

# Forests in Trouble

## Executive Summary

### THE STATUS OF THE WORLD'S TEMPERATE FORESTS

Nigel Dudley  
September 1992

#### Status

**Area of temperate forest.** Temperate forests cover over 2 billion hectares of the Earth's surface, more than half the global forest cover. Most is closed forest, although there are also large areas of open woodland. The majority of the world's temperate forest is held by three nations, Russia, Canada and the United States, with Russia alone containing 41 per cent, and 32 per cent in North America. Of the remainder, 10 per cent is in northern Asia, 8 per cent in Europe excluding Russia, 5 per cent in Australasia, 2 per cent in Latin America and less than 1 per cent in northern Africa and the southern tip of South Africa.

**Distribution of forests.** Forest cover varies enormously within regions. In Europe, for example, forest cover per country ranges from less than 1 per cent in Iceland and 5 per cent in Ireland to almost 60 per cent in Finland. However, size of forest is not necessarily an accurate guide to importance from an environmental perspective. For example, New Zealand has less than 1 per cent of global forest, but contains a disproportionately large richness of biodiversity.

**Rates of change.** Global temperate forest area is currently stable or even increasing. However, this average masks regional losses in the developing countries, particularly in Asia. Forest cover in Europe and parts of North America is generally increasing after overfelling in the past.

**Old growth forest.** However, total area does not show up the rapid and continuing loss of forest quality in many areas, as primary or old growth forests are replaced with intensively managed forests or plantations. Measuring areas of native or old growth forest is difficult because this is often not distinguished from managed forests in surveys. However, amounts remaining in temperate countries range from less than 1 per cent in Western Europe to 25 per cent in New Zealand.

**Protected areas.** Temperate forests are generally poorly represented by reserve areas. In addition, reserves tend to be concentrated in those forests which are least commercial valuable, such as mountain forests, and lowland productive forest ecosystems are not well catered for at present.

**Assessment: although total area of temperate forest is stable, this masks important regional losses and a general and worldwide loss of quality of forests.**

#### Forest Quality

The question of forest quality is critical to an assessment of temperate forest status. Draft criteria for a new definition of forest quality have been drawn up, divided into four sections:

- **authenticity** regarding composition, variation in size, age and presence of dead timber, continuity of forest cover, integration into the landscape, accommodation of natural catastrophes such as fire and windthrow, and management practices that mimic natural processes;
- **forest health** including tree health and the health of forest flora and fauna;
- **environmental benefits** such as biodiversity conservation, soil and watershed protection, and local and global climatic impacts;
- **value to humans** from timber and non-wood forest products, resources such as fuel, building materials, medicines and food, recreations and aesthetic quality.

## Importance of Temperate Forests

Temperate forests are important from the perspective of biodiversity conservation, environmental protection, social values, as homes for indigenous people, and for the industrial resources that they provide. They include a wide range of forest types, of which the two most important are **temperate** and **boreal** forests, the latter being found mainly in sub-polar regions.

**Biodiversity.** Conservation of species, genetic variation and ecosystems has been identified as critically important from the perspectives of current ecological stability, future evolutionary potential and current and future human resources. Temperate forests have generally been paid less attention than have tropical forests, but they have important values of their own. Areas of extreme richness exist in temperate forests, particularly rainforests, and biodiversity in some plant and animal groups can approach that in tropical systems. Genetic diversity within temperate forest species is also increasingly recognised as important. Some temperate forests are amongst the world's most endangered ecosystems, including fragments of original forest found in developed countries of Europe. Temperate forests also shelter many endangered plant and animal species.

**Indigenous people.** Most of the large temperate forest regions are also homes to indigenous people, many of whom have suffered badly through the impact of forest mismanagement imposed by outside forces. Important groups connected with forests include the Inuit (Eskimos) of the boreal regions, North American Indians, the Sami people of Lapland, the Maoris of New Zealand, some aboriginal people in Australasia and tribal groups in northern India.

**Financially measurable benefits, including environmental protection, social values and saleable products.** Forest cover reduces soil erosion and risk of landslips in extreme weather events, thus protecting hydrological systems, encouraging aquatic life and fish spawning. Forests moderate local climate and are increasingly seen as an important sink of carbon in mitigating against global warming. Temperate forests provide a wide range of foods, medicinal herbs and building materials. Fuelwood is an important source of energy in many places. Temperate forests are important recreational areas, especially but not exclusively in the rich countries; a survey by the United Nations Economic Commission for Europe found that most European countries valued over half their forests as of high to medium recreational value. Global value of exports in timber products reached US\$85 billion in 1988. Timber is sold for fuel, as construction timber, pulped for paper and board products, chipped to make artificial materials and as a raw material for the chemical industry.

**Assessment: temperate forests are currently judged mainly on their timber production, and the concept of "sustained yield" is assumed to be an adequate measure of sustainability. However, it is clear that financial considerations alone do not measure anything like all the important forest values.**

## Commercial Forestry

Commercial forestry is currently undergoing radical changes with regard to technology and control. It has major ecological impacts through: logging native or old growth forests; intensification of management of other forests, including establishment of plantations; and through the side effects of the paper and pulp industry.

**Changes in structure of the timber trade.** The timber trade is in general becoming increasingly centralised, controlled by a relatively few large companies. There is also a marked process of vertical integration, with companies involved in all stages of production from forestry to marketing of manufactured products. Increasing mechanisation is reducing the workforce in the forest industries. Technology is also changing, such that the majority of timber products are used as pulp or chips; ie as a cellulose basis for artificial materials rather than as timber. This means that a far wider range of tree ages and species can be utilised, so that previously uneconomic natural forests can be utilised and rotation time of plantations drastically shortened.

**Changes in sources of supply.** Countries with large plantation programmes, such as New Zealand, Portugal, Spain and Chile, are becoming increasingly important on the world stage. Other countries are increasing the rate of cut to keep up with cheap exports of plantation timber or to develop domestic industries, an example being the rapid increase in felling in Canada's British Columbia. As tropical hardwoods are exhausted, companies are increasing their holdings in temperate countries.

**Impacts of logging.** Native or old growth forests continue to be logged in many areas, even when they have been reduced to a few fragments. Areas particularly at risk are: northwest North America including the Pacific Northwest, British Columbia, Alberta and Alaska; northern Russia including Siberia; Chile; native forests in Australia including eucalyptus forests of Tasmania; old growth forests in Eastern Europe and the Baltic states; and forests in China, lowland Nepal and parts of northern India and Bhutan. Logging dramatically reduces biodiversity, particularly through destruction of local species and varieties of lower plants and animals. Many logging systems also increase forest fragmentation, trapping species in islands of old growth and subjecting large areas to climatic influence. Valuable habitat, including dead standing trees and down logs, are lost. Clearfelling also increases risks of soil erosion, watershed destruction and ecological impacts, and driving roads into forests is identified as a particularly damaging side effect of forestry operations. Old growth logging looks set to decline, if only because of resource depletion. There are also increasing controls in some areas, and cheaper alternatives are becoming available. Although many countries have some controls on logging, these are generally inadequate to provide sufficient environmental protection. Saving remaining areas of old growth forest is identified as a conservation priority with respect to temperate forests.

**New Forestry Principles.** One proposal for reducing damaging side-effects of forestry is embodied in the New Forest Principles, currently being developed in North America and Scandinavia. These are similar to many traditional forestry systems in Europe and elsewhere. Both seek to balance forestry objectives and ecological needs by using practices that are based on natural disturbance patterns. This includes: leaving some trees standing after felling to maintain a varied-age stand; retaining dead wood and debris; keeping a mixture of species; and preserving an interconnecting network of old growth, along fire refugia such as rivers, ridges etc. New Forestry Principles remain controversial. Some foresters believe that multiple use forestry is not workable and risks both losing profitability and damaging greater areas of natural forest, and they argue for discrete areas of managed and conserved forest. To some extent the applicability of these two different approaches depends on geographical location, and the amount of natural and managed forest remaining. Indeed, questions about the long term viability of much intensive forestry may mean that the two approaches are less distinct than they appear at first sight.

**Management and forest plantations.** Although it is recognised that an increasing emphasis on managed forest is necessary to protect remaining native forests, most current forestry practises are environmentally damaging. Plantations and intensively managed forests are creating a change in the nature of forest type, narrowing variety in both species and in genetic variation within species. An increasing area is covered with conifer and eucalyptus monoculture. Forest management also: destroys wildlife habitats including by poorly managed afforestation; increases soil erosion and hydrological damage, including trapping acid pollutants from the atmosphere; changes the balance of fire in the system; increases pest and disease attack; and results in large quantities of agrochemicals being used in what were previously natural systems. Much modern forestry is also very unsightly, and can create a range of social problems if badly managed, and if local people are not involved in the planning and execution of management schemes.

**Paper and pulp production.** The world market for pulp has increased by five times over the last forty years and it is now the major use of timber from intensively managed forests and plantations. Pulp is important both because of the total area of forest required and due to the highly polluting milling and bleaching processes, which release both air pollutants and highly toxic dioxin into water, causing damage to health and forcing the abandonment of fisheries in some areas.

**Assessment: Logging of native and old growth forests is currently the single most damaging factor affecting temperate forests. Forest management could play a positive role, both in enhancing secondary forests and in providing alternatives to old growth logging. Current management practise is doing the reverse and creating more problems and cautious improvements are urgently needed.**

### **Temperate forests and pollution**

**Characteristics of forest decline.** Large areas of forest in Europe and North America are showing symptoms of a novel form of decline. Trees most affected are characteristically older, and those isolated or exposed at the edges of stands. Decline is often associated with climatic factors and has several distinctive features, depending on species, including: discolouration and cracking of leaves; premature leaf and needle fall; erratic branching of twigs; and loss of crown density. Most commonly damage includes general decline in vitality and loss of health, in some cases it can lead to death.

**Extent of decline.** According to measurements by national assessors working to guidelines laid down by the UN Economic Commission for Europe, in 1989 some 27 per cent of broadleaved trees and 14 per cent of conifers were showing signs of decline, with a further 25 per cent of conifers "at risk". Decline in Europe and the former USSR affected an estimated 6 billion cubic metres of timber, although these figures are extremely approximate. Effects in other areas, including North America and China, are also recognised but unquantified.

**Causes of decline.** It is now generally agreed that decline is caused by multiple stress, including the effects of a range of air pollutants, such as sulphur dioxide, nitrogen oxides and ozone, and other factors such as drought, cold, pests and diseases, nutrient deficiencies, bad forest management and the impact of agrochemicals. The role of pollution is believed to be significant, although varying between countries. The main sources of pollution are electricity generating systems, industry and road vehicle traffic.

**Impacts of decline.** Damage is affecting forest ecosystems, risking long term changes in composition and a lowering of average age of trees. In addition pollution affects many other forest dwellers, including: epiphytic lichens and mosses; some flowering plants; sensitive invertebrates; and also larger animals either because they are sensitive or through disappearance of their food.

**The use of critical loads.** Attempts to determine necessary reduction in pollution levels centre on the critical load concept, ie the highest load of pollution that an ecosystem can absorb without suffering damage. Critical loads are currently being calculated for soils and freshwaters in Europe. From these, the UN Economic Commission for Europe is defining **target loads** which are what it considers politically acceptable reductions in pollution based on critical loads.

**Responses to pollution.** Countries can respond to pollution-related forest decline by either changing management policy in forests and/or by reducing pollution. The latter, whilst more effective, must be coordinated internationally. Possible strategies for managed forests would be to change species and length of rotation time, and to lime soil. These options are not effective for maintaining natural forest ecosystems. Pollution reduction can be either through technological changes - removing sulphur from coal and oil and reducing pollution from power stations, industry and vehicles - or through reducing the need for use of polluting technologies by energy conservation, fuel substitution and, ultimately, lifestyle change. This last option is the most environmentally acceptable.

**Assessment: the links between pollution and forest decline are clear enough to justify urgent steps to reduce pollution levels. Use of critical loads as guidelines are recommended, and target loads should equate closely with actual critical loads. The problems of pollution in the North cannot be solved solely by technical modifications, but will also involve reduction in consumption and some elements of lifestyle change.**

### **Forests and Global Warming**

**Impact on forests.** The potential impact of global climate change, including the greenhouse effect, ozone depletion and climatic fluctuations, is still very speculative. Even quite a minor alteration in climate could significantly shift the major forest belts, which would cause considerable disruption to existing forest ecosystems. Current climatic models suggest that one effect might be a migration of temperate forests north into areas currently occupied by boreal forests. The tree line of Canada, for example, could shift a hundred kilometres north for every 1°C average rise in temperate. This would put isolated, relic tree populations particularly at risk.

**Role in carbon sequestration.** There is also increasing interest in the potential for planting trees as a way of collecting and storing carbon, and thus counteracting some of the impacts of carbon dioxide emissions from industry and fuel burning. Whilst these may have a part to play in climate stabilisation, it will be far less significant than reduction in pollution emissions or conservation of old growth forests, which store more carbon overall than fast-growing plantations.

**Assessment: Carbon sequestration should not be used either as an excuse for establishing ecologically unsound plantations, nor for avoiding the necessary reduction in outputs of greenhouse gases, which come mainly from the North.**

## Fuel Use and Forest Loss

**Scale of fuelwood use.** Another significant cause of forest degradation is the use of woodfuel and charcoal, which is currently the primary source of fuel for over 2 billion people, mainly but not exclusively in the South.

**The impact of fuelwood collection on forest loss.** Estimations of the importance of fuelwood in forest loss differ from seeing it as a major cause of deforestation in parts of Asia and Latin America to viewing it as a secondary cause following agricultural clearance. Searching for fuelwood is certainly a time consuming and frustrating job for many people, principally women, in developing countries such as Nepal and India. When fuelwood is in short supply, dung is dried and used as fuel, thus reducing soil fertility. However, some early analyses of the fuelwood "crisis" have proved overly pessimistic.

**Reducing fuelwood use.** There have been three main responses to the perceived woodfuel crisis: establishing tree plantations; introducing woodstoves; and substituting fuel. None of these have worked particularly well to date; they have generally benefitted the better off people in communities and left the poorest and landless even worse off than before. Use of woodstoves by no means always reduces overall fuelwood consumption. Alternative methods of using plant material as fuel are being investigated, including pyrolysis, gasification and use of methane digesters; these all potentially pose social and environmental problems of their own.

**Assessment. The continuing use of woodfuel as an energy source points out the need for cheap and sustainable alternatives, and various biomass energy technologies probably have a role to play here. However, such developments must also take place with full care that the environmental consequences have been carefully assessed and any problems minimised.**

## Fire in the forest

**The ecological role of fire.** Fire is a natural element to which many forest ecosystems have adapted, increasing variety, opening up the canopy for regeneration, controlling tree pests and diseases, releasing nutrients to encourage plant growth, and sometimes playing an essential role in germinating seeds. However, forest fires in the wrong place and at the wrong time are ecologically damaging and also carry a heavy financial and social cost. Human intervention has generally upset the fire balance of forests, either through increasing rates to detrimental levels or over-suppressing fires.

**The costs of fires.** Fires are particularly ecologically damaging in areas where natural forests are already fragmented, such as the Mediterranean. Forest fires are also expensive in financial terms; for example in 1987 values of timber lost in fires included: Turkey US\$8.5 million; Poland almost US\$400,000; and Canada US\$51 million.

**Causes of forest fires.** Some fires are caused by natural events, especially lightning and fireballs, often associated with drought. Human causes include: accidents through negligence or mistakes during use of fire in land management or charcoal burning; vandalism; arson, often as a way of reclassifying land, obtaining cheap timber or for insurance claims; and political terrorism. Fire risks are increased by settlement patterns and by some modern forest management strategies including use of monoculture, poor management of brush, and planting species more likely to catch fire in high risk areas. Sometimes fire prevention itself increases major fires by stopping the more common minor fires, resulting in build-up of flammable material.

**Managing forest fires.** Prevention includes changes in management strategy, including legal changes that make some of the criminal reasons for starting fire less attractive, such as preventing reclassification of land (eg for building) on burnt over forest. Education campaigns are needed to teach fire avoidance. Structural changes in forest management are needed, particularly in high risk areas. In some places, fires should probably be allowed to burn to fulfil their ecological function if no risk to human life is involved, as is now being practised in parts of North America.

**Assessment: Forest fire management strategy has generally been inadequate. Forest fires cannot be treated as discrete events, but must be planned into every stage of planning and regulation pertaining to land policy.**

## Legislation

There is currently no international legislation, or even regional legislation, dealing specifically with temperate forests. Attempts to introduce a global forest convention at the United Nations Conference on Environment and Development were rejected. Although it is theoretically possible to use some existing treaties to address individual forest issues, such as some of the global pollution treaties and the Convention in International Trade in Endangered Species (CITES), these are insufficient to tackle the major problems facing temperate forests of the world.

In addition, it is important from a policy perspective to recognise the various links or networks between different forests, and between forests and other habitats. Three main networks are important:

- **genetic evolutionary network** linking forests with a similar evolutionary history, such as the various remnants of the ancient continent of Gondwana, remaining in Australia, New Zealand, Latin America and elsewhere, and the boreal forest network;
- **environmental interaction network** including migration pathways, irregular migration of species, capacity to absorb the impacts of climate change and the forests' role in maintaining hydrological systems;
- **human historical network** looking at past management practices and including particularly the distinction between the Pacific Rim countries, where substantial areas of native forest remain, and the Atlantic countries, where virtually all forests are secondary.

**Assessment: issues of forest quality and of working positively with the existing forest networks are both important in establishing an effective response to current problems in temperate forests. There is an urgent need for some overarching vision of forest policy and a regulatory framework. Short term options include a restructuring of the International Tropical Timber Organisation and the Tropical Forest Action Plan to encompass *all* forests. However, past experiences with the TFAP and ITTO suggest that their net value was probably environmentally negative and any new developments need to be assessed with considerable care.**