decorative materials, bark chips, compost, and lichen (Table 3). Austria provided data on Christmas trees. About 1 million are sold per year in Austria. However, many of these are imported. In the Vienna market in 1995, about 67% of the trees sold were of domestic origin. It is not possible to determine the source of the domestic trees. Experts estimated that between 5% and 20% are from forests (compared to nurseries and plantations). The estimate of 134,000 trees in Table 3 assumes that 67% of the total trees are domestic trees, and that 20% of the domestic trees are from forests.

Christmas tree production from Canada is primarily from private lands; only 191,000 trees came from provincial lands. However, these figures do not include Christmas trees from provincial lands taken without a permit. Canada also exports Christmas trees (over 2 million in 1993). Data on collection of fuelwood for industrial or institutional energy and collection of firewood for household or recreational use is available from 1970-1993.

The Czech Republic reported on medicinal plants, which are collected by more than 19% of families. Important plants include nettle, common elder-blossom, lime-blossom, and dog-rose hip. Finland reported the quantity of lichen exports from 1980-1994. Data from 1994 are shown in Table 3.

Plant products in Sweden include lichens, Christmas trees, and ornamental foliage. Reindeer lichens (*Cladonia* spp.) are used for ornamental purposes such as making wreaths. This activity is important in the local economies of some regions. About 600 tons were exported annually from 1970 to 1975. The amount has decreased since then, but no current estimates are available. Exotic species for the production of ornamental foliage occurs in the south of Sweden, but no figures are available. Annual consumption of Christmas trees is estimated at 2.5 to 3 million trees. In rural areas, trees are often taken from the forest with or without the landowner's permission. In urban areas, trees are typically purchased from markets. However, a large proportion of the Christmas trees are imported from Denmark.

The Swiss report included the greatest variety of plant products. Decorative materials include pine cones, green foliage, and moss.

In the United States, numerous species are harvested for their fur. About 5.8 million animals were harvested in 1995, but this figure includes non-forest species. Generally, fur harvests have been declining because of negative public sentiment about trapping and restrictions on trapping methods.

A number of medicinal plants are collected from forests in the United States, including quinine cork (*Fomitopis officinalis*), cascara bark (*Rhamnus purshiana*), wild ginger (*Asarum caudatum*), and ginseng. Pacific yew (*Taxus brevicola*) was used for the manufacture of taxol for the treatment of cancer. However, harvest has been phased out since the semi-synthesis of taxol. Decorative plant materials are an important commercial product from the forest. A study in the Pacific Northwest indicated that the most important species in that region are beargrass (*Xerophyllum tenax*), salal, and dwarf Oregon-grape. Christmas ornamentals are also important seasonally. Species that retain their needles are particularly valuable, such as noble fir (*Abies procera*), Douglas-fir (*Pseudotsuga menziesii*), and western white pine (*Pinus monticola*).

Table 3. Estimates of Annual Production of Plants from the Forest

Non-Wood Good (unit of measure)	Austria	Canada	Czech Republic	Finland	Sweden	Switzerland
Medicinal plants, dried[1]			2,831			25
Christmas trees[2]	134,000	4,186,000			3,000,000	400,000
Fuelwood & firewood[3]		5,543				
Seeds for forest plants[4]						4,200
Forest plants[2]						1,500,000
Decorative materials[5]						8,550
Bark chips[5]						700,000
Compost, mould[5]						27,000
Lichen[4]				401,000		

[1] thousand kilograms
[2] number of items
[3] thousand cubic meters
[4] kilograms
[5] cubic meters

B.4. Other Non-Wood Goods

The remaining non-wood goods for which data was reported by the countries were pelts and beeswax (Table 4). In Canada, forest species provide a large proportion of the fur harvest in Canada. The number of pelts shown in Table 4 is from forest species. The greatest quantity of pelts comes from beaver, marten, and muskrat.

Finland reported the harvest of 276,000 fur-bearing animals in the 1994/95 hunting season. The most important species were raccoon, American mink, and red fox.

Switzerland reported a harvest of 30,000 skins and pelts. In addition, an estimate of beeswax harvested from the forest was provided.

Table 4. Estimates of Annual Production of Other Non-wood Goods from Forests

Country	Beeswax (kilograms)	Pelts Harvested (Number)
Canada		693,494
Finland		276,000
Switzerland	12,800	30,000
United States		5,800,000

B.5. Value of Non-Wood Goods

The value of the non-wood goods was provided for some products. The available data are displayed in Table 5. All values were converted to U.S. dollars (see Annex 4 for exchange rates). The values were not converted to a single base year. The basis for these values across outputs. In many cases, the values are based on wholesale prices. They do not necessarily represent the total value of the non-wood goods described.

Austria provided estimates of the value of wild berries and mushrooms based on the small sample of markets described previously. The total value of trees sold in 1995 was estimated at $26.4 million. It was estimated that 13% of all Christmas trees came from forests for Table 3. If the same proportion of value can be attributed to forest trees, the approximate value would be $3.5 million.

Canada's maple syrup production in 1993 was valued at $44,868,000. This value varies considerably by year because of the variation in output. By comparison, maple syrup production in 1992 was valued at $59,103,000. The value of Christmas tree output is based on retail sales. Most of that value is from private lands. The value of trees harvested from provincial crown land was almost $700,000. The value of trees for personal harvest without a permit is not included. The fur harvest from forest species generated $10,302,000 during the 1990-1991 harvest season. The highest values were for pelts of marten, mink, lynx, and wolf.
The Czech Republic reported a total value for mushrooms and berries of $44.3 million per year. The average price for mushrooms was roughly $1 per kg, while the average price for bilberries was $1.74 per kg. Applying the mushroom value to the reported quantity in Table 2 provided a rough breakdown between the two categories.

Finland had data available on the income generated from picking wild berries, edible mushrooms, and garden berries from 1977-1995. The numbers have fluctuated considerably over that time period, presumably in response to varying production from climatic conditions. In 1995, about $11.5 million of income was derived from picking wild berries, and about $875,000 of income was derived from collecting from edible mushrooms. Over the 16-year period, the income from picking wild berries has varied from a low of $6,310,720 to a high of $17,863,000. The income from mushrooms has varied from $143,600 to $12,326,000. The most valuable berries are blueberry, lingonberry, and cloudberry. The value of lichens for export was estimated to be $4.73 per kg on average.

Sweden provided estimates of the value of mushrooms and berries, based on 1991 harvest estimates. However, harvest estimates in 1995 varied substantially from the 1991 figures. Therefore, the value of the 1995 harvest was estimated, using the implied per unit values from the 1991 data. The 1991 value of Christmas trees was $5.2 million. The value of game meat was estimated at over $98 million.

Estimated values were provided for most of the non-wood products quantified in Switzerland.
The United States data include the value of edible wild mushrooms in the Pacific Northwest purchased by the mushroom industry in 1992. This value reflects the prices received by the original collectors; the wholesale value was estimated at $41.1 million. The value of decorative materials is also limited to the Pacific Northwest. Value of fur harvest includes all furbearing species.

Table 5. Value of non-wood goods from forests (U.S. Dollars)

Non-Wood Good	Austria	Canada	Czech Republic	Finland	Sweden	Switzerland	United States
Game Meat	28,130,000				98,400,000	10,296,300	
Mushrooms	887,282		24,815	875,000	54,900,000	6,000,000	41,100,000
Honey						5,740,700	
Berries	11,661		19,486	11,500,000	21,830,000		
Medicinal plants, dried				3,994,000		248,100	
Chestnuts						41,500	
Forest Pasture						11,629,600	
Forage Consumption by Wild Animals						23,111,100	
Maple production		44,868,000					
Christmas trees	3,500,000	35,974,035				3,925,900	
Pelts		10,299,830		3,594,600		222,000	40,603,170
Seeds for forest plants						131,900	
Forest plants						1,666,700	
Decorative materials							128,400,000
Bark chips						18,148,100	
Bees wax						55,600	
Compost, mould						1,600,000	
Reindeer Lichen				1,897,000			

C. ENVIRONMENTAL SERVICES

C.1. Protection

Austria, the Czech Republic and Switzerland provided detailed information about the protective function of forests. In addition, Sweden was estimated to have 200,000 ha of forests that are important in protection against soil erosion and climatic effects.

Austria has two types of protection forests. First are protection forests that require protection because of natural factors, such as erosion, and will be discussed in a later section. Second are areas formally declared as forest to protect against certain dangers to people, human settlements and facilities, or cultivated soil. Seventy-four percent of Austrian communities are affected by over 10,000 mountain torrents and almost 5,000 avalanche areas. About a third of Austria's forests are considered to have protection as their main role. However, 161,000 hectares of forest were estimated to have an immediate role in protection and need urgent improvement. Total expenditures for safeguarding the forest's protective role were estimated at $140 million

per year.

Valuing the protective function of forests in Austria was attempted using several approaches. The first was to estimate the replacement cost of protecting against avalanches with artificial barriers. The discounted present value of a permanent barrier structure was estimated to be $104 million over 50 years. The present value of temporary structures over 50 years was estimated at $42 million. The cost of acquiring the protection forests was estimated at $16 million.

The Czech Republic has four categories of protective forests. A total of 69,842 ha of forest land is in these categories. The first category is forest on extraordinarily unfavorable sites such as screes, ravines, ridges and slopes. The majority of the area in protective forests is in this category (50,467 ha). The second category includes alpine forests below tree line that protect forests located downslope, forests on exposed mountain ridges undergoing strong climatic effects, and forests reducing a danger of avalanche inception, for a total of 13,686 ha. Forests in the zone of dwarf pine are the third category, covering 3,473 ha. The fourth category is forest needed for soil protection, accounting for 2,216 hectares. These protection forests are in long rotation periods of 140-160 years or longer.

In Switzerland, 100% of the forest area has legal restrictions related to protective functions. Slightly over half of the forest area (627,000 ha) are protection forests for protection against avalanches and landslides. These areas were judged based on their protective potential (based on soil type and gradient), not on the basis of actual danger to people and property. Actual danger zones are being developed by the cantons. All forest area has a certain role in the protection of soils. Soil protection is also achieved by prohibiting the use of hazardous substances such as pesticides and fertilizers, banning rubbish dumps, and banning traffic except for forestry-related operations.

One approach to valuing the protective function of forests of forests in Switzerland against erosion was made based on the substitution costs (replacement by technical installations and/or replanting the entire forest area with a protective function). A yearly sum of $2 billion was estimated to be required. By comparison, the additional costs to the forest owners to maintain the protective function amounts to only $44 million per year, or $36 per hectare per year. This sum is further reduced by the fact that forest owners receive subsidies for maintenance work in protective functions.

C.2. Water protection

In Austria, forests are critically important in protecting water quality. The trend in water quality between 1988 and 1994 has shown improving quality. Among eight categories, the percent of running water in the highest quality categories increased, while those in the poorest decreased.

Water quality and water regulation are recognized as important services provided by forested ecosystems in Canada. An estimated 20% of the world's supply of freshwater is located in Canada. Although it is impossible to quantify streamflow and water quality changes at the national level, water regulation and production is an important forest-related output in Canada. Forest management and road development policies, practices, and regulations are in place to minimize reductions in water quality related to harvesting and road construction. Special attention is paid to riparian zones, steep slopes, and stream crossings.

In the Czech Republic, nearly 27% of the forested area (726,000 ha) is important for water management. The law requires management of these areas be aimed at protection and improvement of hydrologic and soil-protective functions. Riparian stands represent a specific group of water management stands important for water management, soil protection, climate, refuge, and recreation uses. The area of riparian forest is estimated at 75,000 ha. It was estimated that at least 35,000 ha should be managed with an emphasis on environmental non-productive functions.

Of the 726,000 ha in water management forests, 16% are mountain regions for protection of natural water accumulation and retention; 10% are intended to protect zones of surface water supply, 2% protect zones of

ground water supply, and 19% are intended to protect soil. The zones of water protection were set out by law in 1973 (Law No. 138/1973). By 1991, 617 zones of water protection were declared, as well as 48 zones of spa protection.

Switzerland has about 135,000 ha of land area in water protection zones. About half of that area (65,000 ha) is in forest, accounting for 5% of the total forest area. Water coming from forest areas needs no treatment for use as drinking water. A number of regulations, such as the prohibition on use of environmentally hazardous substances within these zones, also ensure the protection of water resources. If the water coming from forest had to be treated for drinking purposes, the additional costs would be approximately $125 million per year. The restriction on forest management designed to protect water quality cost forest owners about $4.7 million per year.

In the United States, the original forest reserves were set aside to protect watersheds. Comparisons of water quality across different land areas indicate that the quality of water draining forested watersheds is typically the best in the nation. Relatively few forest areas of the country are prone to troublesome pollution loads if properly managed. At least 40 of the 50 states use some procedures to monitor the use of best management practices in forest management.

C.3. Global Climatic Effects

Many countries are calculating carbon balances related to their forest resources. Those countries providing data uniformly presented information on the tonnes of carbon in forest biomass, forest soils, and wood products. Carbon stored in peatlands is important in both Canada and Finland. Table 6 provides a summary of the information.

Table 6. Carbon Storage Inventory (Million metric tonnes)

	Austria	Canada	Finland	Sweden	Switzerland	United States
Forest Biomass	359	14,500	740	950	114	21,299
Forest Soils	475	70,600	1,580	1800	180	33,336
Wood Products	1	600	13	na	22	33
Peatlands		135,000	4,500	3000		
TOTAL	835	220,700	6,833	5750	315	54,668

na= not available

Austrian forests store about 835 million tonnes of carbon. The carbon stored in forest biomass is primarily in the conifer forests (226 million tonnes). Carbon stored in forest products amounts to 4.7 million tonnes, of which between 0.7 and 1 million tonnes remains in domestic forest products other than fuelwood. Currently, per capita emission of carbon is 7.34 tonnes. Annual carbon emissions are about 15 million tonnes.

In boreal forests such as dominate Finland, the largest carbon reservoirs are in the forest soils and peat layers. The carbon storage of living trees has increased at an accelerating rate over the period 1960-1990. The standing stock has increased because the increment has been higher than the sum of fellings and mortality. The carbon storage in ground vegetation is estimated to be 28 million tonnes of carbon. This storage may be decreasing, since the expansion of trees can curtail light and nutrients available for ground vegetation. The total carbon reservoir of tree and surface vegetation biomass in 1990 was estimated to be 740 million tons of carbon.

Finland has about 9.0 million hectares remaining of peatlands. These lands are the largest carbon sink (4000-5000 million tonnes), while the mineral forest soils contain the second largest amount of carbon (860-2300 million tonnes). The numbers in Table 4 are the midpoints of the ranges provided. The total storage of organic carbon is estimated between 5600 and 8000 million tonnes. Forest products currently in use account for 13 million tonnes. Used forest products in landfills account for another 15 million tonnes.

The carbon storage of tree biomass in Finland is increasing by about 9 million tonnes per year. The carbon pool in the wood products in use in Finland increases by about .3 million tonnes per year, and the total pool by about

.6. The carbon pool in landfills increases by about .6 million tonnes per year, and the total pool by about 3 million tonnes per year. Landfills also emit a considerable fraction of carbon as methane, which is a more powerful gas than carbon dioxide. In the long run, fellings are expected to equal growth, so that the main sink of the increasing tree biomass will go to zero. A negative sink impact might result if landfill gas emissions and fossil emissions of the total forest sector are not reduced.

Sweden estimated that approximately 40-50% of total annual carbon dioxide discharge is assimilated in the growing stock of living trees. The annual increase in timber volume in Sweden's forest is about 25-30 million cubic meters, which corresponds to 7-8 million tonnes of carbon. In the boreal forests which dominate Sweden, the largest carbon reservoirs are in the forest soils and peatlands.

Switzerland had no detailed information on the stock of carbon storage in wood products. The Swiss estimate is based on converting 100 million cubic meters of wood in use in various products to roughly 21.5 million tons of bound carbon. Switzerland's forests have very high volumes per hectare, and they are increasing steadily. The low exploitation rate is leading to an increase in amounts of carbon stored.

The United States carbon storage is based on 1992 figures. Forest ecosystems in the United States contain approximately 54.6 billion metric tons of organic carbon above and below the ground. An estimated 27-39 million metric tons per year is added through wood products and landfills. Between 1952 and 1992, carbon stored on forest land increased by about 11.3 billion metric tons. Generally, U.S. forests have been carbon sinks since 1952. Most of the increased carbon storage in the past occurred on private forestland, while projected increases in the future will occur on public forestland.

C.4. Biodiversity

Biodiversity is a complex concept that requires numerous variables to even begin an adequate description. At the national level, there were several common elements in the country reports that are presented below. Although similar variables and ideas are presented, the actual unit of measurement often varies. The discussion is broken into the following sections: protected areas, diversity within forest ecosystems, disturbance regimes, and the status of threatened species.

Protected Areas

To the extent possible, protected areas were reported by IUCN classes I through VI:

> Class I: strict nature reserves/wilderness areas managed mainly for science or wilderness protection.
> Class II: national parks managed mainly for ecosystem conservation and recreation.
> Class III: natural monuments managed mainly for conservation of specific natural features.
> Class IV: habitat/species management areas managed mainly for conservation through management intervention.
> Class V: protected landscape managed mainly for conservation and recreation.
> Class VI: managed resource protection areas managed mainly for the sustainable use of natural ecosystems.

Austria has a total of 1,905,386 ha in areas protected by law (Table 7). The Austrian natural parks are assigned to IUCN Categories IV and V, with the exception of one Category II area. These areas contain varying amounts of forestland. The national parks contain about 18% forestland, while the natural parks contain about 2% forestland.

Table 7. Areas in Austria protected by law

Category	Number of Areas	Area (ha)
National parks	7	214,000
Natural parks	348	284,000
Plant protection zone	14	27,643
Repose area	7	130,743
Landscape preserves	240	1,249,000
TOTAL	**616**	**1,095,386**

Austria recently conducted a study to identify areas particularly significant for biodiversity. The country was divided into 2,563 quadrants, of which 36 were defined as biodiversity hot spots. Two-thirds of those quadrants were not included in landscape reserves or national parks.

Specific designations of forest land include protection forests. The Austrian Forestry Act of 1975 defined protection forests as forests whose location is jeopardised by the erosive forces of wind, water, and gravititation and require special treatment to protect soil, vegetation, and reforestation. A total of 741,000 ha are protection forests. There is also a total of 86 designated natural protection forests covering 3,224 ha. These areas are reserved for natural development of ecosystem; all immediate intervention is prohibited for the purposes of protecting biodiversity and serving research, science, and education.

The number of protected areas in Canada has increased from about 17 million ha in 1930 to over 90 million ha in 1993. The federal government manages National Parks, Native Lands, and the two northern territories, as well as various other types of land such as defense lands. National parks generally prohibit resource extraction (except sport fishing). Provincial forests are generally managed under multiple-use principles. Essentially, Canada has two classes of public forest land: reserved lands and non-reserved lands. Reserved lands are lands which have some protection status, and from which timber harvesting is excluded. Reserved lands are retained exclusively to provide non-wood values. Non-reserved lands are generally managed to achieve multiple use objectives, including timber production. Forest management policies and practices are in the process of undergoing fundamental change in Canada, focusing on ensuring the integrity of forest ecosystems and reflect the principles of sustainable development. Currently, Canada is incorporating the concept of sustainable development into forest management.

Of Canada's total forest area, 7.6% is reserved. Most of the reserved lands are in the western provinces of British Columbia and Alberta. Although area estimates by IUCN class were not available, the categorization of Canadian special designations can be translated to IUCN classes:

IUCN Class	Canadian Designation
I	Provincial wilderness areas, some provincial parks and ecological reserves
II	National parks, some provincial parks and ecological reserves
III	Some Provencial parks and ecological reserves
IV	National wildlife areas, park reserves, recreation areas, some private protected areas
V	Forest ecological reserves, forest reserves, some private protected areas

The Czech Republic classifies forests broadly as protective forests and forest of special purpose, both of which are managed with an emphasis on non-wood functions. Designated commercial forests are managed primarily for wood production. However, the distinction is not always clear, since there is often overlap between protective functions and special purposes, and commercial forests also provide non-wood benefits. The

proportion of forests with non-wood functions amount to 57% of the total forest area. About 12% of forest area is important for water management, particularly in the protection of water basins; 16% is important in protecting mountain headwaters to protect against floods and erosions (Protected Areas for Natural Accumulation of Surface Waters (CHOPAV)); 23% is exploited largely for recreation; and 25% is in proclaimed large-scale protected territories for wildlife conservation as national parks and protected landscape areas. There are 700,000 ha in nature conservation forests. These designations are not mutually exclusive, often applying to same forest land.

Finland has various areas protected by the nature conservation act, wilderness act, recreational act, or by governmental order. These areas can be categorized using IUCN definitions. In addition to officially designated forest land, the total forest land base can also be classified by IUCN categories (Table 8).

Table 8. Protected forest areas in Finland

IUCN Class (Finnish designation)	Officially designated Forest land (ha)	Total Forest land (ha)
I (nature reserves)	34,477	78,568
II (national parks)	117,623	233,084
III (natural monuments	1,601	1,619
IV (managed protection areas)	483,125	764,069
V (landscape and recreation)	26,101	28,791
VI (Sustainable use of ecosystem)	411,023	954,224
Others	11, 023	13,872
TOTAL	**1,085,839**	**2,074,227**

Sweden has a number of designations for protected forests. The number of protected areas has increased from 9 national parks in 1909 covering 300,000 ha to 24 national parks, 1600 nature reserves, 100 nature management areas, and 900 wildlife sanctuaries which in total covered 2.8 million ha in 1995. This represents 7% of the total land area that receives some degree of protection under the Nature Conservancy Act. About 3% of the total forest area (800,000 ha) are totally protected within national parks, nature reserves, and Domän (Forest Service) forest reserves. (All Domän forest reserves are under transformation to nature reserves). In addition, forestry is not allowed on some 4 million ha of forests and other wooded land not defined as forest land according to the Forestry Act. Most of the protected areas are located in the northern part of the country.

Table 9. Protected forest area in Sweden, 1995

Designation	Total Land Area (000 ha)	Forest land area* (000 ha)	Productive forest (000 ha)
National Park	582	109	35
Nature Reserve	2072	1036	558
Nature Management Area	127	82	**
Domän (Forest Service) reserve	1340	503	294
Total	**2781**	**1730**	**887**

* Includes other wooded land
** Not available

Switzerland has almost 38,000 ha in protected areas, accounting for slightly over three percent of the forest area. However, all forestlands are managed subject to certain restrictions related to conserving biodiversity. These restrictions include the prohibition of clear-cuts and the use of environmentally hazardous substances in forests, an emphasis on natural regeneration and silvicultural methods as close to natural as possible. In addition to the protected areas, gene reserves and seed collection stands are being protected through a national register of gene reserves which should be established by 1999 for spruce (*Picea abies*), silver fir (*Abis alba*) as well as pedunculate and sessile oak (*Quercus robur, Q. Petracea*). Table 10 displays forest area contained within protected areas, not the total area. About $20.6 million per annum are spent on nature protection in forests. In total, the forest area protected for the conservation of fauna and flora, and diversity of ecosystems accounts for almost 4% of the total forest area.

Table 10. Protected forest areas in Switzerland

Designation	Forest Area within protected areas (ha)
National park and 44 nature reserves	6,700
Federal inventory of water and migratory bird sanctuaries	960
Federal game reserves	23,200
Total area for protection of fauna and flora	**30,860**
Federal inventory of moors	580
Federal inventory of marshes	110
Federal inventory of alluvial forests	6,180
Total area for conservation of diversity of ecosystems	**6,870**

The United States has numerous federal and state designated areas that protect biodiversity. In most cases, total area is not available by forest and other land types. All federal lands total to 305 million ha, of which 101 million are forestland. National Parks, National Forests, National Wildlife Refuges, and Bureau of Land Management are holdings managed as natural environments for various conservation purposes (Table 11). However, multiple uses are allowed on all these designations with the exception of National Parks, and therefore many of these acres do not meet IUCN classification for protected areas. The National Wilderness Preservation System (NWPS) is composed of specially designated areas on federal lands managed by the Forest Service, Bureau of Land Management, Fish and Wildlife Service, and National Park Service to protect natural ecosystem processes. Currently, about 37 million hectares are in the NWPS. These lands are managed to protect natural ecosystem processes. Extractive uses and motorized access are prohibited. An additional 26 million ha of forestland are owned by state and local governments, and receive varying degrees of protection.

Table 11. Protected Areas in the United States

Designation	Total Area (000 ha)	Forest Area (000 ha)
National Forest System	87,000	57,000

Bureau of Land Management	123,000	15,000
National Park System	36,000	29,000*
National Wildlife Refuges	41,000	
Other Public Lands	18,000	
TOTAL	**305,000**	**101,000**

* Total forest area for National Park System, National Wildlife Refuges, and other federal lands.

About 6.6% of total forest area (19.6 million ha) is reserved, i.e., no timber harvesting is allowed. These lands are primarily in federal ownership. Reserved area has increased dramatically since the 1970s (more than doubling), and is likely to continue to increase in the future. In addition to public lands, a number of private owners have no intention of harvesting timber for their lands.

According to IUCN classification, the United States has a total of 1,585 protected areas in IUCN classes I to V, including slightly over 130 million ha. About 71 million ha are in classes I-III and another 60 million are in classes IV and V. These areas include federal and state lands, but are not limited to forest land. The other classes include both federal and state lands. Aside from NWPS lands, none of the lands managed by the Forest Service or Bureau of Land Management are included because multiple uses are allowed.

Forest vegetation diversity

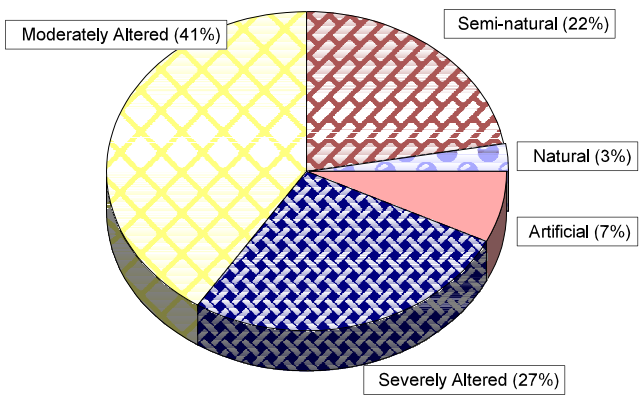
Most countries have descriptive data about forest composition. Data available included the distribution of coniferous and broad-leaved forests, age class distribution, and assessments of the level of human disturbance of the forest.

Austria assessed the "naturalness" of the existing forests, using five categories:

1) Natural forests: forest not influenced by humans, or the influence cannot be recognised today.
2) Semi-natural forests: forest that are little used and exhibit limited disturbance to natural tree communities.
3) Moderately altered forests: forests that are highly used, but retain elements of natural vegetation.
4) Strongly altered forests: forests in which stand structures are clearly modified by timber use and pastures.
5) Artificial forests: forests that are highly used and do not show tree combinations characteristic of potentially natural conditions.

As shown in Figure 1, the largest share of Austrian forests are moderately altered. Only a small percentage (3%) meets the stringent requirements of a "natural forest", but the semi-natural and moderately altered categories account for two-thirds of the forest area. Altered and artifical forest areas are found primarily at colline, submontane, and low mountainous altitudes. Natural and seminatural forests are primarily found at mountainous, low subalpine and high subalpine altitudes.

Figure 1. Distribution of naturalness levels in Austrian forests



Most of Austria's forest are coniferous. About two-thirds of the forest area is in pure coniferous stands (over 80% of the stand is conifers). The other third is either mixed forest or pure deciduous. Less than one percent of total area is estimated to be in exotic tree species.

Current information and databases are insufficient to provide a national assessment of biodiversity in Canada's forests. Softwood species dominate Canada's forests, occurring on 64% of the forest land. Hardwoods are found on 15% of the forest land, while mixed stands account for the remaining 21% of area. The mixture of species varies by forest regions. Coastal forests are predominantly made up of hemlock, cedar, Douglas fir, and other conifers. Forests around the Great Lakes and St. Lawrence have a mix of both softwood and hardwood species, with considerable diversity in both types. The montane forests are primarily, pine, while the Acadian forests are predominantly spruce. The boreal forests are dominated by spruce, pine, poplar and other deciduous species.

The forest area considered productive for timber (235 million ha) can be categorized by age classes. In 1993, 12 million ha (5%) were regenerating after fire or insect damage; 102 million ha (43%) were in mature, old, or mixed-age forests; 83 million ha (35%) were in young forest; and 34 million ha (14%) were in seedling stage. Over 2 million ha were not growing commercial species 10 years after harvest.

In the Czech Republic, the present condition of forests reflects the actions of several generations. During the socialist regime, the emphasis on wood production affected the natural species composition. Coniferous tree species dominate the Czech forests, covering 77% of the forest land. In 1850, conifers covered 70% of the forest area. The primary conifer species is Norway spruce, which accounts for 54 percent of the conifers. Oak and beech are the dominant deciduous species, covering 12% of the forest area.

Since 1920, a larger percent of the forest area has shifted to older age classes. In 1920, almost three quarters of the forest were in stands 60 years or younger. Less than half of the total area is now in that age range. Stands greater than 120 years old have increased from 0 to 6% of forest area. Within the productive forests, about 1.5 million ha are in rotation periods from 80 to 150 years.

Sweden's National Forest Inventory data allows a comparison of changes in forest age class distribution from the 1920s to more recent years (Table 12). There were no significant changes in age class distribution between theses two periods. Scots pine and Norway spruce are the dominant tree species making up standing volume on forest lands in 1991. Exotic species are found on only a small area. In the southern part of Sweden, small areas of Douglas fir and Sitka spruce, and other exotics can be found. In the northern region, there are about 500,000 ha of Lodgepole pine.

Table 12. Comparison of forest land area by age class in Sweden

Age Class	**1923-1929 (%)**	**1989-1993 (%)**
0-20 years	17	26
21-80 years	51	41
81-120 years	14	22
121-	18	11
Total	**100**	**100**

Switzerland has few specific data on the origins of the Swiss forest, so it is difficult to give the proportion of natural forests and plantations. Coppices and selvas are ancient forms of agro-forestry management. Two-thirds of the forest area consists of mixed stands. The proportion of mixed stands is affected greatly by altitude, with a significant decline in diversity over 800 meters. The lowest stand diversity is between 1400 and 1800 meters. Over 1800 meters, a slightly higher diversity is provided by larch, stone and mountain pine.

At the turn of the century a large number of species were introduced to Switzerland, especially from North America. Although no detailed data exist, the proportion of these species cannot be over one percent of total volume. Natural regeneration occurs on almost 90 percent of the forest area. The majority of forest area is in high forest (Table 13).

Table 13. Forest Area by Forest Type in Switzerland

Forest Type	Total Area (000 ha)
High forest	792.9
Selection-type high forest	100.1
Coppice with standards	48.7
Simple coppice	23.7
Selva, plantations	3.1
Permanently open stands	70.7
Bushland	55.7
Inaccessible forest	33.1
Others	58.3
TOTAL	**1,186.3**

Forest area in the United States has remained relatively stable since the 1920s. However, specific forest communities have been reduced significantly. Eighty percent of the bottomland hardwoods of the lower Mississippi River delta have been converted to other land uses. Riparian forest in the arid and semi-arid West are considered the most altered land type in the western U.S. Area declines of greater than 10% between 1963 and 1987 have occurred in southern pines, aspen-birch, and elm-ash-cottonwood communities. Mature and old-growth softwood stands are becoming increasingly rare in the Pacific Northwest and the South. An assessment of forests in eastern Washington and Oregon indicate that over the last 40-55 years, the number of acres in early and late successional stages has declined, while the area in mid-seral stages has increased. In the eastern hardwood forests, disturbance has not kept pace with forest growth, resulting in an increasing proportion of area in older hardwood stands.

Stand size class distribution can be used to describe forest structure and age. Eastern timberlands are composed of about 23% seedling-sapling stands, 28% poletimber stands, and 47% sawtimber stands. Only about 1% of the area is non-stocked. In the western U.S., seedling-sapling stands are found on 13% of timberlands, 15% are poletimber, and 70% is sawtimber. About 2% of the area is nonstocked.

In the eastern U.S. forests, the area of forest types in later stages of succession has increased over the last 20 years, leading to a more mature forest. Other forest types are decreasing, mainly forest types such as aspen-birch that require harvest or other disturbance to maintain. A maturing forest results in increasing average age and size class. Without increased levels of natural or human disturbance, this trend is likely to continue into the future.

Disturbance Regimes

Natural and human-induced disturbances to forest ecosystems affect the ability of the forest to produce non-wood goods and affect the forest environment for leisure activities. Disturbance also affects ecological processes that provide important services to humans. The measures of disturbance presented below can also contribute to evaluation of forest resilience and productivity.

Canada tracks trends in the area of forest land burned, the area defoliated by various insects, and the area harvested. In 1995, forest fires burned 7.25 million ha, insects defoliated 11.6 million ha, and 989,000 ha were harvested. Between 1974 and 1995, area burned varied between practically zero and almost 8 million ha. The 1995 season was the second worst on record. The predominant insect pests in Canada are spruce budworm, jack pine budworm, hemlock looper, mountain pine beetle, gypsy moth, and forest tent caterpillar. There is generally much greater variation in the area affected by natural disturbance than from timber harvesting.

The Czech Republic tracks several types of disturbance to forests. Air pollution is a serious concern for Czech forests. Norway spruce, the dominant conifer, is being seriously affected by industrial pollutants at higher altitudes and by dry seasons and climatic fluctuations at lower altitudes. The species has increased sensitivity to diseases and pests. Scots pine and some deciduous species have problems with fungal tracheomycous diseases. Overall, 60% of the forest area is considered damaged by air pollution, especially spruce and pine stands. About 2 percent of the forest area was felled to clearcut damaged trees. More tolerant species were planted to replace the affected trees, but these species are also less productive.

Game browsing and bark peeling is another source of damage to Czech forests. About 5% of the total area is damaged by bark peeling, which affects about 26 million cubic meters of wood. Another 1 percent is affected by game browsing. Between 1978 and 1988 it was estimated that 7.5% of the conifer area and 1.2% of the broadleaf area were game damaged.

Switzerland provided estimates of damage caused by insects and disease, fire, storm damage, and grazing. The greatest damage from insects has been caused by the bark beetle (*Ips typographus*). Harvests because of beetle damage between 1984 and 1994 have ranged from a low of 60,000 cubic meters to a high of 438,000 cubic meters in 1993. As with most insects and diseases, the amount of damage tends to be cyclical. The most important pests in addition to the bark beetle are *Liosomaphis abietinum*, *Ips cembrae*, *Lymantria dispar*, *Lymantria monacha*, *Thaumetopea pityocampa*, *Ocnerostoma copiosella*, *Cryphonectria parasitica*, *Ceratocystis ulmi*, *Ceratocystis fimbriata*, *Chrysomyxa rhododendri*, beach bark necrosis, *Eronia amylovora*, and Norway maple decline (*A. platanoides*).

Forest fires are a problem primarily in the southern Alps. In 1986, a decree was passed forbidding kindling fires in the open. Table 14 shows the trend in forest fires from 1983-1994.

Table 14. Trend in Number of Fires and Annual Area of Burnt Forest and Other Wooded Land in Switzerland

Year	Number of Fires	Area (ha)
1983	106	464
1984	146	320
1985	116	213
1986	76	63
1987	70	312
1988	55	183
1989	150	213
1990	216	1102
1991	157	148
1992	111	52
1993	99	42
1994	50	192

Damage to regenerating forest areas is caused by grazing and browsing of both wild game and domestic livestock. No data were available about the area of damaged regeneration, but the percentage of damaged trees provides some idea of the extent of the problem. About one-third of trees in regeneration areas are damaged in some way. Game damage accounts for about one-third to one-half of the damaged trees. The high concentration of game in some regions leads to a selection of species that can regenerate naturally and without protective measures.

About 129,000 ha of forest are used as pastures for cattle and other animals. About half (79,200 ha) of pastured forest are endangered or damaged by grazing. Grazing was somewhat of a problem in Switzerland during the last century. Large areas of forest were overrun by cattle, goats, and sheep, leading to lack of regeneration, erosion and floods. Great efforts were undertaken to separate forest and pasture and to reforest eroded areas. Today, interest has increased in conserving these forest pastures as important historic landscapes.

The United States reported data on area of forest affected by various pests and pathogens, and wildfire occurrence. In 1995, over 36 million ha of forest land were affected by southern pine beetle, mountain pine beetle, spruce budworm, spruce beetle, dwarf mistletoe, root disease, and fusiform rust. Over 11 million ha in the western U.S. are affected by dwarf mistletoe, a parasitic plant that reduces growth, kill tops, and causes deformities and mortality in conifers. The area infested has increased over the past century in some regions because of the suppression of fires, which are an effective sanitizing agent. Over 6 percent of commercial forest in the western U.S. is also subject to root diseases, while in the eastern U.S. root disease is reported on over almost 1 million ha.

There are over 4500 exotic free-living species in the U.S. today. Of the 70 major insect pests found in U.S. forests, 19 are exotic. For example, white pine blister rust is distributed across the entire range of western white pine since its introduction in 1921. Up to 95% of the original stands of western white pine and sugar pine have been killed or damaged by this disease.

The frequency and scope of wildfire have changed dramatically since European settlement. Fire suppression activities into the 1930s resulted in fewer and fewer acres burned by wildfire in the 1950s through the 1970s. However, beginning in the 1980s, wildfires (primarily in the West) began to increase again. In 1996 an estimated 2 million ha burned. One of the primary reasons is that decades of fire suppression have resulted in fuel buildups and increased insect and disease susceptibility and mortality.

Threatened Species

Most countries keep lists of threatened and endangered species, although definitions may vary across countries. In some cases, the lists are compatible with IUCN definitions. Limited information is available on the proportion of threatened and endangered species that are forest species. Defining forest dependency or forest association can be difficult.

Austria has 10,882 species of animals (including insects and invertebrates) and 2,873 species of vascular plants. Animal species can be listed under five categories (Table 15). This list includes all species, not just forest species. Since category 0 lists species already extinct, and category 4 measures potential threat, only categories 1 through 3 were summed in the table for total threatened species. This seemed a more reasonable number to use for calculating the proportion of total species threatened. The number of forest species could be determined for plants. Of the total number of species of vascular plants, 790 are forest species (27%). A total of 1,081 plants are considered threatened in all five categories, of which only 97 are forest species. Therefore, less than 10% of all threatened plant species are forest species. However, a little more than ten percent (12.3%) of all forest plants are threatened.

Table 15. List of Threatened Species in Austria*

	Category 0	Category 1	Category 2	Category 3	Category 4	Total 1-3	% of Total Species
Mammals	5	4	3	18	13	25	32%
Birds	23	24	11	22	13	57	29%
Reptiles	1	1	4	8	1	13	81%
Amphibians	0	1	6	14	0	21	100%
Fish	5	5	7	13	9	25	45%
Insects	136	329	724	652	437	1705	17%
Invertebrates	16	61	64	67	78	192	45%
Vascular Plants	53	156	300	401	171	857	30%
TOTAL	**239**	**581**	**1119**	**1195**	**751**	**2,895**	**21%**

*Definitions of Categories:

Category 0: extinct or extirpated
Category 1: close to extinction
Category 2: severely endangered
Category 3: endangered
Category 4: potentially endangered

Canada's forests provide habitat for an estimated 200,000 species. The Committee on the Status of Endangered Wildlife in Canada assesses the status of wildlife and assigns species to one of the following categories: vulnerable, threatened, endangered, extirpated (extinct in Canada, but present in other areas), or extinct. The most recent data included species counts for mammals, birds, reptiles and amphibians, and plants by ecozone. Some species occur in more than one category, since their status may vary by location. Therefore the total species count (Table 16) accounts for only 75 unique species (three species are listed under two categories).

Table 16. List of Threatened Species in Canada

Category	Mammals	Birds	Reptiles & Amphibians	Plants
Endangered	4	4	1	11
Threatened	2	4	2	16
Vulnerable	13	7	2	13
TOTAL	**19**	**15**	**5**	**40**

The Czech Republic provided information using Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) categories (Table 17). In addition, the status of plant communities has been assessed. There are 548 plant communities defined in the Czech Republic at the association level. Eighteen of those communities have been extinguished, 106 are endangered, 236 are threatened or declining, and 188 are not endangered by human activity. Up to 5 protected regions in the Czech Republic have been included in the world biosphere network.

Table 17. List of Threatened Species in Czech Republic

	Critically Endangered	Endangered	Threatened	Total
Mammals	8	12	10	30
Birds	35	58	30	123
Reptiles	4	5	10	19
Fish	6	3	10	19
Amphibians	7	7	4	18
Invertebrates	33	22	36	91
Fungi	27	13	6	46
Vascular Plants	246	143	92	481
Total	**366**	**263**	**198**	**827**

Finland provided information on threatened species by habitat type (Table 18). Total species in each group provides additional context on the situation in forest habitats compared to other land types. In general, forests seem to account for a higher percentage of threatened species than most habitats except watercourses. In the case of cryptogams, forest species dominate the threatened list. However, compared to total species in Finland, a fairly small percentage of species are threatened.

Table 18. List of Threatened Species by Habitat Types in Finland

Habitat	Vertebrates	Invertebrates	Vascular Plants	Cryptogams	Total
Forests	15	318	38	356	727
Peatlands	1	29	21	32	83
Watercourses	26	68	18	41	153
Shoreline areas	4	57	46	32	139
Exposed bedrock	1	16	23	117	157
Fells	6	22	20	22	70
Man-made environments	8	223	61	71	363
TOTAL LISTED	**61**	**733**	**227**	**671**	**1,692**
TOTAL SPECIES	**373**	**25,500**	**1550**	**14,740**	**42,000**
Percent Threatened	16%	3%	15%	5%	4%

The Swedish Environmental Protection Agency develops the list of threatened species for Sweden (Table 19). The number of species continues to increase as knowledge improves. Species are classified into five threat categories. Of the total number of threatened plants, 52% are found in forests. Forty percent of threatened vertebrates and 52% of threatened invertebrates are found in forests. Overall, about 51% of all listed species are forest dependent to some extent. About 44% of listed species are dependent on agricultural lands. Some of the listed species are found on both forest and agricultural land.

Table 19. List of Threatened Species in Sweden

	Extinct	Endangered	Vulnerable	Rare	Care Demanding	Total Threatened	Total Species
Vascular plants	32	93	118	103	99	445	1900
Cryptogams	51	188	265	265	265	1034	7100
Total Plants	**83**	**281**	**383**	**368**	**364**	**1479**	**9000**
Mammals	2	3	9	4	5	23	69
Birds	8	5	16	13	49	91	268
Reptiles	0	0	0	0	4	4	7
Amphibians	0	2	5	0	2	9	13
Fish	1	2	5	6	5	19	150
Total Vertebrates	**11**	**12**	**35**	**23**	**65**	**146**	**510**
Insects	106	196	496	226	723	1747	25000
Other Invertebrates	5	11	25	36	52	129	5000
Total Invertebrates	**111**	**207**	**521**	**262**	**775**	**1876**	**30000**

The Swiss listing of threatened species is based on the IUCN categories (Table 20). The vascular plants are not greatly hreatened with the exception of a number of light demanding species due to the lack of natural forest borders and open forests. Other plant groups, such as pioneer, water and marshland plants are most threatened (35-68% of species).

Table 20. List of Threatened Species in Switzerland

Category	Vascular plants	Mosses	Vertebrates	Invertebrates	Total
Extinct	1	1	22	118	142
Endangered	29	13	30	176	248
Vulnerable	8	70	129	663	870
Rare	48	76	53	258	435
Total Threatened	**86**	**160**	**234***	**1,215***	**1,695**
Total forest species	461	460	376*	2,369*	3,666

*Includes all species, not just forest species.

The United States had 1,126 species listed as either federally endangered or threatened as of January 31, 1998 (Table 21). The total number of plants listed is almost four times the number of listed animals. A recent study of 924 of the listed species analyzed the dependence on forest ecosystems (Table 22). Of the 924 species, 383 species were classified as dependent on forest ecosystems. Of all the land types considered, forests hosted the largest number of endangered and threatened species. Within forest habitats, evergreen types supported more listed species than mixed or deciduous forest types.

Table 21. List of Threatened Species in the United States

Taxonomic Group	Endangered	Threatened	Total
Mammals	58	7	65
Birds	75	15	90
Reptiles	14	20	32
Amphibians	9	7	16
Fish	67	41	108
Snails	15	7	22
Clams	56	6	62
Crustaceans	16	3	19
Insects & Arachnids	33	9	42
Flowering Plants	525	113	638
Other Plants	28	2	30
TOTAL	**896**	**230**	**1,126**

Table 22. Forest type associations among 383 forest dependent threatened and endangered species in the U.S.*

	Deciduous Forest	Evergreen Forest	Mixed Forest	Wetland Forest
All T&E Species	128	178	110	71
Plants	39	60	34	16
Mammal	11	21	15	15
Birds	7	41	16	20
Reptiles	7	10	11	7
Amphibians	2	2	4	2
Fish	28	28	19	8
Snail	8	2	2	1
Clam	19	8	7	
Crustacean	6	1	2	
Insect	1	5		2

* Species can occur in more than one land type category.
The 383 species are from the conterminous U.S. only.

C.5. Local environmental functions

Only Austria and Switzerland provided information about local environmental functions. Austria provided information about windbreaks , which occur on 2,425 ha. These areas are essential in protecting against wind-induced damage, primarily on agricultural land.

In Switzerland, the effect of the forest on air pollution and noise absorption was considered. Studies have shown that forests have a great capacity for filtering and binding air pollutants. A calculation based on the surface area of foliage liable to intercept pollutants results in a figure of 505,000 tonnes of aerosols bound by forests every year. The total amount spent annually on air protection measures in Switzerland is $247,407,410.

Noise absorption may be provided by forests, depending on the landscape configuration. At the moment a register of noise levels is being made at the national level. However, this information will not aid in estimating the effect of forests in reducing noise. Forests also have a local equalizing effect on humidity, precipitation, temperature, and wind. No national assessment was possible.

D. SOCIAL AND CULTURAL SERVICES

D.1. Hunting and Fishing

Two types of data tend to be available for hunting and fishing. The first type is based on harvest data on either number of animals killed, or the weight of the harvest. The second type of data focuses on the participants, including counts of hunters and days of participation. One of the recurring problems in this category is separating out the "forest" component of hunting and fishing.

Hunting rights in Austria are inseparable from land ownership and belong to the rights of the individual landowner. Landowners must acquire a private hunting permit to gain permission for private hunting, which is only granted for contiguous areas of at least 115 ha. Land not belonging to private hunting grounds are part of co-operative hunting grounds. Both type of hunting grounds can be leased, either from the private owner or from the community.

During the 1995/96 hunting season, a total of 109,918 hunting cards were issued in Austria. A total of 879,038 individual animals were harvested. Roe deer were the most common big game species harvested. Rabbits, pheasant, wild duck and fox were the most common small game species harvested (Table 23).

Table 23. Harvest of Game in 1995/96 in Austria

Species	Number Harvested
Red Deer	35,402
Roe Deer	230,895
Chamois	26,793
Wild Boar	11,451
Other Big Game	2,656
Fox	57,748
Rabbit	149,311
Pheasant	172,431
Marten	22,273
Wild duck	78,928
Other Small Game	91,150

Total	**879,038**

Leasing hunting grounds from the Austrian Federal Forests generated significant revenue. In 1995, 882 private leased hunting grounds (645,582 ha) produced an income of over $9 million. An additional $1.6 million was generated from leasing, contracting, or selling trophy hunts on 217 public hunting grounds (205,218 ha), managed by the Austrian Federal Forests. Shooting contracts are used to increase the harvest in cases of insupportable game numbers. An income of $1.2 million was generated from shooting contracts in 1995. Stalking contracts are used to quickly create a balance between game numbers and the habitat condition. These contracts generated $365,000 in income in 1995. Finally, trophy hunts (single shootings) for numerous game species generated $342,000 in income. Altogether, hunting income accounts for approximately 9% of the income of the Austrian Federal Forests.

Fishing rights in Austria are not linked to private ownership. In privately owned bodies of water, the owner retains rights for fishing. For public bodies of water, the right to fish is granted to anyone who provides the necessary proof. If no rights can be proved, the rights belong to the province or community.

The Austrian Federal Forests generated approximately $1.9 million in 1995 for fishing leases and other sales. The leasing of fishing rights in 1995 generated $1.6 million in income. Other income is generated from sales of fishing licenses and fish. Lease rates for running water averaged $824/km/year, while ponds were leased for an average of $1,648/ha/yr.

Canada keeps records of both harvest of game species and numbers of participants. Big-game hunting is an important activity in Canada. The most important species hunted are deer, moose, and wapiti (elk). Most of the big game species are associated with forest environments, with the exception of the polar bear. The number of hunters in Canada has been declining over the last 15 years. In 1981, 1.8 million hunters participated in Canada hunting, while in 1991 the number had declined to 1.5 million. Total person days of hunting over the same time period declined from 32.3 million to 24.3 million. Therefore, total harvest has probably declined since 1983 as well.

Canada also has excellent fishing opportunities in forest environments. Important species include trout, bass, walleye, perch, whitefish, smelt, and northern pike. Retention rates of catch vary from a low of 20% for bass to a high of 96% for smelt. The numbers harvested by species and the percent of catch retained were available for 1990. No information on the number of anglers was available.

The Czech Republic reported a total of 654,570 animals harvested from forestland in 1993. Hunting commercially for trophy game and pheasant is a significant source of income. An estimate of income generated in 1995 was approximately $23 million.

A great variety of fish are also caught in the waters of the Czech Republic. In 1993, the weight of the harvest was almost 2.3 million kg. Important species included carp (*Cyprinus carpio*), bream (*Abramis brama*), European perch (*Perca fluviatis*), and brown trout (*Salmo trutta fario*). About 280,000 permits were issued for fishing, which is about 3% of the country's population. Sport fishing occurs on about 36,000 ha of water area.

Finland hunters pursue a large variety of species, many of which occur primarily in forest environments. The most common species harvested in the 1994/95 season are listed in Table 24, as well as an estimate of the value of the harvest.

Table 24. Game harvest in Finland, 1994/95

Species	Number Harvested	Value of Harvest (thousand US dollars)
Moose	43,000	34,805
White-tailed Deer	9,000	1,305
All waterfowl species	919,000	8,167
Gallinaceous birds	456,000	4,950
Farmland game-birds	201,000	1,367
Arctic hare	363,000	3,631
European hare	69,000	1,102
Red fox	50,000	1,506
Raccoon	86,000	858
American mink	77,000	464
Other furbearers	63,000	3,467
Total	**2,336,000**	**58,777**

Sweden has over 300,000 registered hunters. Moose is the most important game species, with 90,000 animals killed annually (Table 25). Roe deer is the next most important game species. The value of hunting was estimated in 1991. Moose hunting represented half the total value of hunting. Total value is divided into recreation value and meat value (Table 26). The recreation value was two-thirds of total value for moose, and 70% of total value for roe deer.

Table 25. Trend in Game Harvest of Selected Species in Sweden

Species	1991	1994/95
Moose	121,900	88,500
Roe Deer	328,000	288,000
Red Deer and Fallow Deer	3,200	2,600
Hare and Rabbit	250,000	210,000
Red Fox	34,000	45,000
Bear	45	31
Black grouse, capercaillie, hazel grouse	94,000	89,000

Table 26. Value of Hunting in Sweden, 1991 (million US dollars)

	Moose	Roe Deer	Other Game	All Game
Recreation Value	92	62	55	210
Meat Value	62	25	11	98
Total	**154**	**87**	**66**	**308**

Switzerland had a total of 31,110 hunters participating in hunting in 1995. They harvested 128,669 mammals and 53,179 birds from the forest. Almost 1.6 million hours was spent in hunting hoofed game and wild boar, resulting in 79,930 animals harvested. The personal cost for permits and equipment varies widely, but an average cost per hunter was estimated at $900 per year. In total, almost $29,000,000 was spent by hunters in 1995. The service provided by hunters in regulating populations also relieves the state of the responsibility of harvesting animals. This service would require an additional 760 full-time jobs to substitute for the hunters.

United States harvest data for hunting is kept by the states. Big game species (deer, elk, bear, moose) generally have more secure populations now than at the turn of the century. Summaries of state data show that harvest trends have generally been increasing for most big game species, although some regional variations are evident.

The United States has trend data on hunting and fishing dating back to the 1950s. Every five years a national survey is conducted on hunting, fishing, and wildlife-associated recreation. The most recent data is from 1991. There were slightly over 14 million hunters in 1991; big game hunting is the most important activity, involving 10.7 million hunters participating in 214 million trips. Big game is also the group most closely associated with forest environments. Participation rates for hunting have been gradually declining for several decades. Recently the total number of hunters has also declined; population increases are no longer sufficient to substitute for the declining participation rates.

Sport fishing is an important recreational activity across the United States. It is difficult to separate fishing in forested areas. In total, almost 36 million anglers participated in fishing in 1991, taking over 668 million trips. Freshwater fishing accounts for 86% of the days of fishing; the remainder is saltwater fishing. The greatest number of days are spend fishing for black bass, panfish, trout, catfish and bullheads, and white and striped bass.

D.2. Leisure, Tourism

Forest environments are a major attraction for leisure activities. Most of the data available tends to be for activities on public lands.

The Austrian Forestry Act of 1975 allows anyone to enter forests for the purpose of recreation, unless areas are designated as not available for recreation. Some forest areas have been declared recreational forests. At the end of 1995 there were 2,494 ha of recreational forest area. The Forest Development Plan shows that 1.11% of the total forest area (43,046 ha) has recreation as the primary role.

Forests are an important attraction for tourists in Austria. A survey of Germans visiting Austria indicated that 70 to 80% of visitors cited walking and hiking as the most common leisure activities. Almost 70% of all Austrian tourists regard recreation as the main objective of traveling. In 1995, the per capita income from international tourism was $1505, which is more than four times the European average.

A number of efforts are underway in Austria to market recreation and associated services. Examples include leasing land to ski-lift enterprises, or for cross-country ski runs, horseback riding, and lake shore access. There

are currently 940 kilometers of bicycle routes on the Austria Bundesforste forests. Fees are charged for access to the bicycle routes and forest roads. Potential marketing opportunities exist for various other recreation activities, including water sports, cultural activities, and educational activities.

Canada's outstanding scenery, environmental quality, and mountainous areas, combined with the network of national parks and other protected areas are a main attraction to foreign visitors. Since 1973, foreign visitors to Canada have almost tripled. Trends in recreational use of forests are available nationally for camping, visits to national parks, and participation in nonconsumptive wildlife recreation.

The provincial parks track the number of party-nights of camping, although all provinces do not provide data every year. In 1992, approximately 2.7 million party-nights of camping occurred. The national parks accounted for 720,422 party-nights of camping in 1993. Trends in camping have fluctuated over the last 25-30 years. Activity peaked in 1979, declined slightly and then increased again in more recent years.

The national parks also track person visit-days. In 1993, a total of 28.2 million visit-days was reported. The trend in visitors to national parks has shown a slight increase from 1988-1993. Canada has a dedicated survey to track participation in wildlife related activities. One category of nonconsumptive wildlife-related recreation is primary nonresidential use, which includes visits taken for the primary purposes of nonconsumptive wildlife recreation (wildlife viewing, etc.) away from the residence. Participation in these activities has risen slightly, from 3.6 million participants in 1981 to 3.9 million in 1991. Total days of participation has increased more dramatically, from 56.7 million in 1981 to 84.3 million in 1991.

Urban forests are an important resource for providing opportunities to dense population centers. Canada has 1,710 parks with 1.5 million campsites covering 8.5 million ha. These forests are within a 200 km radius of major urban centers. In addition, within the 12 urban centers of Canada that contain 8.7 million people, there are 1,142 forest parks that cover 37,331 ha.

The Czech Republic reported that a total of 605,230 ha (24%) of forest area is important for recreation purposes. About 410,000 ha are recreation forests with simple facilities, while 140,000 ha are recreation forests with special facilities such as recreation centers and summer cottages. Forest parks and suburban forests cover 47,000 ha and spa forests account for 8,000 ha.

A recent study showed that only 10% of all Czechs had never visited the forest. About 27% visit 1-2 times per year, 32% go once a month, 22% visit once a week, and 9% visit even more often. The most frequent visitors are between 15 and 29 years old. Those over 60 years visited the least. The most frequently cited reason for visiting the forest was to rest (42% of respondents), followed by collecting forest products (28%), pursuing a hobby (12%), and recreation (8%).

The most visited areas are close to population centers and the 20 recreation centers. Distance to forest is an important factor in visitation. Forty percent of forest visitors live within one kilometer, while only five percent of visitors live over 50 kilometers from a forest. Of those surveyed, only 11.3% were willing to pay an entrance fee to the forest.

Finland has seven state-owned recreation areas covering 38,339 ha. The Finnish Forest and Park Service manages 1,489,000 ha of wilderness in 12 designated areas. There are also 27 Finnish National Parks that cover 6,704 square kilometers. Finally, there are 10 nature conservation areas that cover 653 square kilometers. Each of these areas provides important recreation opportunities. The state-owned areas had 352,000 visits in 1995. The National Parks attracted 495,000 visitors in 1994; the nature conservation areas attracted 677,657 visits. Total visitation was approximately 1.5 million visitors. Recreation activities that are important in Finland include fishing, walking and hiking, cycling, skiing, rowing and canoeing, motorized off-road traveling, dog team drawing, and horse riding.
Tourism related to natural environments is particularly important in Lapland. In 1994, total income from tourism in the Lapland area was $398 million. Tourism has increased more rapidly in Lapland than in the rest of Finland. Activities tied to the forest resource include cross-country and downhill skiing, snowmobile racing,

dog team and reindeer safaris, fishing, viewing of autumn colors, spa hotel tourism, and working travel tourism. Income from those activities was $334 million in 1994. The estimated effect on employment was 4000 work years.

A Swiss study in the 1980s was undertaken to analyse the area of forest frequented for leisure activities and to determine the average time spent in the forest for that purpose. Overall, 40% of the forest area was used for leisure, while 7% of the forest area supported an especially high intensity of leisure activities. The high intensity areas are mostly urban forests or forests in the immediate vicinity of big towns. Forests in rural areas are the least frequented.

Visitation is highest in spring, and lowest in winter and high summer. However, these figures do not include winter sports, such as skiing. In urban areas, the leisure participants were nearly all local, while in rural areas they are mostly tourists and weekend visitors. In total, it was estimated that 50 million hours are spent in forests every year, with an estimated total value of $222 million. Valuation studies of leisure activities have resulted in values ranging from $5 -$8.30 per visit. This per visit value can be translated to a value of $187/ha.

The United States has a large federal estate that provides varied opportunities for leisure activities. Within the federal estate are numerous special designations that are important for recreation use. The National Wilderness Preservation System provides unique, undisturbed environments for recreation, including over 53,000 kilometers of trails in wilderness areas on National Forests. In total, the National Forest System has over 214,000 kilometers of trails. Specially designated trail miles within that total include 8,542 kilometers of National Recreation Trails, 9,453 kilometers of National Scenic Trails, and 1,342 kilometers of National Historic Trails. Other important recreation designations on the National Forest System include National Scenic Areas (51,000 ha), National Wild and Scenic Rivers (378,000 ha), and National Recreation Areas (1.1 million ha). State parks and state forest lands are also important for outdoor recreation.

The United States conducts periodic national surveys on participation in outdoor recreation. The most recent survey was conducted in 1994-95. Some of the activities most likely to occur on forest lands are hiking, bird-watching, and camping (Table 27). Information on days of participation are available only on federal lands. Table 28 lists the number of recreation visitor days estimated by five federal agencies in recent years.

Table 27. Participation in Selected Recreation Activities in the United States, 1994/95

Recreation Activity	Millions of Participants
Hiking	47.8
Bird Watching	54.1
Off-Road Driving	27.9
Downhill Skiing	16.8
Camping	52.8
Backpacking	15.2

Table 28. Recreation Visits to Federal Sites in the United States, 1996

Agency	Million Visits
Forest Service	859
Bureau of Land Management	59
Bureau of Reclamation	38
Fish and Wildlife Service	30
National Park Service	266
Corps of Engineers	376
TOTAL	**1,628**

D.3. Aesthetic and Scenic Values

The Czech Republic has designated a number of forest areas to protect scenic and historic values (Table 29). These designations are not mutually exclusive, so the numbers cannot be summed.

Table 29. Special Designations for Scenic and Historic Values, Czech Republic

Designation	Number	Thousand Hectares
National parks	3	111.1
Protected landscape areas	24	1042.4
National nature reserves	124	26.8
National natural landmarks	100	4.8
Nature reserves	480	17.6
Natural landmarks	908	26.3
Other	1,612	75.5

In Finland, aesthetic and scenic values of forests received little attention until recently because of the abundance of forests. In the 1990s, scenic values of forests have been emphasized in several working groups of state, but little research on these values has been done. Aesthetic and scenic values attract tourists and enhance the environment for residents. Qualitative approaches to scenic values have been taken by landscape analysis and inventories, focusing on preferred views. Aesthetic values have been included in new forest management guidelines of private forest owners, forest companies, and the state.

Finland has 27 national landscapes that were chosen in the 1990s. Most of the landscapes are cultural and urban, but they also include natural forest landscapes. The first national parks and nature conservation areas were founded in order to preserve valuable scenery. A total of 156 areas covering 730,000 ha has been determined to be nationally valuable landscape. Thirty percent of the designated area is forest land. An additional 171 areas are important at the provincial level.

Switzerland has three national inventories that cover areas worth protecting for scenic and historic values. The total area among these inventories in forestland is 200,000 ha (17% of forest area). The three inventories are: 1) the federal inventory of landscapes, sites and natural monuments of national importance; 2) the federal inventory of landscape and natural sites worth protecting; and 3) the federal inventory of wetlands of particular beauty and of national importance.

The United States has several designations to protect aesthetic and scenic values. Most of the National Parks were created to preserve scenic areas, such as the Grand Canyon. The Wild and Scenic Rivers and Scenic Byway System mentioned above protects special landscapes.

D.4. Cultural and Spiritual Values

Canada, Finland, and the United States all have minority cultural groups that are strongly tied to forests. The Aboriginal Peoples of Canada have a collective cultural/spiritual and social tie to the forest environment. Traditional activities such as hunting and trapping provide subsistence products in many Aboriginal communities. Culturally significant sites such as burial grounds are often situated in forests. The forest also plays a role in native justice. For example, one can be sentenced to live in isolation in the woods for a certain period of time.

The Finns are deeply tied to the forest, which are often important to their livelihood. Numerous mental images and beliefs back to prehistoric times illustrate ties to the forest. Many festivals are based on old traditions. The majority of Finns believe there are spirits in trees and other natural objects. The only traditional cultural minority in Finland is the 5000 Lapps living in northernmost Finland. Their traditional economy is based on reindeer husbandry, fishing, and hunting, even though many have jobs outside the community.

Certain forest lands in the United States are held in trust for Native American people. In 1990, forestland as part of those holdings totaled almost 6.5 million ha. The United States has a trust responsibility to protect, conserve, use, manage, and enhance Native forestlands. However, these lands are analogous to private lands, since only members of the Native American tribes have access. Through various treaties, Native Americans also have rights to natural resources on the federal estate as well.

D.5. Scientific and Historic Values

Austria has 4,194 ha of educational forests that are used by various universities, forestry schools, and other institutions. There are also 86 "natural forest reserves," covering 3,224 ha. All human interventions are prohibited (except hunting), which allows these sites to serve as a natural laboratory for natural ecological processes. The natural forest reserve network is intended to have 430 reserves covering 10,000 ha when completed.

The nature protection law of Vienna allows for the protection of individual natural marvels, which can be protected as natural monuments. Monument eligibility can be based on scientific and cultural significance, singularity and rarity, significant scenic value, or a special ecological role. As of December 1996, there were 437 natural monuments consisting of individual trees or groups of trees. There were also 12 small woods, 3 remains of alluvial forests, and 13 tree avenues or rows of trees.

Switzerland quantified the educational value of forests. A questionnaire was sent to all cantons on the use of forests in education. Certain cantons keep statistics on the number of lessons spent in the forest; others gave rough estimates. Each class is estimated to spend between 2 and 5 lessons every year, which totaled to 163,700 hours in the forest by both private and public schools. In addition to official schooling and training, a number of courses for environmental education are given by various organizations. It was estimated that about 70,000 hours of lessons are given. The value of these courses can be based on costs of a lesson, which translates to roughly $3.5 million.

The United States has several special designations that are important for scientific and historic value. The National Wilderness Preservation System protects forest and other lands that are in pristine condition. These lands play an important role in ecological research. Other designations within the National Forest System include National Scenic-Research Areas (2700 ha), Research Natural Areas, National Monuments (1.3 million ha), and National Historic Areas (2600 ha).

OUTLOOK FOR INTERNATIONAL REPORTING ON NON-WOOD GOODS AND SERVICES OF FORESTS

Non-wood goods and services are the subject of increasing political interest. It is clear that forests are the source of numerous benefits that have not been fully described in the past. Understanding the full array of goods and services from forests is critical in developing policies and management guidelines for sustainable forest management, a goal that many countries have adopted. Numerous countries are committed to international agreements on climate change, biodiversity and sustainability. The justification for supporting better information on nwgs is evident. However, there are numerous decisions to be made on the best approach to developing information on nwgs. This section will address issues in quantifying nwgs, issues in valuing nwgs, and criteria for selecting nwgs of national and international importance.

E.1. Quantifying NWGS

Data on the quantity of non-wood goods and services from forests are limited in comparison to the variety of goods and services that can be described. Most countries have forest inventory systems that collect information on forest vegetation. Typically, the focus of these inventories has been on the productivity of the timber resource. However, the increased interest in biodiversity and other environmental concerns has resulted in revisions to these inventories to include ecological information. These efforts will tend to support reporting on some of the environmental functions of forest that can be meaningful at a national level. Examples include information on carbon storage and carbon accumulation and release from forest ecosystems, and species diversity of forest vegetation. Indirect measures of environmental services may be inferred from vegetation inventories as well.

Forest inventories are typically managed by the forest agencies that have long been involved in international reports on forests. Although changes and additions to these inventories may require additional resources, these changes can be accomplished within an existing infrastructure. For international reporting purposes, additional coordination should not be required.

Recurring, statistically designed inventories of other nwgs are fairly limited aside from a small group of outputs. As mentioned in the summary report, a number of countries maintain data on forest outputs such as berries, mushrooms, firewood, fuelwood, etc. In some cases, this data is maintained on an annual or other regular schedule. For those goods, the output is commonly measured in weight, which is easily converted to a standard measure. It is not clear from the small sample whether enough countries collect the data to allow aggregation across regions. Also, the sampling basis needs further investigation. However, there is a small set of goods that seem promising for national and international reporting. To the extent that the data are maintained by non-forest agencies, collection will require additional coordination effort within the countries.

Data on hunting and fishing activities seem widely available, for harvest levels and number of participants. Most hunters and anglers require licenses, which allows a count of participants. Some countries undertake periodic surveys of these activities to provide information for wildlife management. The difficult task is separating out the proportion of the output that occurs on forest land. For hunting, this separation is fairly easy if species-specific information is available. It seems more problematic to determine the role of forests in fishing activity, particularly in the case of large water bodies. In fact, fishing was not included in the original list of nwgs, but several countries reported on the topic. Surveys of leisure use were much more limited. Both Canada and the U.S. have national, recurring surveys dedicated to wildlife recreation activities. There are also some national surveys of total recreation use in the U.S. Other countries reported from one-time studies. It is not clear how accurate the counts of visitation are on public lands. Campground visits are usually easy to monitor. General visitation, unless access is controlled, is more difficult to estimate in the absence of a survey. As with hunting and fishing, it can be difficult to estimate the forest component of these activities unless the surveys are conducted on-site.

Where surveys do not currently exist, quantifying personal use of the forest would require significant effort in designing a credible sample and in implementing such a survey. If such surveys are not conducted at the

national level or at the local level using common reporting measures, it is unlikely that the information can be aggregated. Since data collection can be a costly undertaking, countries first have to decide which nwgs are important enough to justify such an expenditure.

Another promising area for national and international reporting is the description of protected areas and the status of endangered species. All of the countries in the sample were able to report some information in both these categories. The difficulty with both these categories is separating out the forest component from other areas. Even without querying countries, there are international reports that estimate protected areas and threatened and endangered species according to IUCN classifications. Clearly, some countries have already isolated the forest component in both these categories. Since definitions and designations can vary widely in these categories, requiring reporting by an international standard such as provided by IUCN is the most likely avenue to consistent information. The information should not impose a great reporting burden, since the basic information should be available. The difficult task will be in converting to a common definition. Separating the forest component in protected areas will depend on whether forest inventories can support this process. Separating forest species may require involving experts outside of the traditional network.

There may be opportunities for cooperation in data collection across agencies and other organizations which could be mutually beneficial. Numerous entities in addition to forestry organizations are interested in forest resources, and may already be collecting data relevant to nwgs. Such opportunities may exist between countries as well as within countries.

E.2. Economic Valuation of NWGS

Quantification of nwgs is straightforward compared to valuing nwgs. Attempts at valuation were limited in the team report. It was generally agreed that the focus of our efforts should be on physical quantification. In this section, valuation will be discussed for non-wood goods, non-wood services that involve human use (such as recreation), and non-wood environmental services.

Non-wood Goods

The valuation of non-wood goods is conceptually the same as valuing wood products. These goods can all be measured by some physical quantity that is removed from the forest environment. The product itself is the object of value. Ideally, a market price for the good or a close substitute exists that can be applied. Most commercial products move through several stages of production; at each stage the value is enhanced by additional processing. For example, berry pickers pay for access to the forest, sell their picked berries to a wholesaler, who then sells them to a grocery store for retail. Which value is the correct value for national reporting?

An argument can be made for using the value at any stage of production. However, for the purpose of reporting on forest resources, it seems most appropriate to focus on the value of the goods on the forest. If the value is being calculated from the perspective of the forest owner, then the amount paid for access to the resource would be the correct value. If the value of the product is the focus, then the wholesale price paid to the pickers would be the correct value. (Of course, if the picker and owner were the same, the wholesale price would be the value.) Since some landowners may not charge a fee for access, using the wholesale price would assure that a zero value is not reported. It would seem for purposes of an international report on forest resources that the wholesale price would be most relevant.

Values are less obvious for personal collection of forest products. In most countries, some level of personal collection is allowed on public and some private forestlands. The usual valuation approach is to apply the commercial value if one exists. In most cases, the commercial value (wholesale) would be an acceptable approximation. However, if gathering products is done for cultural or religious purposes, or is undertaken as a family outing or for recreational activity, then the commercial value is likely to be a poor indicator of the value of that product.

Non-Wood Uses

The forest environment provides the setting for a number of uses. With the exception of hunting and fishing, most of these uses do not remove anything from the forest environment. Additional facilities and infrastructure may be provided to support those uses (hiking trails, roads, campsites, etc.). These uses are generally measured by number of visits or number of participants. Some types of activities have reasonable market values, usually for use of developed recreation facilities, such as campgrounds. Private enterprises for activities such as rafting, canoeing, and guide services provide some information. To the extent that such values are available, they can be applied to visitation data.

However, most of these uses cannot be valued using market information. Fees on public lands are often not based on the value of the activity, but on goals such as cost recovery and revenue generation. Private fees are often in support of a recreation activity. For example, the cost of a canoe rental cannot be equated to the value of a canoe trip because it is only one component. As a result, the methods of non-market valuation were developed primarily for application to recreation activities. Although there is considerable debate in both the academic and policy arenas over some of the methodology, there is a considerable body of literature in support of recreation values. These values tend to be focused on a trip or visit, either to a specific site or for a particular activity. Information on the effects of different trip attributes on recreation values is also available.

Although the literature is considerable, much of the information is difficult to generalize even within the same country. The variations possible in recreation activities make it very difficult to develop average values that can be applied across geographic areas and activities.

Non-wood Services

The environmental services of forests can be conceptualized as inputs to a production function. Carbon storage, water filtration, noise absorption, and other services contribute to human welfare in numerous ways. These services are often referred to as "indirect values." Efforts to value these ecosystem services have been limited, although there is currently considerable interest in such activities. One approach that has been commonly used is to estimate the cost of replacement services.

If values are available for these services, there is a potential for double-counting if these values are added to the values for goods and uses. Since these services are inputs, the value of these inputs tends to be reflected in the output values. For example, forests tend to protect water quality. The values for water-based recreation activities are partly determined by water quality. Therefore, part of the value of recreation reflects the input value of water quality.

Non-Use Values

The values described above are all associated with some use of the forest environment. However, there is an extensive literature suggesting that many people value forests beyond direct use values. Common components of non-use values are existence value, bequest value, and option value. Considerable controversy has been generated over both the theoretical basis for these values and methods for estimating such values. No attempt was made to report on these values in this report, but they should not be ignored in a total accounting of forest benefits.

E.3. Which nwgs are most important?

Every country has to determine which nwgs are important enough to devote resources to data collection and interpretation. This section focuses on criteria to consider in determining if a) a nwgs is important nationally; and b) a nwgs is useful for international reporting. Numerous nwgs may be important to a region or small locale, but a smaller subset is likely to be important for national reporting.

A number of criteria can be used to determine the "importance" of a good or service. The following criteria

are candidates for evaluating non-wood goods and services:

1) Importance of the forest in supplying the good or service. What proportion of total production derives from the forest as a "wild" source? From the perspective of forest goods, forest production may be unimportant relative to commercial production off the forest. An example is the production of Christmas trees. If production from tree plantations are excluded, harvest from the forest tends to be relatively minor. When considering services, the question is whether the forest is a critical source of the service. For example, is a forest environment critical for some types of recreation?

2) Geographic scope. Is the nwgs broadly distributed across the country? If a good is collected across all forest regions, or a service is provided by all forests, it has national significance in geographic scope. Broad geographic scope also indicates a national survey would be a useful approach to data collection.

3) Economic importance. Does the good or service provide a significant amount of income and employment (significance could be determined in comparison to the income and employment generated by other forest products)?

4) International commitments. Does the good or service relate to reporting requirements that are part of international agreements?

For those goods and services which are determined to be important for national reporting, priorities could be set depending on whether there is any evidence of a supply problem (e.g. overuse that is harming the viability of the resource), conflicts with other forest goods and services, and international conflicts.

Determining which nwgs should be included in an international report will depend primarily on whether the good or service is reported by a significant proportion of the participating countries, whether the good or service is important internationally regardless of the number of countries reporting (e.g. one country controls most of the supply of the good or service), and whether common measures can be used across countries.

F. CONCLUSIONS

National level information on nwgs is fairly limited in most countries. However, there are areas that appear promising for developing national and international measures. There are significant challenges in creating common measurement units that can be agreed upon. Individual countries will face considerable coordination efforts to collect data across different levels of government and other organizations.

Any substantive effort to improve reporting about nwgs will require commitment by each country at the highest levels. Nwgs cover a wide range of disciplines, and potentially require involvement from parties outside of the traditional network for developing forest assessments. Collecting such diverse information cannot succeed without a commitment of resources. The main reason that only seven country reports were available for this summary is the lack of time available to team members to complete this assignment in additional to normal duties.

The information provided in the summary was used as input in finalizing the questionnaire for the Temperate and Boreal Forest Resources Assessment. Additional information is available from reports on the criteria and indicators for sustainable forest management that numerous countries have produced. The timing for addressing nwgs could not be better. The international interest in forestry issues and the benefits of forests provides a strong impetus for moving forward in this effort.

ANNEX 1

List of goods and services of the forest for the purpose of the study on non-wood goods and services

GOODS

A. Wood goods
Sawlogs
Pulpwood
Fuelwood
Other

B. Non-wood goods
Cork and bark
Food (e.g. berries, mushrooms, nuts, honey, meat)
Fodder
Wool and skins
Tannins
Christmas Trees
Other decorative materials
Essential and aromatic oils
Resins and gums
Medicinal materials
Other

SERVICES

A. Environmental Services
Protection (e.g. against avalanches, floods, and soil erosion)
Water quality and quantity
Global climate change (e.g. carbon dioxide absorption)
Biodiversity
Local environmental functions (e.g. screening, absorption of noise and pollution, microclimate)

B. Social and cultural services
Hunting and fishing
Other leisure pursuits (including contribution to tourism)
Aesthetic and scenic values
Cultural and spiritual values
Scientific and historic values

ANNEX 2

Outline for national contribution to study on non-wood goods and services

A. Background
(Policies, forest area and ownership, protected areas, etc.)

B. Non-wood goods
B.1 Food and fodder
B.2 Other (e.g. cork and bark, wool and skins, tannins, Christmas trees and other decorative materials, essential and cosmetic oils)

C. Environmental Services
C.1 Protection
C.2 Water quality and quantity
C.3 Global climate effects
C.4 Biodiversity
C.5 Local environmental functions

D. Social and Cultural Services
D.1 Hunting and fishing
D.2 Other leisure
D.3 Aesthetic and scenic values
D.4 Cultural and spiritual values
D.5 Scientific and historic values

E. Interactions, conflicts, and priority setting

F. Conclusions

For each subheading in sections B to D, there should be three points:
1. Description (quantity, value, economic impact)
2. Trends
3. Issues

ANNEX 3

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ANNEX 4

Exchange Rates Used in the Report

Austria: $1.00 US = 12.134 ATS (November 4, 1997)

Canada: $1.00 US = $1.3887 CN (April 3, 1997)

Czech Republic: $1.00 US = 28.78 Czkr (April 3, 1997)

Finland: $1.00 US = 5.008 FIM (April 3, 1997)

Sweden: $1.00 US = 7.65 Sk (Sweden) (May 11, 1997)

Switzerland: $1.00 US = 1.434 Sfr (April 3, 1997)

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The Timber Committee is a principal subsidiary body of the ECE (UN Economic Commission for Europe) based in Geneva. It constitutes a forum for cooperation and consultation between member countries on forestry, forest industry and forest product matters. All countries of Europe; the former USSR; United States of America, Canada and Israel are members of the ECE and participate in its work.

The ECE Timber Committee shall, within the context of sustainable development, provide member countries with the information and services needed for policy- and decision-making regarding their forest and forest industry sector ("the sector"), including the trade and use of forest products and, when appropriate, formulate recommendations addressed to member Governments and interested organizations. To this end, it shall:

1. With the active participation of member countries, undertake short-, medium- and long-term analyses of developments in, and having an impact on, the sector, including those offering possibilities for the facilitation of international trade and for enhancing the protection of the environment;

2. In support of these analyses, collect, store and disseminate statistics relating to the sector, and carry out activities to improve their quality and comparability;

3. Provide the framework for cooperation e.g. by organizing seminars, workshops and *ad hoc* meetings and setting up time-limited *ad hoc* groups, for the exchange of economic, environmental and technical information between governments and other institutions of member countries that is needed for the development and implementation of policies leading to the sustainable development of the sector and to the protection of the environment in their respective countries;

4. Carry out tasks identified by the UN/ECE or the Timber Committee as being of priority, including the facilitation of subregional cooperation and activities in support of the economies in transition of central and eastern Europe and of the countries of the region that are developing from an economic point of view;

5. It should also keep under review its structure and priorities and cooperate with other international and intergovernmental organizations active in the sector, and in particular with the FAO (Food and Agriculture Organization of the United Nations) and its European Forestry Commission and with the ILO (International Labour Organisation), in order to ensure complementarity and to avoid duplication, thereby optimizing the use of resources.

More information about the Committee's work may be obtained by writing to:

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2. Forest Products Statistics (database (chronological series, since 1964) also available on diskettes)
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