

BirdLife European Forest Task Force



How Much, How To ?

– PRACTICAL TOOLS FOR FOREST CONSERVATION

ILKKA HANSKI & MARCUS WALSH

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Preface

BirdLife International

BirdLife International is a worldwide partnership of conservation organisations that seeks to conserve all wild bird species and their habitats. The BirdLife Network is represented in over 100 countries around the world. In Europe, BirdLife International currently has 27 Partners, 7 Partners Designate, and 7 Affiliates.

BirdLife International seeks to conserve all bird species on earth, and their habitats, and through this to work for the world's biological diversity and the sustainability of human use of natural resources. The BirdLife Partnership is co-ordinated by staff in the Global Secretariat at Cambridge (UK), and by regional offices at Brussels (EU Office, Belgium), Wageningen (Netherlands), Quito (Ecuador), Nairobi (Kenya), Amman (Jordan), and Tokyo (Japan).

BirdLife European Forest Task Force

Europe's forests need better protection. Although among the richest ecosystems for wildlife, most European countries sufficiently protect at most a few per cent of their forests. Many of these protected areas are located on poor soils or in remote highlands, where species diversity is lowest. Commercial forestry practices remain mostly too harsh to allow specialist bird species and other forest biodiversity to survive.

A great number of organisations and institutions make efforts for forest conservation, including many national BirdLife Partners involved in forest protection and sustainable commercial forest management initiatives. BirdLife's European Forest Task Force co-ordinates these efforts, provides information and training, and raises funds for programmes to help protect Europe's biologically most valuable forests. Our warmest thanks to all who have contributed to this book, particularly to Professors Per Angelstam and Ilkka Hanski, whose inspiring and profound lectures at BirdLife Forest Task Force seminars form the basis of this publication.

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Summary

An Ecological Assessment of the Need for Forest Protection in Northern and Central Europe

by Ilkka Hanski

The most significant threats to the long-term survival of forest species in Europe are the low levels of decaying wood in managed forests, and the loss and degradation of the forest types that are naturally most diverse. The level of threat is high. For example, in Finland more than 100 species of animals, plants, and fungi have already gone extinct and the current extinction debt is of the order of 1 000 species. "Extinction debt" refers to the numbers of species that will disappear sooner or later under the current environmental conditions; their populations can only be saved by increasing the area of protected forests.

The amount of decaying wood in managed forests is so low, and the patches of woodland key habitats that are currently preserved are so isolated and small, that the threshold condition for the long-term persistence of most threatened species is not met. Eliminating the extinction debt and thereby avoiding further extinctions of species requires that the quality of forest landscapes is improved above the threshold condition for the endangered species. For species dependent on decaying wood this implies that the amount of decaying wood at the forest stand level should be of the order of 50 m³/ha (or somewhat less, 20–30 m³/ha, if this were the average over larger areas). The current figure in Finland is around 3 m³/ha, with comparable levels in most other European countries. The target levels cannot be reached in all commercial forests, hence it is sensible to concentrate efforts in increasing the amount of decaying wood in smaller areas, including protected areas, where the threshold for threatened species can be reached. However, the current network of protected areas is not sufficient. In South Finland, only around one per cent of forests are protected, and the current European average is less than two per cent. Less than one per cent of the forests in Europe outside Russia are currently in a natural or semi-natural state.

Results of ecological studies suggest that increasing numbers of specialised forest species become endangered when the area of natural and semi-natural forests falls below 10–20 per cent of the forested land. Applying the precautionary principle, the target of forest protection should thus be set at 20 per cent, but a target of 10 per cent is acceptable if protected forests and those to be restored are chosen carefully so that they form a functional network of various forest types.

Protection of biodiversity in commercial forests decreases the probability of currently more abundant species gradually becoming threatened. Therefore, softer methods of forestry in commercial forests, including even modest increases in the amount of decaying wood, help attain the overall aims of conservation.

From How Much to How To – An Implementation Strategy for Forest Conservation

by Marcus Walsh

Most countries have sufficiently protected less than one per cent of their forests, and the average for Europe as a whole, excluding the European part of Russia, is only 1.6 per cent. Much of this is located in poorly-productive or high-altitude areas of limited value for biodiversity. Conversely, many protected areas have only recently been taken out of commercial forestry and are decades away from becoming valuable for specialised species. Logging, legal and illegal, takes place even inside national parks.

A six-part strategy is proposed for bringing Europe's forest conservation to ecologically sustainable levels:

1. To analyse where high conservation value forests are located.
2. To analyse the historical vs. current distribution and species composition of forests and compare this with ecological estimates of species' minimum needs (GAP analysis).
3. By combining the above data, to analyse the ecologically optimum locations for new forest protected areas in the country / region. Compare with the region's existing protected area network and forestry practices.
4. To draw up a plan to maximise the social and economic benefits of protection.
5. To review the national legal and forest policy frameworks', as well as available financial instruments', ability to further the conservation programme; to consult with the relevant stakeholders.
6. To establish a long term field monitoring programme for evaluating both the ecological and socio-economic progress of the strategy.

Examples are given concerning how to carry out parts 1–3 of the strategy, which are largely a question of applied science. Items 4–6 address the socio-economic and political realisation. Forming larger forest units for protection is not only ecologically advantageous, but makes sense also economically: large protected areas such as national parks can create considerably more jobs and wealth for the local rural economy than the equivalent amount of timber. However, environment and forestry officials charged with preparing site protection do not usually have the necessary expertise to plan such things as tourist product development, nor the expertise (and resources) needed to encourage local people to invest time in developing new skills. Labour and service industry experts need to be involved in conservation planning.

A nation's legal and policy instruments have a decisive effect on the practical implementation of forest conservation. Compared to many other sectors, the European Union plays a relatively modest role in European forest issues. Although the EU Habitats Directive requires the Union's Member States to assure the "favourable conservation status" of a wide range of forest species and habitats, it is clear from the presented analysis that most EU nations are nowhere near this target. EU forest policy and guideline documents emphasise sustainable management and "exploitation compatible with nature conservation", but fail to recognise the natural limits of how much this can achieve in the major forest belts. An ecological assessment of the adequacy of the Natura 2000 network of forest reserves and their management guidelines is urgently needed.

It tends to be assumed that the cost of biodiversity protection must be borne entirely by the state, but most forest biodiversity loss is through commercial exploitation. In the pulp and paper sector, water and air pollution problems have widely been addressed on the "user pays"-principle, i.e. that those exploiting and depleting the resource must bear the cost of redress. A similar "biodiversity levy" on logged and imported timber would be a simple, effective and fair financing tool for forest conservation.

It is important to measure the success of current and future forest conservation efforts at all scales. Suitable indicator species tend to be specialists on a particular forest type or need specific conditions. It is not possible to find a forest indicator that would cover all Europe's forests, and care should be taken in choosing species that are truly indicative of natural forest conditions. Routine forestry inventories should in future also include measurements of biological as well as commercial parameters, such as the amount and types of stands' decaying wood and the presence of big trees of previous generations. It is important to also monitor for the success of social and economic programmes centred on forest conservation.

1

Introduction

Most people agree that preserving natural forests and their species, whether in Europe or the tropics, is a desirable goal. The huge variety of species they contain may be our future food, sources of medicines or other products, and we have already used such resources to the enormous benefit of mankind. The genetic variety of species is an as yet largely untapped reserve of information and possibilities. But fine forests are worthy of protection in themselves: those lucky enough to visit truly virgin or other old forests retaining natural features are often profoundly affected, returning with a strong commitment to conservation.

Our generation is driven to conservation because we are collectively uncomfortable with the idea of being remembered for turning the habitats of orang-utans, bears, and tigers, as well as that of countless plants, birds and insects, into cellulose or saw-wood – the force second only to poverty driving a large percentage of the world's forest species to extinction. Extinction from forest loss is not a threat to be put off for worrying about some time in the future: for example, the orang-utan is expected to be extinct in the wild by 2010, and we are now losing 1–2 birds species every year. For every mammal or bird, we lose tens of plants and invertebrates, whose extinctions are now a *daily* occurrence.

The majority of extinctions are taking place in the tropics, because species richness in tropical forests is highest. But forest biodiversity is falling rapidly also in Europe, relative to species richness in places at a rate comparable with that of tropical regions. Although deforestation in Europe has been reversed, the replanted stocks, sometimes of non-native trees, are frequently little more than plantations. They are hardly even related to the majestic mixed forests that once dominated Europe and of little help in preserving natural variety.

European and all Northern Hemisphere nations need a clear agenda for preserving natural forests, whether at home or on other continents; it is hard to imagine how we will convince others to carry out measures we cannot attain ourselves. We are also committed to preserving natural variety: most of the world's nations, including those of the European Union, have signed treaties to halt the decline of biodiversity. As recently as 2004, at a follow-up meeting in Malaysia to the United Nations Convention on Biological Diversity (UNCED – CBD), the EU reaffirmed an earlier proclamation to halt biodiversity loss on our continent by 2010.

Will this happen for forests under current conservation initiatives such as the Natura 2000 programme or the Ministerial Conferences on Protection of Forests in Europe (MCPFE)? Scientists, organisations such as BirdLife International, the EU's own European Environment Agency (EEA), as well as many others who monitor and analyse the effects of these programmes in field conditions, are pessimistic. The European Forestry Strategy draft from the EU Commission of September 2004 professes:

"... several EEA assessments of the environmental situation in Europe...have pointed out a gradual loss of forest biodiversity. According to other reports, the changes that forests underwent over the last few centuries have brought a great number of species to the verge of extinction in several European countries, with 20–50% of mammals and 15–40% of birds among the forest-dwelling species being categorised as threatened....Meeting the Gothenburg objective of halting the gradual loss of biodiversity by 2010 can be expected to remain a demanding task for some time in the forest sector."

This is civil servant-speak for "won't happen".

We need to do better – but how much better? How much protected forest is enough for conservation? How does one recognise and find high conservation value forests, and are there economical ways to protect them? The EU forestry strategy draft contains little about such matters, but without such information we are groping in the dark, and our conservation initiatives will not focus on the essentials. This book is designed to give or at least point to some practical answers. Future editions will explore some of the How To-themes in more detail.

Helsinki, 17th October 2004

Marcus Walsh

BirdLife European Forest Task Force

2 An Ecological Assessment of the Need for Forest Conservation in Northern and Central Europe

by Ilkka Hanski



Man has affected the structure of Europe's forests for thousands of years. However, especially in the less populated areas in northern Europe, particularly dramatic changes in forests have occurred only after the Second World War following the rise of the modern timber processing industries and forest management (forestry) methods aiming at maximising forest growth and favouring a few tree species over others. Modern forestry affects wildlife to a varying degree: some species are generalists whose populations remain large also in industrially managed forests. The other extreme is represented by ecologically specialised species adapted to living in natural forests, that is, forests that have experienced little or no human intervention. Populations of such species have greatly declined following the reduction in the area of habitat suitable for them.

This paper examines the ecological basis for evaluating the effects of modern forestry on long-term changes in forest wildlife, as well as the relative merits of protected forest areas and wildlife enhancement measures in commercial forests. In looking at the causes why species become endangered, it will also become clear what changes are necessary in current forestry practices to reduce species endangerment and to arrest the ongoing wave of species extinctions.

The root cause of declining forest biodiversity in Europe is the dramatic change in the structure of forest ecosystems caused by modern forestry. In natural forests, forest fires, temporal and spatial variation in environmental conditions, competition between individual trees as well as individual differences in their development all contribute to a forest structure that is diverse both in terms of tree species composition and age structure, with a characteristically large amount of decaying wood. In contrast, modern forestry tends to produce forests relatively uniform in age and size, with only one or a few tree species, and with a very

Overview of Finnish forests and forest biodiversity

As this paper makes extensive use of data gathered in Finland, and uses the state of biodiversity in Finnish forests as an example, a brief overview of Finland's forests is given. Forests with little or no signs of human influence make up less than one per cent of all forests south of Lapland, Finland's northernmost province located towards the climatic limit of forests. In the southernmost forest zones (the hemiboreal and southern boreal zones) this figure is only 0.2 per cent. The amount of protected forests south of Lapland is also around 1 per cent, but less than half of this is in a natural state ("forest" is here defined as vegetation producing more than 1 m³ of timber per hectare per year). Figure 1 illustrates the paucity of natural forests in southern Finland: old forests aged more than 150 years are coloured in red, while the green shades describe the volume of wood in the forest; the darker the green, the more wood per hectare is present.

Most endangered forest species in Finland are able to survive only in the southern part of the country, hence protecting forests at high latitudes will not help them (see also under "Endangered species of southern Finland"). In central Europe, a comparable situation occurs on mountains: protecting only montane forests will not save the majority of species that can only occur in lowlands. The significance of protected forests in northern Europe and on mountains can, however, be expected to increase with climate change and as ever greater numbers of species become endangered at lower latitudes and elevations.

National Forest Inventory 1990–1994,
Finnish Forest Research Institute
Old-growth forests and volume of growing stock

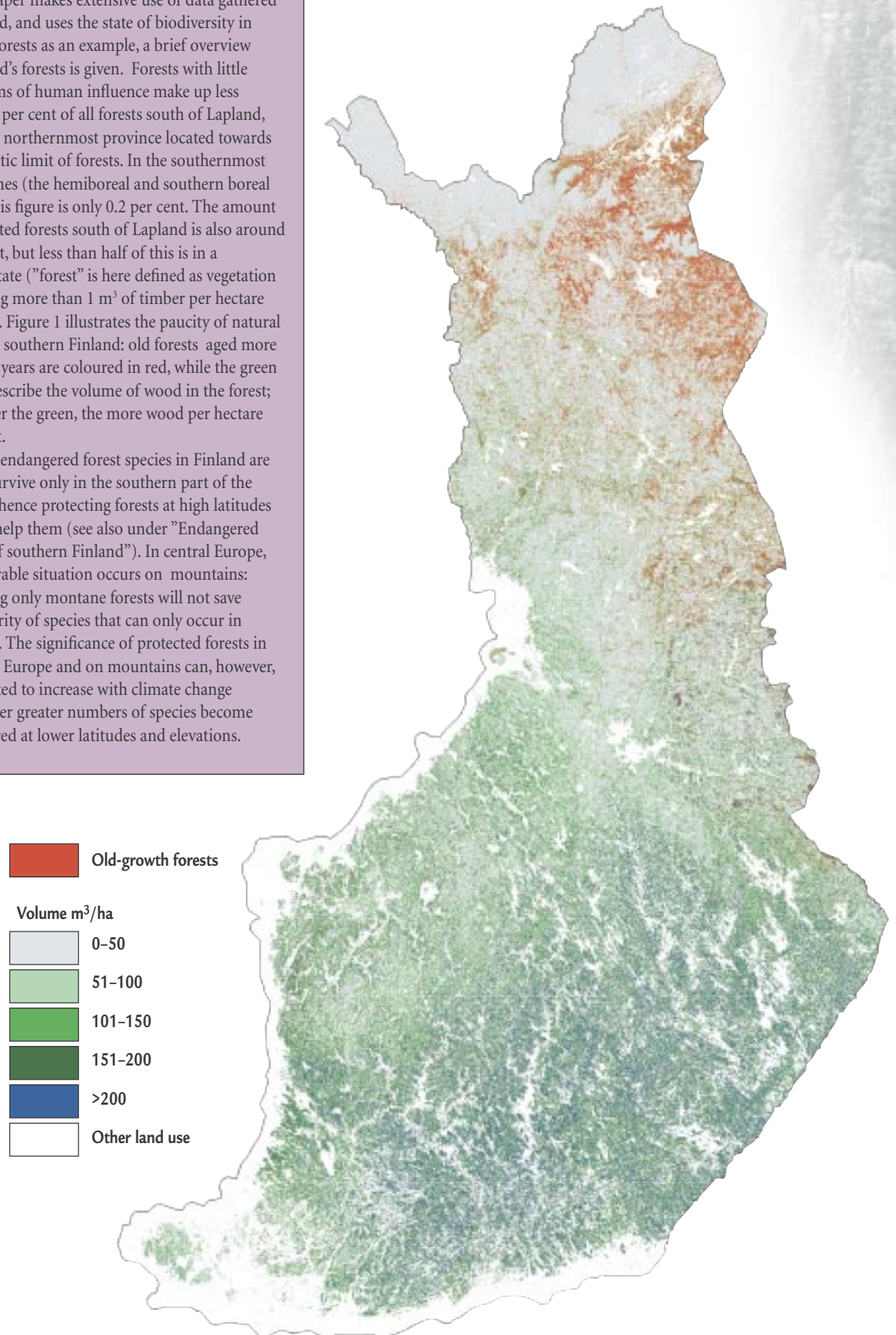


Figure 1. The structure of Finnish forests according to the National Forest Inventories conducted in 1990–94. The forest stand volume is indicated by the darkness of the green colour, while red colour shows the presence of old-growth (stands older than 150 years) (Figure courtesy of Professor Erkki Tomppo).

Beetles

by Ilkka Hanski

More than 3 500 beetle species are known from Finland, the majority of which live in forests. Of the 2 500 insect species living in decaying wood, a remarkable 800 species are beetles. Because the small amount of decaying wood in commercial forests is the major cause of endangerment of forest species, it comes as no surprise that nearly half of all insect species classified as endangered in Finland are beetles.

Ecological studies clearly indicate that the amount of decaying wood in southern Finnish forests is below the threshold value for many specialised beetles. A good example is the comparative study by Siitonen & Martikainen (1994) on beetle species living in large decaying aspens in Russian Karelia, and at the same latitude on the other side of the border in Finland. One hundred and twenty randomly selected large aspens were searched for beetles on both sides of the border. On the Finnish side Siitonen & Martikainen found 5 rare species, of which one is classified as endangered. On the Russian side the comparable sample contained 21 rare species, of which 15 are classified as endangered in Finland. Large aspen trees do occur also in Finland, but their density is so low that the threshold value for the specialist species is not met.

low amount of decaying wood. The continued decline in forest biodiversity cannot be stopped and reversed unless the area of natural and semi-natural forests is not greatly increased from its current European average of 1–2 per cent or less.

It is important to understand that for a species to persist in the long-term what really matters is not the fate of particular individuals but the fate of populations. The size and viability of a population depends first of all on the amount and quality of available habitat. This is why a decrease in the area of habitat can cause a species to go extinct even if forestry is not directly responsible for the loss of a single individual. "Precision conservation", looking to save species through preservation of small patches of "key habitat" harbouring small ephemeral populations (that is, groups of individuals), but failing to preserve enough habitat to retain viability of populations at the forest landscape level, has no ecological justification.

Population fluctuations and extinction risks of local populations

A population consists of interacting individuals of the same species living in the same environment. Many species live in landscapes that are fragmented either naturally or have become fragmented as a result of human encroachment. In this case the individuals in each habitat fragment comprise a local population.

Population ecologists study the factors and processes that affect the structure of populations, especially those causing variation in population size (population dynamics). Key mechanisms include interactions among individuals of the same species, such as the competition between owls for nest holes, and among individuals of different species, such as in the predator-prey relationship between squirrels and pine martens. The structure of the habitat may also be a critical factor. For example, the temporally variable occurrence of suitable breeding habitat affects the population sizes of insects dependent on decaying wood. Weather is another important factor greatly affecting the breeding success of many species, from which one can infer that climate change is likely to affect not only species' geographical ranges but also their population dynamics within the existing ranges.

All local populations face a smaller or greater risk of extinction. The magnitude of this risk depends on many factors, some of them stemming from processes occurring within populations themselves (inherent randomness in births and deaths, the genetic makeup of the population), others being external (random environmental fluctuations, human persecution). Regardless of which of these factors happen to be paramount, a general rule is that the smaller the population, the greater its risk of extinction. This rule is supported both by ecological theory and by hundreds of field studies, of which Figure 2 gives a few examples.

The high extinction probability of small local populations has immediate significance when evaluating the capacity of small fragments of forest, often called woodland key habitats

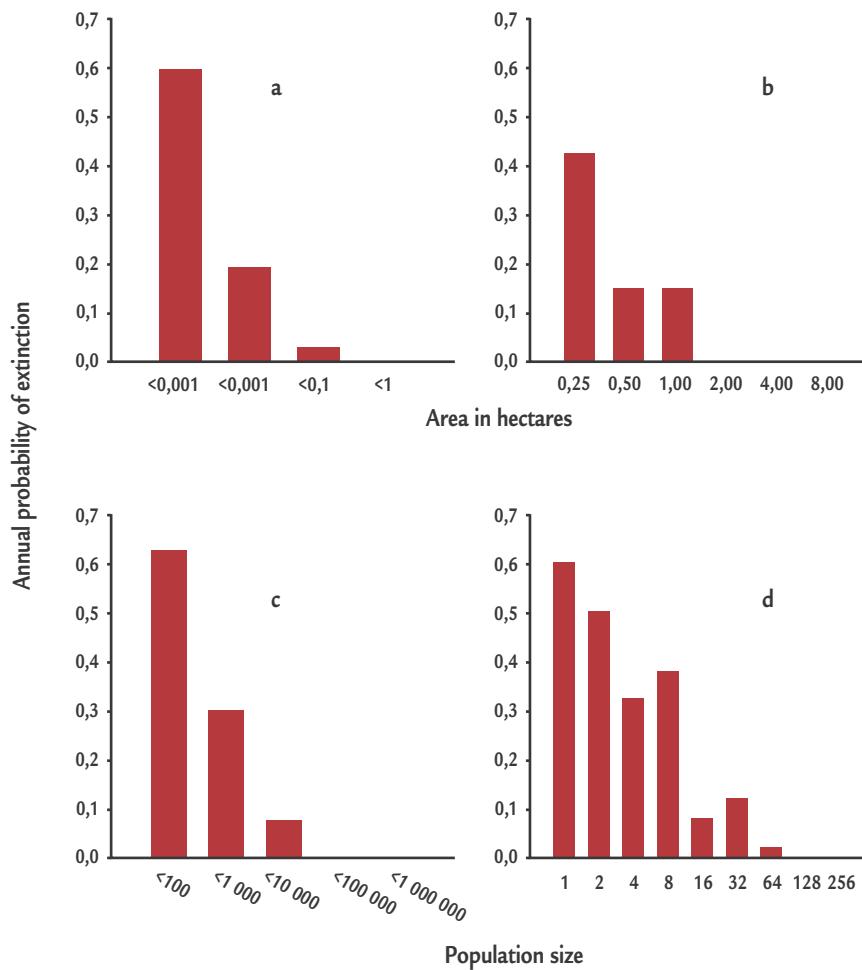


Figure 2. Populations occupying small habitat patches (a and b) as well as small overall populations (c and d) face a high risk of extinction. The figure shows research results for insects and spiders (Hanski 1994, Biedermann 2000).

(WKH), to preserve viable local populations. In cases where WKHs are limited to very small sizes of a few hectares or even less, as in Finland, the local populations are inevitably extremely small and it is highly unlikely that they will persist for long. One comprehensive study (Pykälä et al 2001) of ecologically specialised lichen species in South Finland showed that of local populations discovered in 1989–95 as many as 40 per cent had disappeared by 2000–2001. Most of these populations occurred in WKHs. During the same period, virtually no new populations were discovered.

Extinction thresholds and the ecological responses of species

The ecological response of a species refers to the change in its population size in response to a change in its habitat. Figure 3 shows two different kinds of ecological responses. The figure on the left depicts a linear response: an improvement in the habitat quality or quantity is accompanied by a corresponding change in the population. On the right is a situation where the response has a threshold value: as long as the habitat quality or quantity remains below the threshold value, a change in the quality or quantity has no effect on the population

whatsoever. Only after the habitat quality exceeds the threshold value will the population benefit from further habitat improvement.

The right-hand graph depicts the type of non-linear response that is typical of rare and endangered species. Because of the non-linearity of the response, it is important to consider how to allocate resources aimed at protecting biodiversity. The text boxes in this paper describing the situation of endangered birds, beetles, lichens, bracket fungi, and the flying squirrel (*Pteromys volans*) in Finland (and by implication also in most of the rest of

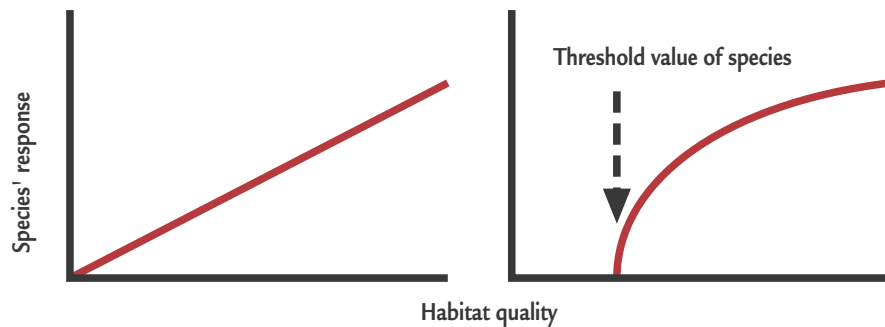


Figure 3. Two possible scenarios of species' response to changes in the quality of their habitat. On the left is a linear response, on the right a non-linear response. In the case of a non-linear response, the habitat quality has to exceed a threshold value for the species to have a viable population. Threatened species in particular tend to have a non-linear response. It is therefore important to consider how conservation efforts are distributed over the landscape.

northern Europe) make it clear that conditions in most forest stands and larger tracts of forest are currently considerably below the threshold value of endangered species. This means that a small improvement in the quality of forest stands will not lead to a corresponding increase in the populations of endangered species, as habitat quality will remain under the threshold values. On the other hand, if one were to concentrate the conservation efforts into a smaller area, the quality of these forests could be raised above the threshold value, hence offering the respective local populations the chance of survival (Hanski 2000). Exactly how strongly the conservation efforts should be concentrated for optimal results will vary according to many factors, but the general rule is that some degree of concentration of the conservation efforts is required in landscapes that have been much influenced by human activities.

The message of concentrating conservation efforts is especially relevant when increasing the amount of decaying wood and protecting woodland key habitats. The amount of decaying wood in commercial forests is typically significantly less than the threshold value for endangered species dependent on decaying wood. Similarly, the network of WKHs in Finnish forests is currently so sparse, accounting for much less than 1 per cent of the forested land, and the individual WKHs are so small, that the network of habitat patches which they create at the regional scale remains below the threshold value for endangered species. The small local populations of endangered species that may be currently found in WKHs will disappear over time, and will largely remain unreplaced.

The Flying Squirrel

by Vesa Selonen

Finland's forests hold three nationally endangered mammals: the wolf (*Canis lupus*), the garden dormouse (*Eliomys quercinus*), and the flying squirrel (*Pteromys volans*). Wolves are threatened because of persecution, but the recent decline in flying squirrel populations is attributed to changes in forests caused by management practices. The flying squirrel is an uncommon species with a large territory: around 60 hectares for males and over 5 hectares for females. This means that conservation of flying squirrels requires large-scale planning.

Flying squirrels prefer spruce-dominated stands, but are capable of moving and feeding also in other forest types.



Figure 4. The paths taken by two young flying squirrels (*Pteromys volans*) dispersing away from their place of birth to new territories. Spruce forest is marked in dark green, other forested areas in light green, sapling stage stands and bogs in brown, and open areas in white (V. Selonen, unpublished).



TARJOTIOMELA

Flying squirrels move with ease between separate spruce stands as long as the open area in between does not exceed its maximum gliding distance, about 70 metres. Young flying squirrels leave their parents' territories in the autumn of their first year, moving an average of 2.5 km from their birthplace, with a maximum displacement of 8–9 km (Figure 4). Individuals moving further than the average tend to move off in the direction of greatest spruce forest cover, but are able to cross barriers and generally move in a fairly straight line. Completely open areas cannot be crossed, but bushes or individual trees growing in ditches can be used to cross fields.

Because of their good dispersal ability, flying squirrels are able to move relatively easily between forest patches in a fragmented forest landscape. A more significant problem for the viability of flying squirrel populations is the quality of commercial forests, which do not fulfil the requirement of the species. Flying squirrels require deciduous trees for feeding and breeding. The key conservation measures for this species are increasing the mix of deciduous trees in commercial spruce stands and preservation of large aspen trees (*Populus tremula*) suitable for breeding.

The number of species increases with area

A universal ecological rule is that the number of species in a community increases with the size of the area occupied by the community. Figure 5 gives some examples. The dependence of the number of species on area is true both of clearly distinct habitat patches such as islands or protected areas, as well as of arbitrarily delineated regions.

Why does the number of species increase with area? There are many reasons, of which the two most important ones are the high probability of extinction of small populations, and the greater variety of habitats and environmental conditions within larger areas. To start with the former, and as noted above, small populations run a high risk of extinction for many reasons. If a species is rare, it may disappear from sites where it in principle could survive – the local population was just so small that it happened to die out. On the other hand, if the species is present nearby, a new local population may eventually replace the one that vanished. The study of such spatial dynamics, in which local populations go extinct and new ones appear, is the subject of metapopulation ecology. The larger the area, the greater the probability that the species will be present in at least some part of the region, and hence the greater the probability of its long-term survival in balance between local extinctions and establishment of new local populations.

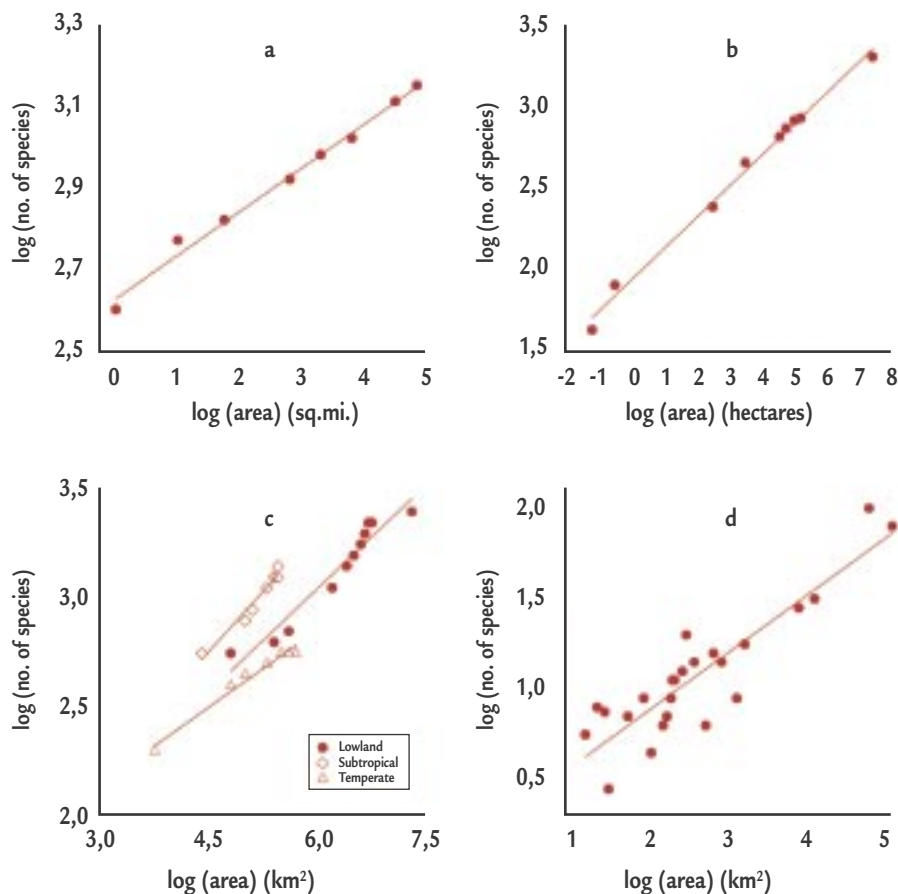


Figure 5. Four examples of species-area relationships (from Rosenzweig 1995). (a) and (b) show the number of plant species in areas of different sizes in Britain, (c) shows the species-area relationship for birds in three different climatic zones in South America, and (d) gives the results for lizards on the Caribbean Islands.

Considering the importance of spatial variation in habitat quality, if a forested area is small in size, then even if it were in a completely natural state there will not be present all the possible combinations of environmental conditions that are present in a similar but larger area. Many species adapted to natural forests are ecologically highly specialised and thereby can survive only under specific conditions. The larger the area, the more likely it is that the necessary conditions for the survival of many species are present.

The dependence of the number of species on area has been quantified in innumerable empirical studies. These studies allow us to predict that cutting the amount of suitable habitat required by a set of species to one per cent of its original area will result in the number of species present declining to less than half their original number – the rest will go extinct. Applying this rule to the example of southern Finland, the "original number of species" refers to species adapted to survive only in natural or semi-natural forests. The number of such species is not precisely known, but has been estimated to be of the order of 10 per cent of all forest species, making about 2 000 species (this estimate is based on information about beetles and bracket fungi, in which the fraction of species dependent on natural forests is 8 per cent and 22 per cent). Based on the species-area rule, this means that around 1 000 species can be expected to go regionally extinct, if – as is currently the case – only about one per cent of forests remains in a natural state or nearly so. This prediction assumes that conditions in commercial forests will not exceed the threshold value for the presence of these species even if some decaying wood and WKHs are retained in accordance with current forestry practices.

The above method of predicting extinctions is crude and only the order of magnitude is of significance. It is however noteworthy that the estimate thus derived is similar to the number of species currently classified as endangered on the basis of scientific monitoring (see below "Endangered species of southern Finland"). In other words, two completely independent estimates based on entirely different assumptions produce the same result about the number of species expected to go extinct unless the ecological conditions in forests substantially improve.

The species-area estimate does not take into account the effects of habitat fragmentation, which further weakens species' chances of long-term survival. It should also be emphasised that surface area of the habitat per se is not the decisive factor: the decisive factor is the area of habitat suited to the species. Protection of natural or semi-natural forests is therefore more significant than protection of commercial forests. On the other hand, in the

Birds

by Timo Pakkala

The majority of Finland's 80 or so regularly breeding forest bird species are still widespread and relatively common. Many are also found in sparsely wooded areas around farmlands. However, in the most recent Finnish assessment of endangered species, 8 bird species were regarded as endangered, and a further 10 species to be in long-term decline. The main reasons for the observed declines in forest game birds (*Tetraonidae*), several woodpecker species (*Picidae*), forest specialist tits (*Paridae*), and the Siberian jay (*Perisoreus infaustus*) are changes in tree species composition and age structure, as well as a steep decline in the amount of decaying wood present in most forests. Especially in commercial forests in South Finland there is a very limited amount of suitable feeding and breeding habitat for endangered forest birds. Fragmentation of forests has

also lowered the density of forest birds and reduced their breeding success, which in turn has adversely affected the populations of several species across entire forest landscapes.

The population fluctuations of the three-toed woodpecker (*Picoides tridactylus*) have been studied within an area of more than 300 km² in South-Central Finland. The occurrence of the species was found to be clearly dependent on the quality of the forest landscape. Figure 6 shows that if habitat quality within a forest region does not exceed a threshold value, the three-toed woodpecker is likely to disappear completely, or it survives only through immigration of individuals arriving from high-quality areas nearby. The shape of the curve in Figure 6 based on the field data should be compared with that of Figure 3.

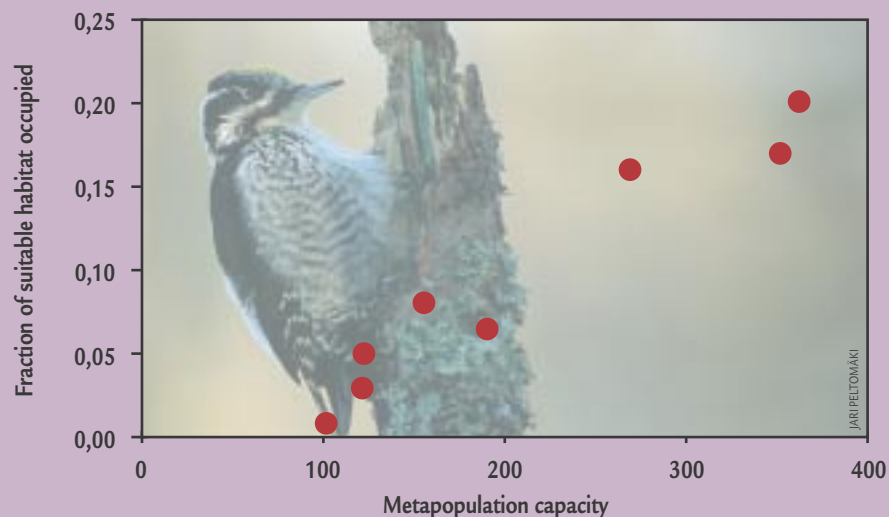


Figure 6. Distribution of the three-toed woodpecker (*Picoides tridactylus*) in eight forest sites around Lammi, southern Finland. The variable on the horizontal axis (metapopulation capacity) describes the quality of the forest site for the three-toed woodpecker. The vertical axis shows the relative abundance of the three-toed woodpecker in each site. Note that the species has a non-linear response to the quality of the forest site, with a threshold value of 100.

longer term any forests taken out of intensive timber production have significance. Most of Europe outside the region of the former socialist countries has currently little natural or semi-natural forests, and the overall area of such forests remains considerably below the ecologically acceptable minimum for strictly protected areas. Therefore, forestry should be excluded in all existing natural or semi-natural forests in this region. Additionally, a small fraction of forests currently in commercial use should be taken out of forestry. The latter should be returned to a more natural state as quickly as possible, using appropriate restoration measures where resources permit.

Effects of fragmentation

Loss of a species's habitat usually entails fragmentation of the remaining habitat, which is then present in ever smaller and more isolated patches. Studies of forest birds and mammals have shown that populations decline particularly sharply once the amount of suitable habitat drops below 10–20 per cent of the total landscape area. Below this level, individuals' ability to move between the remaining fragments of habitat becomes impaired, and local populations suffering extinction are less likely to become replaced by establishment of new populations. This leads to a situation where the species is no longer able to use all the available habitat, and some suitable patches remain unoccupied. If suitable habitat continues to decline further and fragmentation increases, eventually the threshold value for the occurrence of the particular species is reached. At this point the species will go regionally extinct even if some suitable habitat is still available. Below the threshold value the amount of suitable habitat is too low, and too fragmented, to maintain a viable population.

The scenario described above is relevant for forest birds and mammals but it cannot be applied directly to e.g. insects or fungi, whose ecology is different in many respects. Many insects are adapted to living in a variety of microhabitats such as decaying wood, and their survival is more dependent on the amount of such microhabitats than on other attributes of the surrounding forest. However, also these species have a threshold value for long-term survival: when the density of suitable microhabitats in a forest falls below a species-specific threshold, the species disappears.

Although the key factor affecting the long-term survival of such species is the density of suitable microhabitats, in practice the microhabitats occur in sufficiently large numbers only in natural or semi-natural forests. Siitonen et al. (2001a) have shown that many insects and fungi specialised on decaying wood become significantly endangered when the amount of natural forest in a larger tract of forest falls below 10–20 per cent of the total area. The Lake Vodla region of Russian Karelia, where natural forests account for more than 40 per cent of all forests, held twice as many endangered bracket fungi, and many times the number of endangered insects specialising in decaying wood, compared to an area on the Finnish side of the border, where the amount of natural forests varied between 9–19 per cent (within a 10–30 km radius of the study sites).

The extinction debt

Large-scale destruction of natural forests may result in the immediate extinction of some species, if their last local populations happen to get wiped out in the process. However, it is important to understand that the majority of extinctions caused by habitat loss do not occur

Lichens

by Laura Kivistö

A typical feature of old-growth boreal coniferous forests is abundance of tree-growing lichens. Common and widespread species survive the effects of commercial forestry or forest fragmentation, but old-growth forests have many specialised species unable to tolerate conditions in commercial forests. These species are indicators of old-growth forests and have been used to evaluate forest conservation values in Finland and elsewhere. The recent Finnish assessment of endangered species (Rassi et al. 2001) classifies around 10 per cent of lichen species as endangered, the most important reason being the effects of commercial forestry. The rapid decline in the area of old-growth forests has caused a decline in the numbers of old deciduous trees, snags, and dry dead trees, all of which are important substrates for many endangered lichen species. Even single sturdy old trees with large amounts of epiphytes may

represent a lichen community of considerable importance.

A comparison of old-growth fragments in North-Central Finland and in South-Central Finland shows that the number of indicator lichen species is considerably lower in the latter region (9 versus 15 on average; Figure 7). The scarcity of indicator species in suitable habitat reflects the changes that have taken place in southern Finland's forests over the past decades. Distances between forest patches suitable for indicator species have increased to the point where the species' ability to disperse effectively has been impaired. There is no longer an old-growth forest continuum, and species have had either insufficient time or do not have the ability to recolonise new suitable habitat. As a result, the many lichen species that still occur in old-growth forests in southern Finnish have greatly declined.

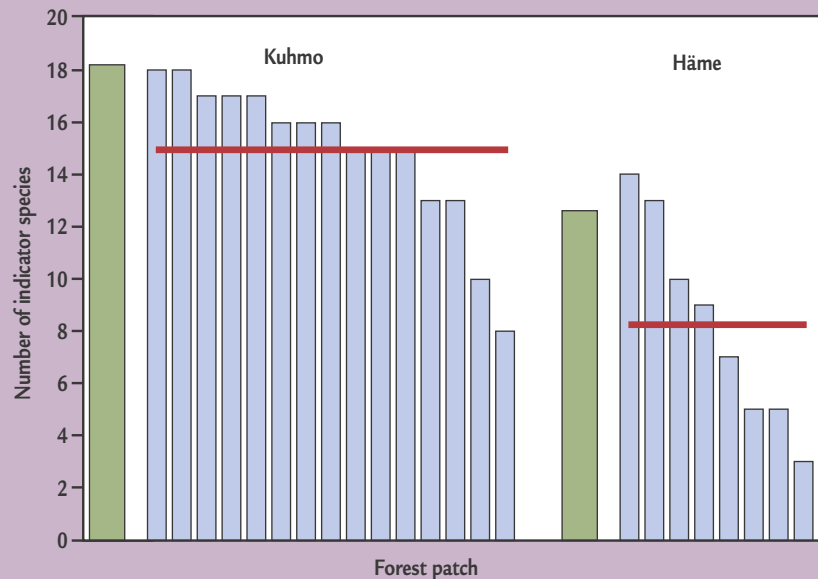


Figure 7. Occurrence of old-growth forest indicator lichen species in spruce forest stands in Kuhmo, north-eastern Finland (the bars on the left), and in North Häme, southern Finland (the bars on the right). The green bar shows the number of species in the largest tracts of old-growth, the blue bars show the number of species in isolated forest patches of 2–20 hectares in size. Note that the number of species is significantly lower in North Häme than in Kuhmo. The horizontal red lines indicate averages (L. Kivistö and M. Kuusinen, unpublished).

immediately, but rather with a delay of varying length following environmental changes. The term "extinction debt" refers to species that are predicted to go extinct as a result of past environmental changes, but that have not yet done so. I have suggested above that the extinction debt of Finland's forests is of the order of 1 000 species.

Extinction debt at large spatial scales is created in the following manner. As natural forests shrink in area, species demanding such forests become rarer. However, unlike naturally rare species, the newly rare species are typically not equipped with attributes, such as the ability to spread quickly, that would permit them to survive in the long-term in a

sparse network of suitable habitat patches. When habitat fragmentation reaches the species-specific threshold value, the species's natural population dynamics no longer function as before. Following extinction in an individual habitat patch due to chance or some adverse temporary environmental change, the habitat patch remains uncolonised for long periods or recolonisation becomes impossible.

An extinction debt is run up when the amount of suitable forest habitat for endangered species has fallen below the threshold value for one or more species. Extinction of a species from a large region may take tens or even hundreds of years, but if the extinction threshold has been crossed, extinction will happen as surely as loss will come shooting against a pair of weighted dice. The more drastic the environmental changes, the quicker extinction will take place. The slowest response to environmental change occurs in species that, following such changes, find themselves close to their extinction threshold. This means that in conditions where a species's long-term survival is tenuous or improbable, the time delay with which it reacts to environmental changes is especially long.

Figure 8 shows a probable example of extinction debt in Finnish forests. This figure shows the distribution of 101 endangered beetle species that occur in heath forests in eight forest vegetation zones in Finland. The number of species declines from south to north, which is the common pattern in virtually all species groups. Figure 8 also shows the numbers of regionally extinct species. Note that the fraction of species that have gone regionally extinct is especially large in the southernmost parts of the country. The large differences in the fraction of regionally extinct species between different parts of the country cannot be explained by the current structure of the forests, which have a very low proportion of natural and semi-natural forests everywhere apart from Lapland (Figure 1). The observed difference in the occurrence of regionally extinct species is most likely the result of differences in the history of forest use. Over time, more intensive forest use has spread gradually northward, so that species in southern Finland have had more time to respond to environmental changes than those further north. This means that the extinction debt of the more northerly regions is likely to be large, and more extinctions can be expected in the future unless the amount of forests with natural conditions does not considerably increase.

If habitat quality improves as a result of e.g. suitable restoration measures, and conditions for a specialised species thereby improve, the species's responses will once again take place with a time delay. This leads to a species credit, a situation opposite to that of an extinction debt. In the course of time, some regionally extinct species may succeed in recolonising the area where more habitat has been created, assuming that local populations of the species have persisted in nearby areas, for instance in protected reserves.

Endangered species in southern Finland

Finnish forests hold a total of about 20 000 species. The latest Finnish classification of endangered species included an assessment of about 7 000 of them, as for the remaining species there was not enough information to allow a reliable estimation of their status. Of primarily forest species, 62 were classified as extinct and 564 as endangered. Assuming that the same proportions hold for unassessed species, one can estimate that the total number of endangered forest species in Finland is $(20\,000 - 7\,000) \times \frac{564}{62} \approx 1,600$ species, and the total number of extinct species is over 100. There are additionally thousands of regionally extinct species.

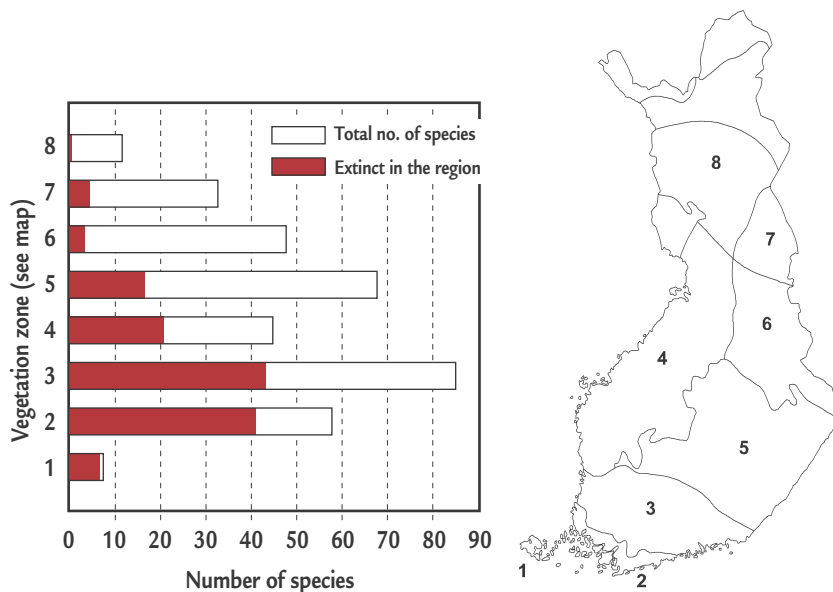


Figure 8. The number of threatened coniferous forest beetle species out of the national total of 101 species historically known from eight forest zones in Finland (shown by the length of the horizontal bar) and the corresponding number of regionally extinct species (red section of the bar) (Ympäristöministeriö 2000).

Forest biodiversity declines naturally with increasing latitude so that northern Finnish forests (the northern boreal vegetation zone) hold only one fifth of Finland's forest beetle species, and only a couple of these species are exclusive to the north. The situation is the same for most other species groups. This means that forest species cannot be protected by protecting forest only at the northernmost latitudes, or at high elevations on mountains for that matter. But northern forests, if they remain in a natural state, will in the future have an increasing role to play in conservation: where the climate warms, larger numbers of species will survive further north than is currently the case, and – as these species continue to disappear from southern boreal regions – their sole possibility of surviving in the fauna will be further north. The same applies to montane forests. However, a necessary condition for the forests at high latitudes and elevations to function as refuges for forest species is that the forest landscapes at large are not so fragmented that dispersal of species becomes impossible.

Conclusions

The above discussion of the numbers of endangered forest species in Finland and the causes of them being endangered can be summarised as follows – comparable conclusions apply widely to other parts of northern, eastern and central Europe:

More than 100 species have already gone extinct in Finnish forests, and the extinction debt is currently of the order of 1 000 species. These 1 000 species will disappear sooner or later if the area of natural and semi-natural forests does not increase significantly in the near future. Countries with a similar history and pattern of timber exploitation can expect to face similar levels of extinctions.

The most significant reasons for species becoming endangered are the loss of the naturally most diverse stands of forest such as old-growth spruce forests in northern Europe, and the scarcity of decaying wood in managed forests. In Finland, the density of decaying

wood in managed forests is so low, and the network of very small woodland key habitats is so sparse, that the threshold value for the presence of endangered species is not met.

Paying back the extinction debt without species going extinct requires that the quality of forests is improved beyond the extinction threshold for endangered species. For species specialising in decaying wood this means quantities of the order of 50 m³ per hectare, or somewhat less, around 20–30 m³ per hectare, if this is the average over large areas. Such

Bracket fungi

by Reijo Penttilä

Bracket fungi (*Polyporaceae*) are one of the most endangered groups of forest species in Europe. In Finland 37 per cent (82 species) of the 219 recognised species are classified as endangered or in long-term decline. Commercial forestry is the main cause of endangerment in 90 per cent of species: the main causes are changes in the age structure and species composition of forests, and especially the decline in the amount of decaying wood in comparison with natural forests.

The majority of bracket fungi – more than 70 per cent of the species – are specialised in decaying and dead wood, hence it is natural that the amount and types of such wood present in the forest has a major effect on the diversity of these fungi. In natural and semi-natural forests in southern Finland the amount of decaying wood often exceeds 100 m³/ha, and the number of bracket fungi species is twice as high as in mature commercial stands, where the amount of

decaying wood seldom exceeds 10 m³/ha. In a study of commercial forests in Central Finland (Penttilä et al. 2002, Siitonen et al 2001b), no endangered bracket fungi were found at all in stands with less than 20 m³/ha of decaying wood, which appears to represent a threshold value for the occurrence of these species (Figure 9).

Fragmentation of natural forests into small and isolated patches has significantly reduced the populations of many endangered bracket fungi in Finland. In North-Central Finland, endangered and declining bracket fungal species can still be found even in relatively impoverished forests, but further south they occur only in the very best and largest natural forest fragments. It appears that endangered bracket fungi cannot maintain viable populations in southern Finland, and many are threatened with regional extinction unless forest conditions become considerably improved in the near future.

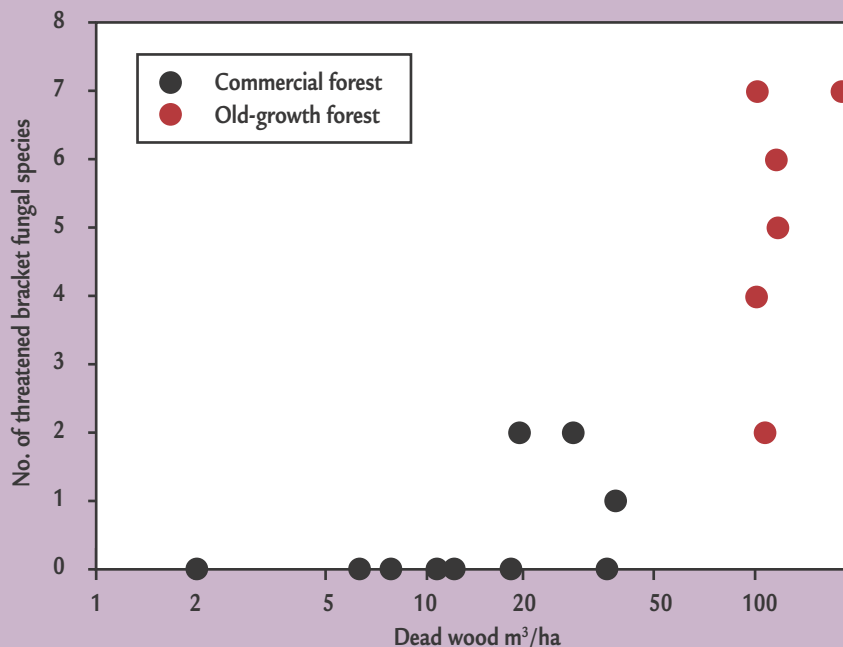


Figure 9. Occurrence of threatened bracket fungal species in forest stands in North Häme (southern Finland) in relation to the amount of dead wood in the stand (R. Penttilä, unpublished).

amounts of decaying wood are not attainable in all commercial forests, hence it is necessary to concentrate the conservation efforts in selected areas. Even so, the amount of decaying wood should be increased to some extent in all commercial stands, as this would help many still common species to remain so.

Southern Finland as well as all of Europe outside the former socialist countries have very little forest that can be considered close to natural, less than one per cent of the forested area. Theoretical and empirical research results suggest that species endangerment accelerates and species begin to go extinct once the area of natural forests drops below 10–20 per cent of the forested area. Applying the precautionary principle, this means that conservation target should be set at 20 per cent strictly protected forests, but a target of 10 per cent is acceptable if the sites selected for protection – or, if necessary, restoration – are carefully chosen so as to represent a wide variety of different forest types and to form a functional network of reserves. Measures to improve the persistence of wildlife in commercial forests are also helpful because they decrease the probability of even greater numbers of species becoming endangered, and hence such measures are an integral part of achieving the overall conservation target of putting an end to the loss of biodiversity in European forests.

Literature

- Andrén, H. 1994. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. *Oikos* 71, 355–366.
- Biedermann, R. 2000. Metapopulation dynamics of the frog hopper *Neophilaenus albipennis* (F., 1798) (Homoptera, Cercodidae) – what is the minimum viable metapopulation size? *Journal of Insect Conservation* 4, 99–107.
- Hanski, I. 1994. Patch-occupancy dynamics in fragmented landscapes. *Trends in Ecology and Evolution* 9, 131–135.
- Hanski, I. 1999. *Metapopulation ecology*. Oxford University Press, Oxford.
- Hanski, I. 2000. Extinction debt and species credit in boreal forests: modelling the consequences of different approaches to biodiversity conservation. *Annales Zoologici Fennici* 37, 271–280.
- Hanski, I., Lindström, J., Niemelä, J., Pietiäinen, H. ja Ranta, E. 1998. *Ekologia*. WSOY, Porvoo.
- Hanski, I. and Ovaskainen, O. 2002. Extinction debt at extinction threshold. *Conservation Biology* 8, 666–673.
- Hanski, I. K., Stevens, P. C., Ihalempiä, P. and Selonen, V. 2000. Home-range size, movements, and nest-site use in the Siberian flying squirrel, *Pteromys volans*. *Journal of Mammalogy* 81, 798–809.
- Hänninen, H. 2001. Luontokohteet ja säästöpuusto talousmetsien hakkuissa – seurantatulokset vuosilta 1996–99. Kirjassa: Siitonen, J. (toim.) 2001. Monimuotoinen metsä. Metsäluonnon monimuotoisuuden tutkimusohjelman loppuraportti. Metsäntutkimuslaitoksen tiedonantoja 812, 81–95.
- Kotiranta, H. 2001. The threatened and near threatened Aphyllophorales of Finland. In: Moore, D., Nauta, M.M., Evans, S.E. & Rotheroe, M. (eds). *Fungal conservation. Issues and solutions*, pp.177–181. British Mycological Society, Cambridge University Press.
- Kurki, S., Nikula, A., Helle, P. and Lindén, H. 2000. Landscape fragmentation and forest composition effects on grouse breeding success in boreal forests. *Ecology* 81, 1985–1997.
- Kuusinen, M., Jääskeläinen, K., Kivistö, L., Kokko, A. ja Lommi, S. 1995. Indikaattorijäkälien kartoitus Kainuussa. Metsähallituksen luonnonsuojelujulkaisu Sarja A: 39.
- Kuusinen, M. and Siitonen, J. 1998. Epiphytic lichen diversity in old-growth and managed *Picea abies* stands in southern Finland. *Journal of Vegetation Science* 9, 283–292.
- Mönkkönen, M., Huhta, E., Mäkelä, J. ja Rajasärkkä, A. 2000. Pohjois-Suomen vanhojen metsien linnusto ja metsämaiseman muutos. *Linnut-vuosikirja 1999*, 91–97.
- Ovaskainen, O. and Hanski, I. 2002. Transient dynamics in metapopulation response to perturbations. *Theoretical Population Biology* 61, 285–295.
- Pykälä, J. 2002. Vaateliaat jäkälät häviävät avainbiotoopeilta. *Ympäristö* 6, 25–26.
- Pakkala, T., Hanski, I. and Tomppo, E. 2002. Spatial ecology of the Three-toed Woodpecker in managed forest landscapes. *Silva Fennica* 36, 279–288.

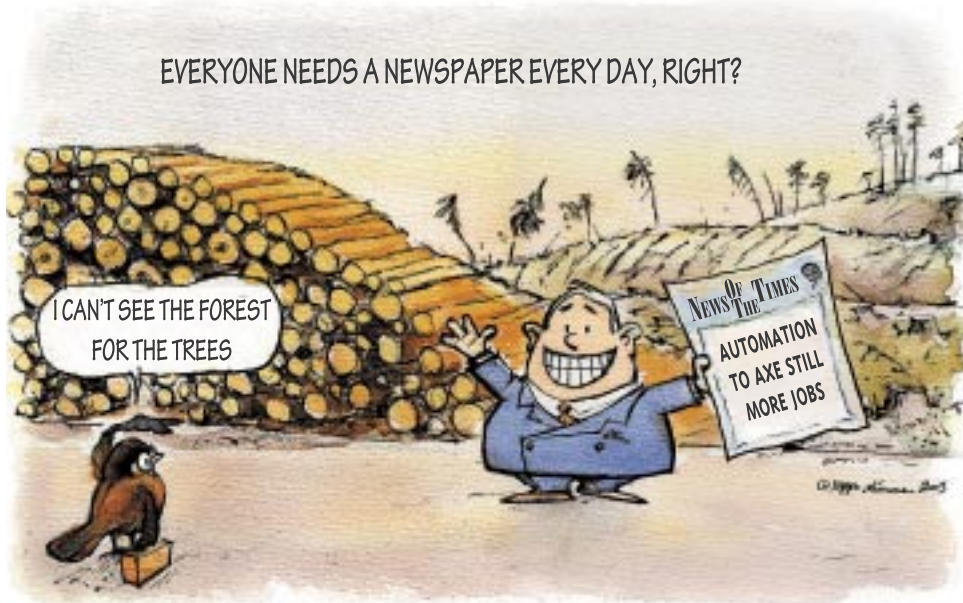
- Penttilä, R., Siitonen, J. and Kuusinen, M. 2004. Polypore diversity in mature managed and old-growth boreal *Picea abies* forests in southern Finland. *Biological Conservation* 117, 271–283.
- Rassi, P., Alanen, A., Kanerva, T. ja Mannerkoski, I. (toim.) 2001. Suomen lajien uhanalaisuus 2000. Ympäristöministeriö & Suomen ympäristökeskus, Helsinki.
- Rosenzweig, M. L. 1995. Species diversity in space and time. Cambridge University Press, Cambridge.
- Selonen, V. Hanski, I.K. and Stevens, P.C. 2001. Space use of the Siberian flying squirrel *Pteromys volans* in fragmented forest landscapes. *Ecography* 24, 588–601.
- Siitonen, J. 2001. Forest management, coarse woody debris and saproxylic organisms: Fennoscandian boreal forests as an example. *Ecological Bulletins* 49, 11–41.
- Siitonen, J. and Hanski, I. 2004. Metsälajiston ekologia ja monimuotoisuus (Ecology and diversity of forest species, in Finnish). In: Kuuluvainen, T. et al. (eds.), *Metsän kätköissä*, pp. 76–109. Edita, Helsinki.
- Siitonen, J. and Martikainen, P. 1994. Coleoptera and *Aradus* (Hemiptera) collected from aspen in Finnish and Russian Karelia: notes on rare and threatened species. *Scandinavian Journal of Forest Research* 9, 296–314.
- Siitonen, J., Penttilä, R., and Kotiranta, H. 2001a. Decaying wood, polyporous fungi and saproxylic insects in an old-growth spruce forest in Vodlozersky National Park, Russian Karelia. *Ecological Bulletins* 49, 231–242.
- Siitonen, J., Kaila, L., Kuusinen, M., Martikainen, P., Penttilä, R., Punttila, P., ja Rauh, J., 2001b. Vanhojen talousmetsien ja luonnonmetsien rakenteen ja lajiston erot Etelä-Suomessa. Kirjassa: Siitonen, J. (toim.) 2001. Monimuotoinen metsä. Metsäluonnon monimuotoisuuden tutkimusohjelman loppuraportti. Metsäntutkimuslaitoksen tiedonantoja 812.
- Tibell, L. 1992. Crustose lichens as indicators of forest continuity in boreal coniferous forests. *Nordic Journal of Botany* 12, 427–450.
- Virkkala, R. ja Rajasärkkä, A. 2001. Luonnonsuojelualueet metsä- ja suolintukantojen säilyttämisessä. *Linnut-vuosikirja* 2000, 34–43.
- Virkkala, R., Korhonen, K.T., Haapanen, R. ja Aapala, K. 2000. Metsien ja soiden suojelutilanne metsä- ja suokasvillisuusvyöhykkeittäin valtakunnan metsien 8. inventoinnin perusteella. Suomen Ympäristö 395, Ympäristöministeriö, Helsinki.
- Väisänen, R. A., Lammi, E. ja Koskimies, P. 1998. Muuttuva pesimälinnusto. Otava, Helsinki.
- Ympäristöministeriö 2000. Metsien suojelun tarve Etelä-Suomessa ja Pohjanmaalla. Suomen Ympäristö 437, Ympäristöministeriö, Helsinki.



3

From How Much to How To – An Implementation Strategy for Forest Conservation

by Marcus Walsh



Clarifying the ecological basis of protection needs as described in the previous chapter is the prerequisite for setting clear targets for forest conservation policy. Although the recommended general target of leaving ca. 10 per cent forest in a natural state may seem modest, virtually all European countries fall far short of this goal (see box "Forest protection in Europe"). Strict protection of a kind where no forestry measures take place except for the enhancement of the forests' ecological value through restoration is in fact rare (Figure 10). Most countries have strictly protected less than one per cent of their forests, "strictly" corresponding to IUCN (World Conservation Union) categories I–II. The average for Europe as a whole, excluding the European part of Russia, is only 1.6 per cent, much of it also located in poorly-productive or high-altitude areas of limited value for biodiversity (Figure 14).

With some exceptions where regular intervention is necessary, other categories of "protected" forests often permit harmful logging to a varying degree, others merely maintaining some tree cover for e.g. watershed or landscape management. Such forms of protection can be good buffer zones for natural forests, but cannot replace them (Figure 12). Additionally, a lot of forest strictly protected today was recently in commercial use and without restoration will take a long time to reach even a semi-natural state useful to the specialised species requiring such conditions. Another problem is illegal logging, which can affect even national parks.

It is important to note that "10 per cent for conservation" does *not* mean 10 per cent of the current forest cover in the region, if this cover has dropped markedly from earlier levels (Figure 12). Species are adapted to the situation prevailing before deforestation, some

of it induced relatively recently by industrialisation, and it is against the earlier forest cover one needs to estimate the conservation challenge (see Ch. 3–2). In addition, if 10 per cent is to be enough, it needs to be backed up by some marked changes in forestry practices in at least another 10 per cent of forests (Ch.3–3).

If deforested conditions have prevailed for a long time, a large number of forest specialist species will probably be extinct in the region. In such situations it is customary to set one's conservation goals at preserving the existing biodiversity. However, restoration offers possibilities to gradually bring back native forests and their species to regions where they have disappeared. This is especially true of Central Europe, which lies close to the major remaining centres of forest biodiversity in the east and south-east parts of our continent.

As described in Chapter 2, it is ecologically misguided to see the conservation of small vs. large scale forest habitats as alternatives; both are needed (Figures 11 & 12). Species needing large tracts of undisturbed habitat frequently require the effects on forests of large-scale disturbances such as floods, fire or pest outbreaks, all of which obviously are vigorously inhibited in any form of commercial forestry no matter how nature-friendly it may be otherwise. Attaining these conditions requires large tracts of undisturbed forest of the order of at least thousands or preferably tens of thousands of hectares. Such conservation usually requires the use of public land.

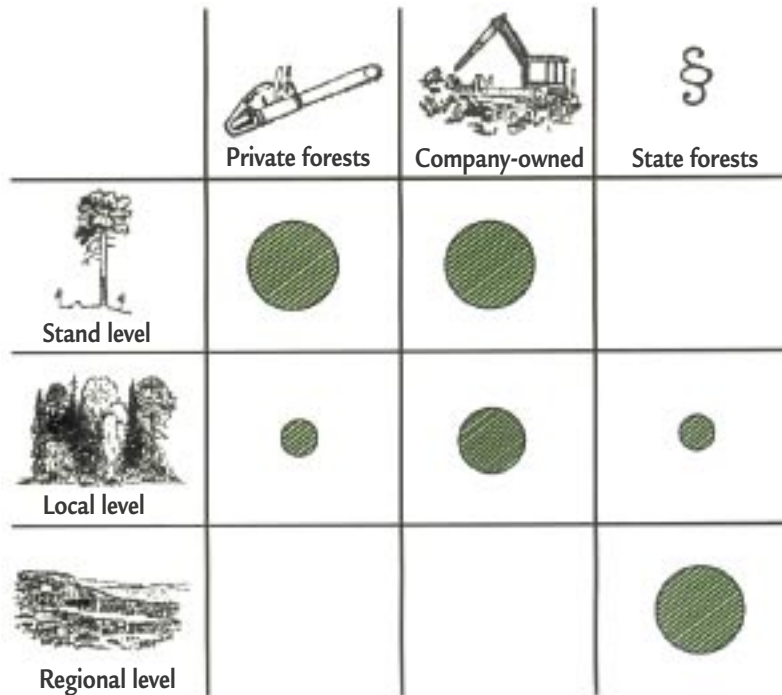
Other species are specialised in a different way: they live in or around specific rare habitat types, sometimes referred to as woodland key habitats. These are often patchily distributed and sometimes relatively small in area, such as forest springs or the banks of fast-flowing streams. Species of these habitats may tolerate commercial forestry as long as

Figure 10. Forest protection levels in Europe. Most countries have strictly protected only 0–1 % of their forests, corresponding to IUCN (World Conservation Union) categories I-II. See introduction to Ch. 3 for discussion. Sources: UNEP et al. 2000, Diaci 1999, Parviainen et al. 1999, EU Cost E4 1998.

Country	Total forest area (ha)	Strictly protected (IUCN I-II)	Country	Total forest area (ha)	Strictly protected (IUCN I-II)
Albania	1 030 000	14 500 (1.4%)	Lithuania	1 978 000	Around 1%
Austria	3 924 000	8 062 (0.2%)	Macedonia	906 000	?
Belarus	7 865 000	?	Moldova	324 000	?
Belgium	665 000	1 260 (0.2%)	Netherlands	334 000	3 028 (0.9%)
Bosnia-Herzegovina	2 276 000	3125 (0.1%)	Norway	11 950 000	148 000 (1.2%)
Bulgaria	3 590 000	Around 1%	Poland	8 942 000	46 202 (0.5%)
Croatia	1 775 000	2 856 (0.2%)	Portugal	3 306 000	2 827 (0.09%)
Czech	2 630 000	25 000 (1.0%)	Romania	7 865 000	27 530 (0.4%)
Denmark	445 000	6 085 (1.3%)	Russia	816 538 000	ca. 2 400 000 (0.3%)
Estonia	2 016 000	Around 7% ¹⁾	Slovakia	2 016 000	15 428 (0.8%)
Finland	23 000 000	1 035 000 (4.5%)	Slovenia	1 099 000	10 420 (0.9%)
France	15 156 000	14 000 (0.09%)	Spain	12 511 000	32 644 (0.3%)
Germany	10 700 000	24 976 (0.2%)	Sweden	28 000 000	832 370 (3.0%) ¹⁾
Greece	6 513 000	142 000 (2.2%)	Switzerland	3 955 000	1 018 (0.03%)
Hungary	1 811 000	3 665 (0.2%)	Ukraine	9 458 000	?
Ireland	570 000	5 736 (1.0%)	UK	2 305 000	10 000 (0.4%)
Italy	8 675 000	62 053 (0.7%)	Yugoslavia	2 894 000	?
Latvia	2 884 000	Around 1.0%			

¹⁾ These countries have government programmes to raise the amount of strictly protected forest to 10 per cent

Figure 11. Forest stakeholders have different relative responsibilities for forest conservation at different spatial scales. The larger the circle, the greater the relative responsibility in the category, though this will vary by country depending on the distribution of forest ownership between the public and the private sector, as well as the number of smallholders vs. large forest owners. Source: Angelstam & Mikusinski (2001).



the habitats are managed properly, and with buffer zones that avoid clearcuts, so that the microclimate of their local habitat is preserved. This level of conservation also involves the participation of forestry companies and private owners as well as the state (Figure 11).

”Ten per cent for conservation” further assumes that the protected forests are of tree species native to the area, that these forests are in a natural state or can be restored, and that they form a connected biogeographical belt stretching across Europe. If forest cover in a given region is drastically lower than before, and exists in isolated patches, the relative percentage of forests needed to achieve a satisfactory conservation status of its species may be much higher.

Six steps to implementing a practical forest conservation programme

Launching an ecologically meaningful forest conservation programme is a major long-term challenge, which should be regarded as a process rather than an as individual project. Such a process cannot sustain momentum unless its targets are clearly defined, and it is here that the profound importance of the previous chapter on population ecology can be appreciated. It represents Nature’s tolerance levels; to meet our commitment to preserve biodiversity, these levels have to be taken as is, and we must adapt to them. But how do we turn this information into a clear and practical forest conservation vision at the level of nations or other large regions? One holistic approach suggested here involves six steps, introduced below:

1. Analyse where high conservation value forests are located.
2. Analyse the historical vs. current distribution and species composition of forests and compare this with ecological estimates of species’ minimum needs (GAP analysis).
3. Combining the above data, analyse the ecologically optimum locations for new forest

Setting forest conservation targets

by Marcus Walsh

”Precision conservation”, looking to save species through preservation of small patches of ”key habitat” harbouring small ephemeral populations (that is, groups of individuals), but failing to preserve enough habitat to retain viability of populations at the forest landscape level, has no ecological justification.” – Ilkka Hanski, p. 12.

Figure 1 shows a diagram of forest conservation needs in the boreal and temperate zones. The outermost circle represents the country or region as a whole. Progressing inwards, the second largest circle with a few green dots inside represents forest cover lost in the region, which needs to be taken into account when evaluating the scale of forest protection needs. The effects of forest loss vary depending on whether it has taken place over recent decades or already centuries ago.

Next inwards, the entirely (palest) green circle represents basic commercial forest, which nonetheless needs to contain elements of value to conservation. These include especially woodland key habitats (= dark green dots), biodiversity-rich sites in commercial forests, which should in the main be at least of the order of several hectares to be of ecological significance. Other important elements in commercial forests include leaving as much dead wood as possible, and maintaining primarily mixed stands that retain big trees of previous generations. These and other requirements are often laid down in forest certification regulations.

The medium green circle around the centre represents a special category of commercial forests designed to supplement protected areas and act as their buffers and links, but nonetheless offering a reasonable economic return: more research is needed into this category, but it is known that these aims can be reached through continuous cover or similar types of forestry (see Ch. 3–3). Many kinds of ”protected” forest in Europe falls in practice into this category, which should be applied to at least 10 per cent of forests. If it is not, the amount of strictly protected

forest required increases. The converse is not true: increasing the amount of special commercial forests does not obviate the need for strictly protected forests imitative of natural conditions (see Ch. 2).

Finally, the darkest green in the middle of the circle represents protected forest in a natural state or forest set aside for restoration to natural conditions. This should be applied in at least 10 per cent of the forests, carefully chosen to represent different vegetation types. Unfortunately, certification schemes seldom have much to say about the two inner green zones, because such schemes have hitherto mostly focused on biological criteria at the stand level. Improved regional or national level criteria are needed for large forest owners such as governments and major forestry companies.

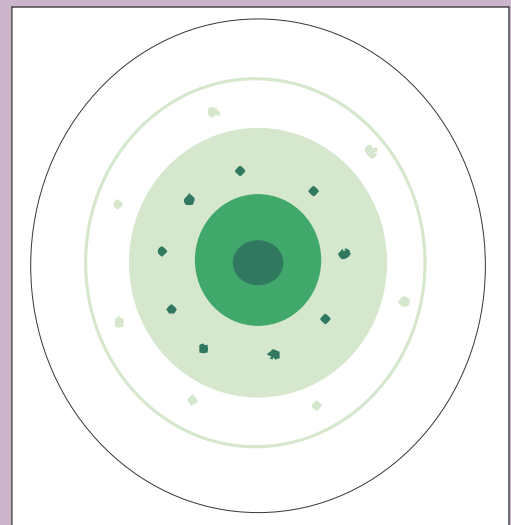


Figure 12. The different levels of forest conservation needed for successful protection of biodiversity

protected areas in the country / region. Compare with the region’s existing protected area network and forestry practices.

4. Draw up a plan to maximise the social and economic benefits of protection.
5. Review the national legal and forest policy framework’s, as well as available financial instruments’ ability to further the conservation programme; consult with the relevant stakeholders.
6. Establish a long term field monitoring programme to evaluate both ecological and socio-economic progress.

3–1. Step 1: Locating High Conservation Value Forests

It is generally assumed that forests get protected because of their high conservation value. In fact, many high conservation value forests (HCVFs) get left out of protection for financial or political reasons, but also due to lack of information about their whereabouts. Protected areas tend to get located at high latitudes or in otherwise unproductive regions

Forest protection in Europe

by Harri Hölttä & Marcus Walsh

The importance of European countries (excluding Turkey and the Caucasus) for forest biodiversity divides them broadly speaking into four groups:

1) Western Europe

Includes the following countries: Ireland, UK, the Netherlands, Belgium, France, Germany, Denmark, Austria, Switzerland. In these countries, especially Ireland, UK, Belgium, Netherlands and Denmark, both forest cover and forest biodiversity have decreased strongly through human impact. Mountainous areas are exceptions, especially in Austria and Switzerland, but generally the number of natural old forests is virtually zero and plantations, sometimes of non-native tree species, make up a significant part of the forest cover. Promoting forest biodiversity in this region requires extensive restoration measures using native trees.

2) Mediterranean Europe

Includes the following countries: Spain, Portugal, Italy, Greece, all islands of the Mediterranean Sea, as well as the Mediterranean forest zone of France and the Balkan region. This region holds a variety of wooded habitats besides true forests, e.g. shrublands and grazed pastures with scattered trees, all of which are important for biodiversity. Mountainous areas hold some natural forests, but little remains. Major human impact on forests took place here earlier than in any other part of Europe, and protection of remaining forests (or in other cases maintaining the low-impact agriculture that sustains them) needs to be supplemented with restoration. Rampant coastal urbanisation and alien tree species are two serious threats.

3) Eastern Europe

Includes the following countries: Estonia, Latvia, Lithuania, Poland, Belarus, Czech Republic, Slovakia, Hungary, Ukraine,

Moldova, Romania, Slovenia, Croatia, Bosnia-Herzegovina, Yugoslavia, Bulgaria, Albania, Macedonia and the southern parts of European Russia. Forest cover has decreased also in this region, but the change has not been as dramatic as in West and South Europe and the region's forests' current overall value for biodiversity is much higher (Figure 13). The share of strictly protected forests is also somewhat higher. Poor accessibility of some areas as well as earlier benign forestry methods have saved significant amounts of valuable forests in many of the region's nations, but there is currently very high logging pressure in a region where forests currently represent a much-needed ready cash crop.

4) Northern Europe

This group includes Norway, Sweden, Finland and the northern parts of Russia. Northern Europe experienced major human impact latest of all, but despite this the region's forests have been severely damaged with the advent of intensive industrial forestry methods after ca. 1945 (Figure 13). Forest cover has been maintained, but natural forests outside most arctic regions have been fragmented and the majority of forests outside Russia converted from naturally mixed to one- or two-species even-aged stands. The amount of strictly protected forests is higher than elsewhere in Europe, but is concentrated in the biologically least productive arctic areas, which lessens its significance (Figure 14). Especially in Russia the amount of old-growth and other natural forests is significant, but, despite much adverse publicity, logging of these sites still occurs. Conservation measures in the region should include a move to protect all remaining old growth forests and restoring the forests immediately around them, as well as a partial move to other forms of forestry than the clearcut-low thinning type especially in biologically sensitive areas (Figs. 1 & 6).

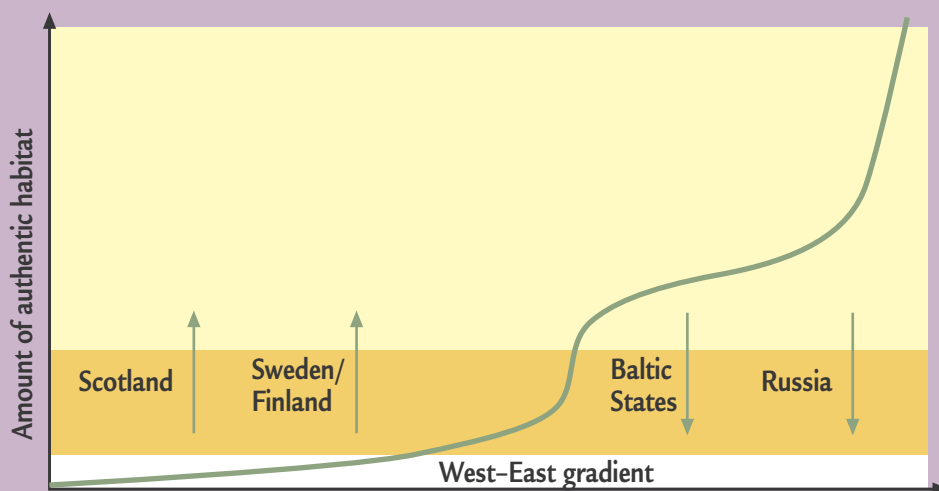


Figure 13. The amount of natural and semi-natural (sites retaining some natural features) forest habitat left in a West-East gradient in northern Europe. The green line represents the amount of remaining good quality habitat, and the yellow box the minimum habitat quality range required by many forest specialist species. Arrows pointing upwards indicate the need for restoration. Arrows pointing downwards indicate falling habitat quality due to greatly increased logging pressure in E Europe. Source: Angelstam & Lazdinis 2000.

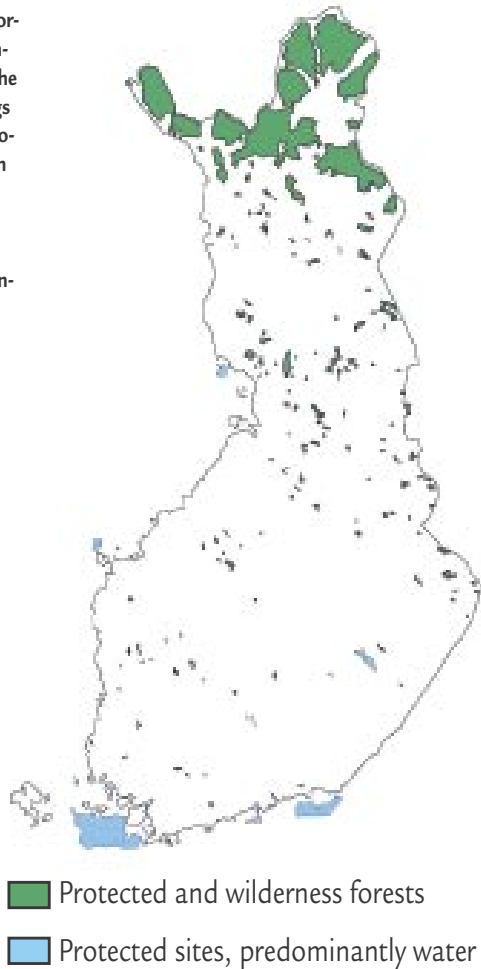
Figure 14. Finland's ca. 4.5 per cent strictly protected forests are mostly located in unproductive regions in northernmost Lapland, considerably above the arctic circle (the picture shows all protected areas, including tundra, bogs and water). Such an unevenly distributed network of protected forest sites excludes a large number of vegetation zones and their species. The situation in Norway and Sweden is similar, but see Ch. 3–2. The Finnish Natura 2000 proposal added less than 0.2 per cent more protected forest to the situation depicted here. Source: Finnish Environment Institute (SYKE).

where human economic pressure is lowest – but so frequently is the biodiversity (Figure 14). Also, HCVPs classified as important or already protected may in reality be inadequately conserved because of a lack of strict protection or due to poor management.

Carrying out separate nationwide on-the-ground inventories to search for HCVPs is in most cases excessively slow and expensive. However, in many parts of Europe, this is seldom a problem at the planning scale of whole nations or large regions, because existing information can be combined to form a reasonably clear picture of where HCVPs are located and fieldwork therefore concentrated. Such information includes

- Commercial forestry databases
- Satellite images
- Results of earlier inventories, e.g. data on rare species
- Local or historic maps of forest cover, vegetation etc.
- Local knowledge

From these sources, how quickly patching together an overall picture of HCVP distribution takes will depend on the quality of the data as well as how it is stored and therefore amenable to analysis. As an example, Figures 15 and 16 give sample results and methods used in searching for HCVPs in Estonia, Latvia and Lithuania. As for most of Europe, the national forestry services of all three countries maintain a database of forests, designed primarily for planning logging schedules and monitoring timber growth. However, the databases' information on stands' predominant tree species and their average age can, with a little informed manipulation, yield much useful data on their probable conservation value provided the database is sufficiently accurate (Figure 16). In this particular case, the database information was supplemented by national and NGO data on rare species of various taxa. Data errors occur for individual sites, but a clear picture emerges of regions where HCVPs are likely to be concentrated at the landscape level, and where conservation planning efforts should therefore be focused (Figure 15).



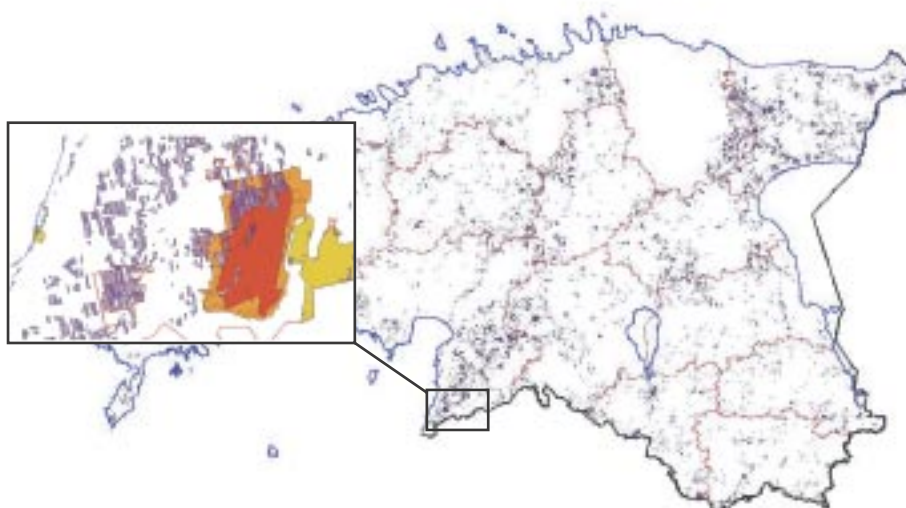


Figure 15: Estonian results from a project using forestry databases to search for high conservation value forests (HCVFs) in the Baltic States – see Ch. 3-1 for discussion. If stand level digital maps are available, the database scans can be visualised at any scale, giving a good picture of HCVFs both locally and nationwide.

Green, yellow and red areas in the enlarged picture are already given some degree of protection, purple areas none at all. The deeper the purple, the more HCVF criteria were fulfilled in the stand (see Figure 16). The white areas on the country map lacked digital maps at the time of the project, so that HCVFs located in these could not be visualised, although their whereabouts is known. Source: Kurlavicius et al. (2004).

Figure 16. Criteria for identifying potentially high conservation forests in the Baltic States. The criteria were elaborated using local expertise about forest growth rates and habitat types. Source: Kurlavicius et al. (2004) & www.balticforestmapping.net.

Criterion
1. Little or no signs of human influence
2. Average age of stand exceeds X years, "X" defined separately for each tree species or stand type, and with latitudinal gradient
3. Considerable amount / continuum of dead wood of different types; area rich in wood-rotting fungi
4. Forest blocks larger than 100 ha unfragmented by roads, clearcuts or drainage
5. Forests on steep slopes or ravines
6. Uneven age / canopy structure of stand with old trees of previous generations present in the dominating canopy layer
7. Native hardwoods present in the dominating canopy layer (Norway maple (<i>Acer platanoides</i>), wych elm (<i>Ulmus glabra</i>), soft-leaved elm (<i>Ulmus minor</i>), lime (<i>Tilia cordata</i>), beech (<i>Fagus sylvatica</i>), hornbeam (<i>Carpinus betulus</i>), apple (<i>Malus sylvestris</i>), wild cherry (<i>Prunus avium</i>), pear (<i>Pyrus salicifolia</i>), willow (<i>Salix alba</i>) crack willow (<i>Salix fragilis</i>))
8. Forests showing large-scale disturbance effects (fire, storm damage, beavers)
9. Forests with endangered vegetation types
10. Populations of several high conservation value forest indicator species known to be present (spotted eagle <i>Aquila clanga</i>), flying squirrel (<i>Pteromys volans</i>), rarer woodpeckers (Picidae)
11. Capercaillie (<i>Tetrao urogallus</i>) leks or long-term nests of eagles <i>Aquila</i> or black stork (<i>Ciconia nigra</i>)
12. Forests of limited access (e.g. forest islands on bogs)

3-2. Step 2: GAP analysis

GAP analysis as the term is applied here means estimating the "gaps" in the amount of different types of forest habitats needed in the long term to maintain viable populations of those naturally occurring species that cannot survive in conventionally managed commercial forests. GAP analysis therefore aims at identifying the most endangered types of habitat in the region (see Ch. 3-1) and compares it with historical records of how much of these habitats has disappeared. Based on this it then estimates whether specialised species' critical thresholds have been exceeded (Figure 3). But which species? – extinction thresholds have only been estimated for a very few. One possible solution – whose accuracy always needs to be assessed separately – is to use a suite of so-called umbrella species, the presence of which is known to correlate with natural conditions, and therefore the presence of a large number of other rare taxa.

Figure 17 summarises the results of the GAP analysis commissioned by the Swedish government and published by Angelstam & Andersson in 1997. It used an umbrella species for each of the four of Sweden's forest biogeographical zones (the northernmost fifth zone in the NW of the country has little forest in commercial use).

The bar chart above the map illustrates how the forest conservation percentages needed in each zone were obtained: the extinction threshold of each species was estimated at 20 per cent, i.e. that once the percentage of originally present suitable habitat in the zone has declined below this level, the long-term survival of the umbrella species is in jeopardy. From this 20 per cent, allowance was made for the fact that normal commercial forest cover per se does some good for the species (compared to it being converted to, say, fields). This allowance is the black part of the bar chart. The percentage below the black part of each bar represents the conservation need for forests within each zone; this need is further broken down into different forest management categories.

Following publication of the GAP analysis, the government of Sweden moved to protect over a ten-year period all the as yet unprotected valuable forest cited in the report – a total of ca. 900 000 hectares – partly through establishment of larger sites on government land, partly through expanding woodland key habitats. No decision has yet been taken on the restoration needs, but the official target is to reach five per cent protected forests by 2010 and 10 per cent in the next decades after.

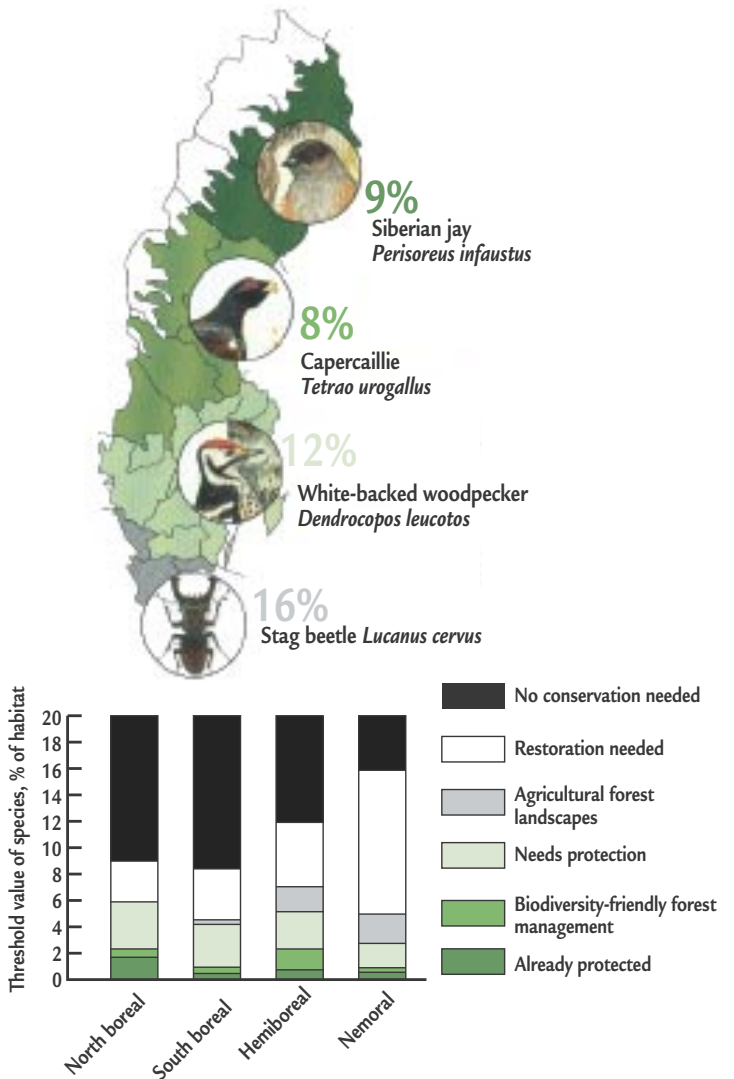


Figure 17. Results of the GAP analysis carried out in Sweden. For details see Ch. 3-2. Source: Angelstam & Mikusinski (2001).

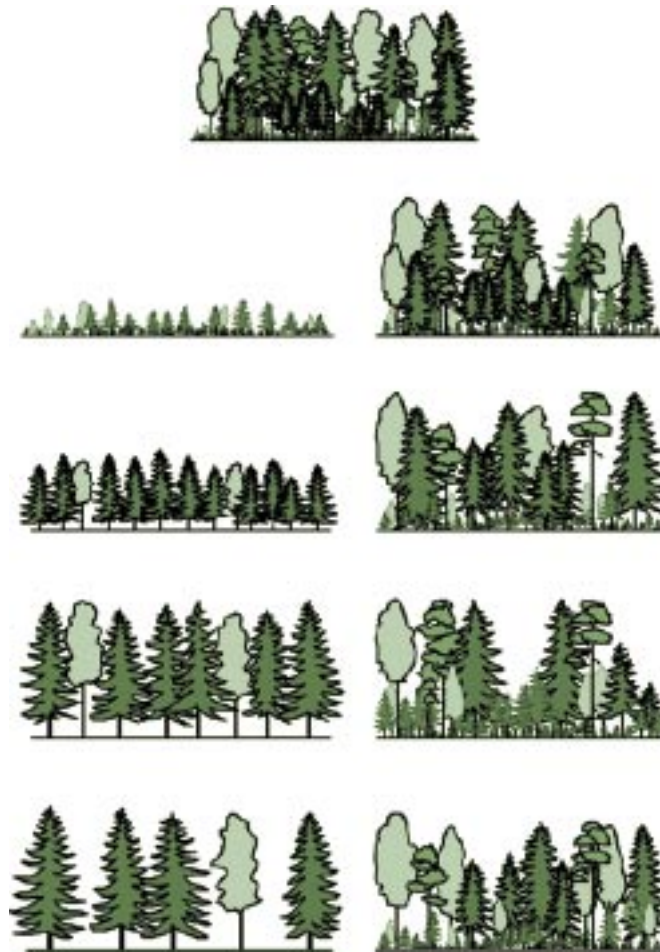


Figure 18. Forest development at boreal latitudes following treatment of a naturally generated stand (top picture) using conventional clearcut-low thinning forestry (picture series at left) and continuous cover forestry (series on right). Continuous cover retains much of the original structure. Source: Lähde et al. 2000.

As a result of its progressive and determined approach, Sweden is rapidly becoming the leading country for sustainable forest use and forest protection in Europe. However, her long history of intensive forest use, particularly in the southern parts of the country, means that extensive and expensive restoration of habitat to more natural conditions is now ecologically essential (Figures 13 & 17). This is true of most countries in W Europe, while in E Europe forests still retain a high degree of natural conditions (Figure 13). For this reason it is most important that eastern Europe be helped and encouraged to attain and make use of the full cultural, ecological and tourist potential of its forest heritage. Over-emphasis on short-term gain for pulp and saw-wood will quickly erode this advantage and deprive these countries, particularly their rural populations, of a major source of cultural inspiration and long term income. Hearteningly, in 2002 the Estonian parliament adopted a resolution to strictly protect 10 per cent of the country's forests by 2010.

3-3. Step 3: Interpreting HCVF data for conservation

One possible approach to reaching required forest conservation levels is outlined in Figure 12. Applying these principles to the Estonian example shown in Figure 15 might mean to focus on the NE-SW HCVF "corridor" running through the country. Other HCVF centres should be linked to this main corridor by maintaining forest cover, so that isolation is avoided. Strict conservation measures could be centred in the main corridor in order to

form as large units as possible, which is the most favourable method economically as well as ecologically (Ch. 3–4). If the main NE-SW corridor does not satisfactorily include all vegetation types, or if there are exceptionally valuable sites also elsewhere in the country, then strict protection measures should be extended to cover also these. Other, smaller sites can be protected through e.g. the woodland key habitat concept (Figure 12).

The starting point for increasing the number and size of protected areas should be the rarest national habitat types, and to enlargen existing protected sites. But conservation of forest biodiversity through protecting or restoring only ten per cent or so of existing forests means that significant changes need to take place in commercial forest management at all levels (see box "Setting forest conservation targets"). The most challenging level of management is represented in Figure 12 by the medium green circle surrounding the protected forests in the centre. Such forests would form buffer zones around and connections between protected areas, and themselves function as protectors of HCVPs in cases where strict protection is not possible or necessary.

This level of conservation in a commercial forest means foregoing large scale clearcuts as much as possible, and favouring e.g. different forms of continuous cover forestry techniques (Figure 18). Continuous cover is not imitative of all aspects of forest dynamics, and is not equally suited to all forests types. Cost-benefit analyses of continuous cover methods and harvesting techniques for different forest types are currently a "hot topic", and much new information can be expected to appear in the next few years. In best-case scenarios very little commercial penalty is paid because the harvesting costs of continuous cover are offset by natural tree regeneration with little or no planting or thinning required between harvesting (Figure 19).

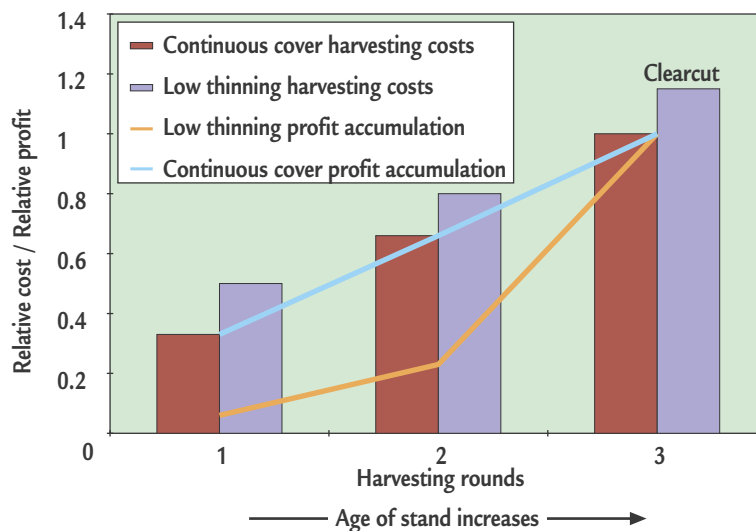


Figure 19. Schematic diagram of accumulative harvesting and transport costs (bars) and the accumulation of income from logging (lines) over one tree generation cycle in continuous cover vs. clearcut-thinning forms of forestry. Both assume mechanical harvesting only, but continuous cover costs include manual selection of harvestable trees at Finnish price levels for labour. The frequency of continuous cover harvesting can also be greater than pictured but in general produces a steadier income than conventional methods, where the big returns are concentrated at the clearcut stage. Continuous cover may not always match the profits of conventional methods as depicted here. Harvesting costs are slightly lower for c. cover over the whole cycle in Finland because the costly low-thinning stages are avoided. Note that in the longer term returns may be influenced by the chosen form of forestry. Source (harvesting data): Imponen (2002) Metsäteho Ltd.

Added value to continuous cover forms of forestry also comes from superior possibilities for game management. Species such as Hazelhen (*Bonasa bonasia*), Black Grouse (*Tetrao tetrix*) and Capercaillie (*T. urogallus*), that suffer from large clearcuts and excessive undergrowth clearance, are aided by maintaining forest cover. Other benefits include uninterrupted recreational and scenic value, and the potential capacity of continuous cover to produce better quality timber because of the slower initial growth of saplings. These benefits are collectively increasingly highly rated, so that even in cases where some overall loss of revenue occurs, many owners are nonetheless willing to forgo some timber profit in favour of the other gains that continuous cover can achieve. If allied to leaving extra decaying wood and retaining good-size woodland key habitats, continuous cover types of harvesting have the potential to become a very powerful force for biodiversity and landscape protection. It is to be hoped that every effort will be made to optimise this method for different forest types, including optimisation for use with 21st century forestry machinery.

Also more conventional forest management needs to be made more imitative of natural conditions. As discussed in chapter 2, species specialised on WKHs and other patchy habitat will not survive if such patches are delineated too narrowly during forestry measures. For example, in Finland the average WKH is only 0.3 ha; several studies have shown that rare species at Finnish WKHs have disappeared rapidly following logging down to such small habitat remnants. A better-functioning compensation scheme would help to encourage owners to delineate larger WKHs rather than to "cut their losses".

3-4. Step 4: Maximising the social and economic benefits of forest protection

Of all land ecosystems forests hold the most species, and the most endangered species. The ecological and moral case for forest conservation is straightforward to make, and indeed needs to be reiterated constantly in the face of the growing conflict between conservation needs and increasing consumption of wood products. Will conserving forests to the necessary ecological degree lead to a drop in our standards of living? Do citizens approve of forest conservation? Such questions, rather than the ecological ones of the previous chapters, are often the key to success in formulating a conservation programme and tend to get more public attention than ecology-based pleas or even the most commended scientific studies.

A (strictly) protected forest is usually assumed to be put outside commercial use, but of course this is by no means necessary – only logging is usually prohibited, and even this sometimes not entirely. Restoration measures, such as removing spruce or non-native conifers from deciduous stands sometimes yield considerable amounts of timber for many years after the initial protection has been carried out.

Perhaps the most important social aspect of forest protection on a large scale is whether it can generate the same number or more jobs as are forfeited by leaving the site's wood uncut. It is an easy matter to count the volume of timber left standing, and to turn this into equivalent jobs; it is much harder to show that forest conservation also generates jobs, and how this happens.

Figure 20 compares two national parks in Finland, Nuuksio and Oulanka. Nuuksio is located within 30 kilometres of 1.2 million people; Oulanka is 800 kilometres away, yet Oulanka receives more visitors annually. The major difference is in the size of the parks: Oulanka is eight times the size of Nuuksio. It can tolerate large numbers of visitors and develop its tourism without compromising the ecological integrity of the park. Adjacent

Figure 20. A comparison of two national parks in Finland. See ch. 3–4 for discussion. Sources: Harkki et al. (2003), Kuusamo-Ruka Tourist Service.

	Nuukio Nat. Park	Oulanka Nat. Park
Park size (ha)	3 400	27 000
Annual visitors	140 000	165 000
Distance from Helsinki (km)	30	800
Park-related jobs in immediate region	30	700
Visitor centre	no (but planned)	yes
Holiday centre	no	yes
Programmes for visitors	dispersed	centred
Wood craft / furniture sales or exhibitions	no	no
Park sponsorship from wood industries	no	no

to Oulanka are hotels and ski complexes which, together with the various guide services, generate 700 full time jobs to this remote area. This is twice the number Oulanka would provide were it to be used for timber production, even including all indirect jobs from industrial investments, sub-contracting etc. In Nuukio the number of visitors may possibly have to be limited in future because the park is too small to tolerate the current level of disturbance. This is likely to have a negative effect on investment interest from the tourist sector, which hitherto has been low anyway despite the park's prime location. Forming larger forest units for protection is not only ecologically advantageous but makes sense also economically.

Although the contribution to a country's Gross National Product is greater through the timber processing industry than through jobs in the service sector typical of tourism, the latter generates far more jobs because services are more labour intensive. In fact, the paper and saw-wood companies' increasing automation has lead to drastic job losses in the sector despite ever-increasing timber use (Figure 21). (The only exception to this rule are the second-degree manufacturing wood industries such as furniture making and house-building, but this sector uses only a tiny fraction of Europe's wood and is not at odds with conservation targets). Service sector jobs mostly cannot be automated, or moved abroad; they stay at the forest site with local people.

Since large protected areas frequently are located in quite remote areas, jobs related to forest protection can have far greater importance to the local community than the annual financial turnover they generate would indicate. In view of this and job trends in the forestry sector (Figure 21), one can question the assumption that nations benefit from giving over virtually all their forests to timber industries. "Ten per cent for conservation" can make sound economic as well as cultural and ecological sense, *if* such issues as sustainable tourist development are taken into account right from the early planning stages for conservation. This is not what usually happens, however. Environment and forestry officials charged with preparing site protection do not usually have the necessary expertise to prepare the ground for such things as tourist product development or the expertise (or resources) needed to encourage local people to invest time in developing new tourism-related skills. Securing government and private sector investment in tourist infrastructures is also an important part of this process.

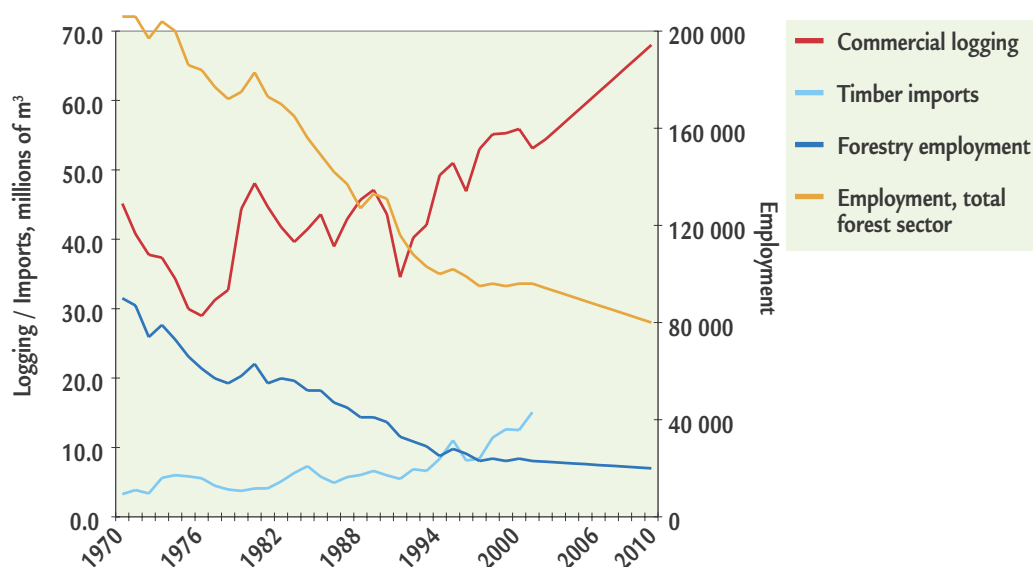


Figure 21. Forestry and total forest sector employment in Finland 1970–2000 compared to logging and wood imports. Trend to 2010 is from the Finnish Ministry of Labour. Sources: Finnish Forest Yearbook 2001, 2002.

As for most industries, once a certain critical size is reached, it tends to generate even more custom and infrastructure as more companies and services seek to take advantage of the large number of potential customers convening at a single location. This is what has happened in Oulanka. Such clusters of companies around protected forests can and should by all means include also the wood industries themselves – demonstrating and selling their products to visitors already in a positive, wood-oriented frame of mind. While in a few cases generating excessive numbers of visitors may cause problems for forest protected areas, in most cases the challenge will be get more; this should be planned for from the beginning. Initiatives designed to acquaint Europeans with our forest national parks, such as the PAN Parks programme (www.panparks.org) are timely, and more are urgently needed.

3–5. Step 5: Reviewing the legal, policy and financial framework for forest conservation

A nation’s legal and policy instruments have a decisive effect on the practical implementation of forest conservation. Forestry legislation can impede or encourage forest protection in a wide variety of ways: typical impediments include making strict protection legally too complicated to realise in practice, discouraging nature-friendly forestry methods by subsidising or promoting other types, and encouraging delineation of forest key habitats too narrowly to achieve the purpose of their conservation. Of equal importance are the wording and scope of various policy instruments such as certification, national forestry strategies, and – perhaps most importantly of all – the available financing instruments for conservation.

Figure 22 lists some key legal, policy, and financing instruments for forest conservation. One of the most significant factors overall is the relatively modest role of the European Union, although the EU Habitats Directive requires the Union’s Member States to assure the “favourable conservation status” of a wide range of forest species and habitats. It will be readily appreciated from a comparison of Chapter 2 and Figure 10 of this book that this goal is nowhere near being reached in Europe as a whole, despite a few promising exceptions

Figure 22. Review of legal, policy, and financing instruments for forest conservation. For discussion, see Ch. 3–5.

Policy instrument	Relevant stakeholders & effects			Status
	State forests	Municipal / corporate, etc.	Private forests	
EU Natura 2000 programme	x	x	x	Evaluation of programme's ecological significance urgent. Guidelines over-emphasise management.
EU Forestry Strategy	x	x	x	Currently more evaluation than strategy
National legal & policy instruments				
Forestry law recognises need to ensure long-term favourable conservation status of species and habitats	x	x	x	Law may mean little in practice, unless followed up by policy with specific targets.
National Forests main source for creating larger protected areas.	x	x	(x)	Excessive production targets can be incompatible with conservation needs.
All forests have well-defined environmental targets for commercial forest management	x	x	x	National Forest sector should be progressive, inc. experimentation with new forms of forestry, e.g. Continuous Cover. Woodland Key Habitats must be of ecologically meaningful size in all ownership categories.
Forest sector obliged to keep data on and take account of information on status of rare species and habitats	x	x	x	Information flow from environment to forestry sectors often slow.
National Forest Strategy includes ecological GAP analysis of forests	x	x	x	See Ch. 3–2 & 3–3.
Strategy exists to develop sustainable social and economic use of as well as investments in protected areas	x	x	(x)	Emphasis should be placed on investments around larger sites, which have the greatest ecological and economic potential
Recreational forests left in as natural a state as possible	x	x		Many regional and municipal recreational forests are excessively and unnecessarily managed
Forests accounted for in land use and landscape planning	x	x	x	Should avoid fragmenting important forest corridors, e.g. between protected sites.
Forest advisory services routinely offer advice on nature-friendly management	x	x		Advisory services tend to emphasise clearcut-and-replant forms of forestry, except where required to do otherwise
Funding instruments				
EU Rural Development funds	x	x	x	Potentially significant for multi-functional forest use approaches
National forests can be used in exchange for HCVFs on private land	x			An important tool, because available also to relatively impoverished countries
National budget funds for forest conservation and compensation schemes to private owners.	x			Budgetary funds should be earmarked for compensating loss of timber value due to protection. Commercial forest management such as ditching, forestry roads etc. should not be subsidised.
Biodiversity levy on logged wood		x		"User pays"- principle similar to wastewater and emissions management. See Ch.3–5.

such as Sweden and Estonia (Ch. 3–2). EU forest policy and guideline documents such as the Forest Strategy and "Natura 2000 and Forests" emphasise sustainable management and "exploitation [meaning logging] compatible with nature conservation", but fail to recognise the natural limits of how much this can achieve in the major forest belts. An ecological assessment of the adequacy of the Natura 2000 network of forest reserves and their management guidelines is urgently needed.



Figure 23. Fungi are a classic non-timber forest crop. In 2003 – a particularly good year – the value of the Finnish commercially sold crop, including exports, was 16 million Euros. Households picked another 16 million Euros' worth for personal consumption. Still only a small fraction of the of the potential is harvested, and export demand exceeds supply.

Earlier EU forest policies have been formulated by nations from southern and westernmost Europe, which have widespread deforestation and little natural forest cover left. Given that restoration of these countries' original forests is a very long term prospect, the emphasis on forest management in EU documents is understandable. But the current EU looks very different: enlargement of the Union north and east has brought within its borders a very large amount of high conservation value forest, and a large number of peoples for whom forests – particularly old forests – have a daily social and cultural, not merely economic, significance.

Future EU environmental and forest policies should accept the need for reserves of natural forests to achieve the aims outlined in its own conservation legislation. "Sustainable exploitation" should take in non-logging forms compatible with reaching a ten per cent forest protection target, and Rural Development funds be directed also for this purpose. These will in turn influence national policies, especially national forest strategies, which are likely to be the dominating factor in European forest policies for some time to come. Because of this, there is a considerable need for exchange of information and experience among forestry and nature conservation professionals on how to maximise the benefits vs. costs of both strict protection and multifunctional use of forests. Facilitating this information need is itself an area where the EU could be more active in future.

The use of state forests for conservation and developing new forms of management is the key to achieving ecological sustainability, not only through direct protection but also by facilitating land exchange and introducing new forestry methods (Figure 22). However, there are many other levels of importance: for example, what kind of forest management practices are officially recognised and recommended through forest advisory services will influence the outcome of nature protection in virtually all commercial forests. If no forms of continuous cover forestry are sanctioned or scientifically understood, or woodland key habitats intentionally delineated small to avoid compensation claims, it is unlikely that any certification scheme can redress such a massively unfavourable balance. Landscape ecological planning (LEP) and municipal zoning also have great conservation potential if allowed to look at larger regions from the point of view of optimising forest use categories (Ch. 3–1, 3–3.).

Virtually all forest conservation goals in Europe could be reached relatively quickly were sufficient funding available. Even where forests are widely in industrial or private ownership, sufficient forest comes on the market to be bought for nature conservation if funding permits. It tends to be assumed that this cost must be borne by the state, but most forest biodiversity loss is through commercial exploitation. In the pulp and paper sector, water and air pollution problems have widely been addressed on the "user pays"-principle, i.e. that those exploiting and depleting the resource must bear the cost of redress. A similar "biodiversity levy" on logged and imported timber would be a simple, effective and fair financing tool for forest conservation. Alternatively, companies owning large tracts of forest could pay the levy through setting aside part of their land for protection.

Many of the barriers to realising the forest conservation targets of Figure 22 are due to lack of knowledge or money rather than ideological opposition. However, environmental officials and non-governmental agencies must learn to present the case for conservation in a more convincing and convivial manner and avoid promises they cannot keep (Ch. 3–4). Landowners sometimes first hear of the ecological value of their forest when they get

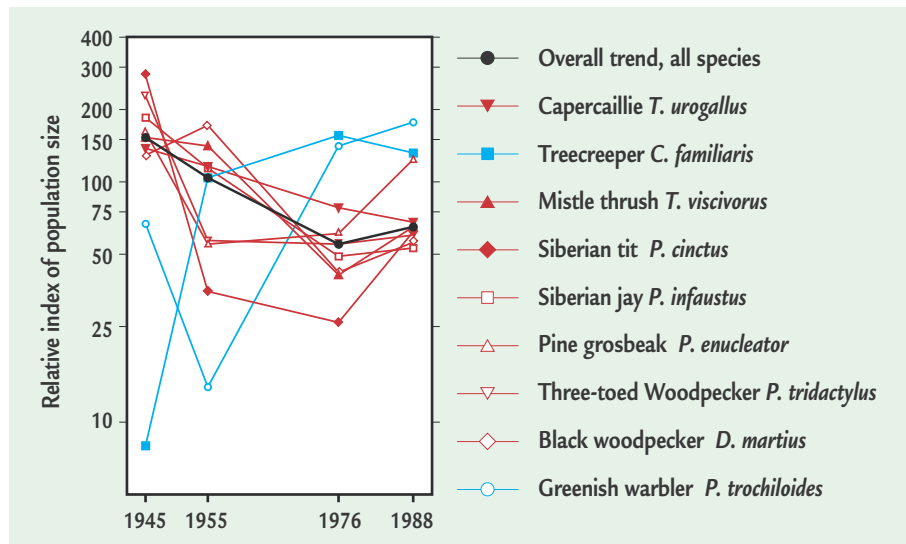


Figure 24. Population trends in some old-growth species in Finland 1945–1989. Y-axis = relative per cent population changes. Some species in Finland show a recovery in the 1990s as forests in N Finland have matured, but the overall trend is still far from original population levels (100% = average of all species in the group over the entire period). For discussion, see Ch. 3–6. Data from Väisänen et al. 1998



Figure 25. A typical product of modern silviculture are single-species "tree fields" with undergrowth removed. Such forests contain very little dead wood, few large trees, or other natural diversity, and hold little attraction for visitors

an official letter from a ministerial agency announcing that their land has been inventoried and is going to be protected! The outrage provoked by such gross treatment has caused untold harm to conservation efforts. Many costly misunderstandings could have been avoided over a cup of coffee and a chat.

3–6. Step 6: Monitoring for results

The forest conservation ideal for Europe depicted in Figure 12 will not be reached rapidly. How will we measure success and whether our efforts are worth it? Merely measuring forest cover, or the percentage of forests set aside for protection is not enough, or out of context even a suitable measuring stick at all. A good illustration of this is the biodiversity index of forest specialist birds in Finland (Figure 24). The index has fallen drastically in the last 60 years, yet Finland retains the highest forest cover in Europe, and has already protected more than four per cent of her forests. A similar situation exists in Sweden and Norway. What has gone wrong?

Nordic forest use is the most intense in the world and covers virtually all productive forest south of the arctic circle. Logged stands are replanted, or monitored carefully to reseed naturally, but for 50 years forestry has aimed at simplifying forest structures away from natural conditions. Prevailing schools of Nordic forestry

science hold that trees grow fastest when all or most undergrowth is regularly removed and stands thinned 2–3 times before final clearcutting (Figure 25).

Such forests cannot solve the biodiversity crisis any more than eucalyptus stands can in the tropics. They leave little room for wildlife specialised on more natural conditions, and are the prime reason for the observed decline in the (mostly) hole-nesting birds of the index in Figure 24. As for protected forests in the Nordic region, virtually all are situated in the northernmost arctic regions (Figure 14), where forest growth is minimal and many species cannot survive at all. It is essential to design one's protection network to cover all the region's significant biogeographical zones.

The above example illustrates how important it is to choose suitable species and units to measure forest health. Many of the indicators purporting to measure "sustainable forestry" merely measure the presence of trees. Another typical claim, that sustainable forestry is defined by the annual tree growth increment exceeding the annual logging rate, is also spurious, because biodiversity loss is not concentrated in rapidly-growing young single-species stands, but in the mature old ones that are getting logged.

Species whose presence are good indicators of natural forest conditions and therefore likely correlate with the presence of also other rare species, are referred to as umbrella indicators. Monitoring the regional or nationwide changes in umbrella species' populations gives a good indication of forest quality for biodiversity, but this is sometimes quite hard to realise in practice because such species are frequently rare, or difficult to monitor. Birds as a group can be a good choice as umbrella indicators, because they are relatively visible, there are a sufficient number of experts available who can recognise them, and because birds are popular with the general public. For some countries we already have long-term data sets

Figure 26. Summary of research and programme needs related to forest protection

Ecological topics	Rationale
What average size and density of woodland key habitats has ecological significance?	E.g. WKH average in Finland, 0.3 hectares, leads to disappearance of most relevant species (Ch. 2).
Assessing the ecological significance and quality of the Natura 2000 forest network.	Most EU Members States' current network proposals known to be below ecological minimum needs for forests.
Carrying out an high conservation value forest search and GAP analysis in each European country.	An essential prerequisite for effective conservation measures; see Ch. 3-1 – 3-3.
Optimising the cost-benefit scenarios of biodiversity-friendly forestry measures.	Minimising costs of Continuous Cover forestry methods for various forest types; optimising species and placement of retention trees etc.
Forestry data gathering to include a set of biological parameters.	Data on the amount and type of decaying wood per hectare, numbers of old trees etc. measure how well management for biodiversity is working.
Developing the umbrella species concept to measure forest health.	See Ch. 3-6.
Social and economic topics	
Formulating a detailed strategy for maximising the economic potential of protected forest areas.	Larger protected sites have great economic potential for the service sector. Financial investment and training of local people are potential key bottlenecks.
Optimum legal and policy framework for furthering forest conservation.	Removing obstacles to forest conservation, e.g. recognising the need for forests in a natural condition, facilitating voluntary land exchange programmes, tightening certification regulations.
Monitoring the success of economic gains from forest protection.	What is working, and why.
Developing new ways to raise money for forest conservation.	E.g. Publicly-owned foundation, biodiversity levy on logged wood, exchanging of state forests for private HCVFs.
Developing Landscape Ecological Planning.	Regional and municipal perspectives to avoid fragmentation of larger remaining forest tracts.
Training environmental officials' and institutions' communications skills.	Hiding behind statutes and regulations is no substitute for face-to-face contact.
Environment and forestry sector to work on mutual vision of forest protection and wood use.	A win-win scenario. "10 per cent for conservation is 100 per cent for credibility".

on birds that provide vital, and sometimes the only, earlier comparative data for trends on how populations are faring. However, regular monitoring does not take place in enough countries, and it is important that this situation be improved at the EU level as soon as possible. The umbrella concept should also be seen as a multi-species tool, and birds supplemented by other taxa giving additional useful information on forest conditions. These include specialised lichens, bracket fungi, and certain beetles (see box texts, Ch. 2).

All indicator species tend to be specialists on a particular forest type or need specific conditions. It is not possible to find umbrella species forest indicators that would cover all Europe's forests from the Mediterranean to Fennoscandia, although at the EU level such things have been attempted. In future, field data from forest inventories should also include measurements of biological as well as commercial forestry parameters such as the amount

and types of stands' decaying wood, the presence of big trees of previous generations etc. Combined with improved satellite imagery to monitor for tree species and their age composition over large areas, such "ecosystem indicators" of forest health will in themselves tell a lot about how we are faring at restoring forests' biological health. However, species monitoring will still be needed to measure how well rarer species actually are surviving, returning and increasing in the habitats.

Finally, with reference to chapter 3–4, it is important to also monitor for the success of social and economic programmes centred on forest conservation: the amount of money spent on forest conservation issues, the number of visitors to protected sites such as national parks, the number of jobs generated from these visits, the number of businesses active around the sites etc. are all suitable indicators for success and very important to measure.

Conclusion

Forest conservation is ecologically essential, culturally desirable, and economically feasible. The majority of forests can remain in commercial use, but a certain percentage, around ten per cent of the original cover, needs to concentrate on conservation, and some forestry practices must continue to change throughout the commercial sector. If Europe cannot achieve this, we can hardly expect other regions, struggling with far greater demographic and financial problems than ours, to do so either. However, it is clear that conservation goals can confer great social and economic advantages as well as ecological ones, and that these have not been realised fully although there is ample evidence and examples as to how to carry them out. Some of the more urgent research needs are outlined in Figure 26.

Arguably we have reached a sufficient level of knowledge where the traditional antagonism between commercial forestry interests vs. environmental experts and concerned citizens can be turned around into a mutual programme to protect forest sufficiently, to together further multiple uses of wood, and to develop wood/forest-related jobs where automation is removing them. The countries, companies and organisations to first realise this process in reality rather than merely in their public relations material will reap huge economic and publicity benefits. Their new knowledge and co-operation skills will also be much in demand in a world increasingly desperate to preserve our forests' wealth – in every sense of the word – of natural variety.

Literature

- Angelstam, P. & Andersson, L. 1997. I vilken omfattning behöver arealen skyddad skog i Sverige utökas för att biologisk mångfald skall bevaras. SOU 1997:98, Bilaga 4 [Estimates of the Needs for Forest Reserves in Sweden, in Swedish].
- Angelstam, P. & Andersson, L. 2001. Estimates of the Needs for Forest Reserves in Sweden. *Scand. J. For. Res. Suppl.* 3, 38–51.
- Angelstam, P. & Lazdinis, M. 2000: Sustainable forestry. Balancing forest production and biodiversity maintenance in the Baltic drainage basin. *Baltic Bulletin* 1/2000:5–9.
- Angelstam, P. & Mikusinski, G. 2001. Hur mycket skog kräver mångfalden? En svensk bristanalys. Världsnaturfonden WWF, Solna [How much forest needs to be protected? A Swedish gap analysis; in Swedish, with English summary].
- Diaci, J. (ed.) 1999. Virgin forests and forest reserves in Central and east European Countries. History, present status and future development. University of Ljubljana, Department of forestry and Renewable Forest Resources – Biotechnical Faculty.
- European Union 2003. Natura 2000 & Forests – Challenges and opportunities: pdf document at http://europa.eu.int/comm/environment/nature/nature_conservation/useful_info/documents_publications/pdf/n2kforest_en.pdf
- Finnish Forest Research Institute (METLA) 2001, 2002. Finnish Forest Yearbook. METLA, Helsinki.
- Harkki, S., Savola K., & Walsh, M. 2003: A Comprehensive Conservation Programme for Finland's Forests in the 21st Century. BirdLife Finland, Helsinki.
- Höltkä, H. 2002. Priority areas for the conservation of forests. Presentation at BirdLife European Forest Task Force Meeting, Bratislava. Document at www.birdlife.net/action/change/europe/forestff.htm.
- Imponen, V. 2002. Puuntuotanto ja -hankinta [Timber production and purchases]. MONTA seminar 17.5.2002, Helsinki. pdf report at www.metsateho.fi
- Kurlavicius et al. (In press). Identifying high conservation value forests in the Baltic States from forest databases. In: *Ecological Bulletins 51 – Targets and tools for the maintenance of forest biodiversity* (Per Angelstam, Monica Dönz-Breuss and Jean-Michel Roberge, eds).
- Lähde, E., Laiho, O. & Norokorpi, Y. 2000. Hyvän metsänhoidon opas. RAK Kustannus, Helsinki. [A manual for high quality forest management, in Finnish]
- Parviainen et al. 1998. EU/ COST E 4: Results of Forest Reserve Research Network Project. pdf document at <http://www.metla.fi/eu/cost/e4/coste4.pdf>
- Parviainen, J. et al. (eds.) 1999b. Research in Forest Reserves and Natural Forests in European Countries. Country reports. European Forest Institute Proceedings no. 16. Joensuu, Finland.
- United Nations Environment Programme (UNEP) World Conservation Monitoring Centre & WWF 2000. European Forests and Protected Areas: Gap Analysis. UNEP/WCMC, Cambridge, UK.
- United Nations (UN-ECE/FAO) 2000. Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand (industrialized temperate/boreal countries). UN-ECE/FAO Contribution to the Global Forest Resources Assessment 2000. pdf file at <http://www.unece.org/trade/timber/fra/pdf/contents.htm>
- Väisänen, R., Lammi, E. & Koskimies, P. 1998. Muuttuva pesimälinnusto. Otava, Helsinki. [The 2nd Finnish Breeding Bird Atlas; In Finnish with English summaries].

APPENDIX – Glossary of Forest Conservation and Forestry Terms

Compiled by Keijo Savola & Marcus Walsh

Biodiversity Is the natural variety of living things from the genes of individuals to the communities of species and the habitats they help form. Geodiversity, the natural variety of geological formations, is sometimes also included in biodiversity.

Biotope A surroundings where the key environmental factors are similar (compare → habitat)

Birds Directive One of the European Union's cornerstone Directives for biodiversity protection (the other being the → Habitats Directive). Member States are to designate Special Protection Areas (SPAs), especially for birds listed in the Directive's Annex I as priority species for conservation. Of the ca. 140 European bird species associating with forests, 52 are in Annex I.

Boreal Forest The northern coniferous forest belt, also called the taiga. Its tree species mix and other features vary with latitude, and the belt is often subdivided into the northern, middle, southern, and hemiboreal zones. Various types of coniferous forest also dominate at higher altitude in more southerly regions.

Certification see Forest Certification.

Commercial Forest A forest where forestry measures are carried out. In the boreal zone such forest is often even-aged and contains one or two species only, in western Europe it is frequently conifer plantations of non-native species. Commercial forests usually have very low amounts of decaying wood.

Continuous Cover Forestry A method of commercial forest practice using multi-species uneven-aged stands. Logging removes individual or small groups of trees, which are replaced naturally by seeding from the remaining trees. The aim is to imitate the development of such forests as do not naturally see large-scale disturbances such as forest fires. Continuous cover is better than conventional forestry based on understorey thinning and clearcuts at protecting forest cover and landscape values, but does not per se guarantee the preservation of e.g. species requiring decaying wood.

Dead Wood see Decaying Wood

Decaying Wood Wood of different types at varying stages of decay is an essential element to a very large number of forest species. Decaying wood is often used synonymously with rotting wood or dead wood..

Edge Effect The effect of surrounding conditions and species on the forest environment around the forest edge. Edge effects have increased considerably as forests have become more and more fragmented from logging, forestry roads, power lines and other human activities. Edge effects are harmful to some species; for example, it allows some predators to penetrate to areas they otherwise would not. The edge effect changes the forest microclimate at up to 100 metres' range.

Endangered Species A species threatening to go extinct either globally, regionally or nationally in the short or longer term. Endangered species are subdivided into categories Critically Endangered, Endangered, Vulnerable etc. according to how quickly they are likely to disappear unless action is taken to save them.

European Union see Bird Directive, Habitats Directive

Favourable Conservation Status A conservation target level defined in the EU Habitats Directive, to be fulfilled through the Natura 2000 conservation network as well as national initiatives. The target includes a requirement to conserve habitats but also, where necessary, to restore them so that favourable conservation status is attained.

Forest Certification A voluntary system, whereby the forest owner agrees to abide by certain ecological and social requirements in forestry operations. In return the owner receives a certificate of the high standard of forest management. There are several certification organisations, and a wide range of opinions about their relative merits or efficacy generally.

Forest Fires Natural forest fires are usually started by lightning, and many species are specialised on post-fire forest landscapes. Forest fires are actively suppressed today, so that controlled burning should be used more often as part of management for biodiversity.

Forested Land Some countries define forest through annual growth, i.e. as land with trees increasing their total volume by more than a certain amount per annum. Others define forest through the amount of ground covered by tree canopy. Different definitions lead to discrepancies in statistics concerning forest cover, the amount of protected forests etc.

Habitat A place where a species lives and that it needs to survive (compare → biotope). A habitat is usually described using its dominating biological or physical characteristics.

Habitats Directive The second of the European Union's cornerstone Directives for biodiversity protection (the other being the → Birds Directive). The Habitats Directive defines priority forest habitats for Europe, which – together with the listed priority species of various taxa associated with them – must be protected sufficiently to enjoy a → Favourable Conservation Status.

Landscape Ecological Planning (LEP) A system of land use planning aiming at preservation of biodiversity in commercial forests. There is considerable disagreement as to the ability of currently practised LEP methods to achieve its stated goals.

MCPFE see Ministerial Conference on the Protection of Forests in Europe

Ministerial Conference on the Protection of Forests in Europe (MCPFE) is a high-level liaison body of around 40 European countries and the European Union addressing forestry and forest use. MCPFE recommendations for → National Forest Plans are widely applied in Europe.

Natural Forest or Naturally regenerated forest Forest naturally seeded and untouched by management or otherwise influenced by Man. Refers to forest of any age, i.e. a natural forest is not necessarily old-growth.

Natural Variety see Biodiversity

Nemoral Forest The great deciduous forest belt, in Europe blends gradually into the boreal zone at its northern limits and into steppe or scrub in the South.

National Forest Strategy A detailed plan on usage of a nation's forest resource. If set out according to → MCPFE guidelines, should address economic, social, and ecological aspects of forest use. Most environmental NGOs and scientists would regard the majority of N.F. Strategies as excessively biased towards economic questions at the expense of biodiversity.

Old-growth Forest A forest of age well above the normal final felling age for commercial stands. Natural forest is often referred to colloquially as old-growth, but natural forest can be of any age, while old-growth can be any older forest ranging from wholly natural to an ordinary commercial stand.

Prioritised Forest Types see Habitats Directive

Recreational Forests Forests reserved in town planning etc. zoning plans for recreation, hiking, etc. use by the general public. Most recreational forests are managed and logged, many unnecessarily intensively from a biodiversity preservation and public education point of view.

Restoration Returning a habitat no longer in a natural state back to its original condition, e.g. by filling in drainage ditches, replanting mixed stands of native trees to replace monocultures and plantations etc.

Retention tree Tree left (usually standing) at a logged site.

Rotting Wood see Decaying Wood

Semi-natural Forest A forest with many features of a → Natural forest, although with traces of human activity. Semi-natural forests can be almost as valuable for biodiversity as natural forests. Commercial forests of native species left to themselves gradually become semi-natural in character.

Source-sink Dynamics A situation where a large or particularly suitable habitat (the source) maintains a species' population. The source produces more individuals than it can support, and some of these move outside the best habitat to sites that can only support them for a short period (sinks). A typical example of a source is a large forest in a natural condition surrounded by sinks in the form of → woodland key habitats. In such a situation, following the populations of the key habitats alone would give a completely wrong impression of the species' needs and potential for survival.

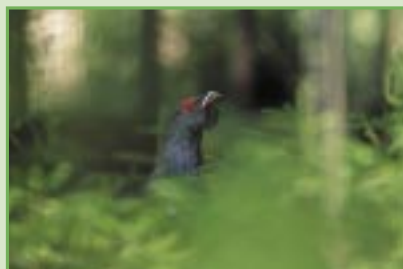
Woodland Key Habitat (WKH) A general term for forest habitats important for biodiversity, such as springs, brooks, and forests on rare soil types, that are supposed to be preserved during forestry interventions. WKH borders are frequently delineated too narrowly during logging, and they lose their biological value quickly as a result. Many countries count as WKHs only such habitats as are defined in forestry or nature protection laws.

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