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Editor's summary

The following is the editor's condensed summary of the articles in this issue.

Photo: Skogforsk, Sweden

Background pollination is a problem in seed orchards with genetically improved trees. See the article by Annika Parantainen and Pertti Pulkkinen.

• Wood and fibre properties are under strong genetic control in birch. Furthermore, fibre traits are not correlated with growth. Density, on the other hand, is negatively correlated with diameter. These findings, reported by **Lars-Göran Stener** and **Örjan Hedenberg**, have important implications for breeding birch trees.

• Background pollination reduces the value of seed from seed orchards with genetically improved trees. Much work has been devoted to examining this problem and seeking ways to reduce it. **Annika Parantainen** and **Pertti Pulkkinen** investigated a Scots pine seed orchard in Finland. They found, among other things, that differences in phenology between the orchard clones and surrounding stands do not necessarily effectively reduce background pollination.

• The way seed is collected may have an important impact on genetic diversity. Collecting a lot of seed from a few, heavily seed-producing trees is efficient from a financial point of view. On the other hand, collecting less seed from each tree, but from many trees, increases the genetic diversity of the collected seeds. **Kyu-Suk Kang**, **Erik Kjaer** and **Dag Lindgren** developed a theory on how these divergent strategies can be balanced, with Danish hazelnut as the model species. They suggested a maximum limit of nuts to be collected from each tree.

• When seedlings are transferred from the nursery to the field, they usually suffer from a transplant shock, exhibiting temporarily reduced growth. This can be especially problematic in short rotation crops such as Christmas trees. **Hanne Rasmussen** and her colleagues in Denmark have investigated how growth can be manipulated to optimise Christmas tree production with Nordmann fir. In this paper, they show how removal of lateral buds can increase leader growth.

• If properly done, given the right site conditions, actively growing birch seedlings can be planted in the summer with at least as good survival and growth as seedlings planted in the dormant stage in the spring. A factor in favour of summer planting is that root growth peaks in late July. Thus, seedlings can efficiently establish in the warm summer soils. This finding was reported by **Jaana Luoranen** and her colleagues in Finland.

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Forest research in the north

In the coming issues News and Views will take a tour of the Nordic countries and look at the way forest research is organised and performed in the different countries. Forests have a key role in terrestrial ecosystems, they are used by many people for recreation, hunting or earning their living and forestry is a major business sector in the Scandinavian countries. The central role of forestry should naturally be reflected in the scale of forest research. Is this the case? As well as considering questions like this, we will be examining unfolding changes in the structure of forest research in the Nordic countries. Organisations are being amalgamated, converted from public institutes to independent companies or relocated to new regions. We will give you an overview of these developments. First, we start by describing the country with the smallest forest research organisation – Iceland.

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Forests on Iceland

• Pre-commercial thinning has traditionally been carried out by cutting down secondary stems at the base of the stem. An alternative, and practically attractive, method would be to top the stems at a higher level on the stem. **Karin Fällman** and her colleagues at SLU in Sweden compared the results of topping at different stem heights in birch with conventional and no pre-commercial thinning. They found that topping increased the quality of the remaining stems. The recommendation is to top secondary stems at 60% stem height.

• Mixtures of Norway spruce and Scots pine grow as well as monocultures of the species. Admixture of some spruces in a pine stand can even result in higher volume increments than in a pure pine stand. **Magnus Lindén** and **Erik Agestam** based their conclusions on experimental plots in southern Sweden established over 20 years ago.

• After a strong thinning, such as a shelterwood cut, diameter increases. And, it increases more at the basal part of the stem, thus causing stem form to deteriorate. **Per Holgén** and his colleagues report stem form reactions to shelterwood cutting in a spruce stand.

• Computer tomography can be used to create images of the internal properties of stems, and much work has been devoted to the use of this technique for sorting individual logs based on quality. In his paper, **Urban Nordmark** presents a method to model the internal knot structure in sawlogs from young Scots pine.

• Logging requires an input of energy, and the amount of energy consumed must be considered when the environmental impact of forestry is evaluated. **Radomir Klvac** and his colleagues developed a new computer model, which they used for comparing energy use in mechanized wood harvesting systems in Ireland and Sweden. They found, among other things, that fuel consumption was the major energy component, and that energy use per harvested cubic metre was slightly higher in Ireland compared with Sweden. They also suggest a strategy to reduce energy consumption.

• The paper industry is an international business and investments are not bound by national borders. The factors that affect investment location decisions in Europe were analysed by **Robert Lundmark**. He found that labour costs, distance to main markets and agglomeration effects determined investment levels. The effect of raw material prices and availability is more ambiguous, but in the long run, it seems that waste paper availability is important to attract industry.

New SNS projects

In its meeting in November 2002, the SNS board granted financial support to three new research projects and one pilot project.

1. Genetic variation of structural timber quality

Most Nordic sawn timber is used for structural purposes. Such timber should be suitable for constructions and in many cases carry a load. Therefore, the quality of structural timber may be defined in terms of shape stability, strength and stiffness. Inadequate shape stability of sawn timber is a major problem for the sawing and building industries, manifested in trends away from the use of wood, such as large-scale replacement of wooden studs with steel studs. Furthermore, there are warning signs that there may be further reductions in the stiffness of wood from fast-growing plantations.

The new project will study the possibilities to improve the structural timber quality of Norway spruce by tree breeding. Wood samples will be taken from Nordic field trials and special emphasis will be put on deriving genetic parameters and molecular markers for spiral grain, microfibril angle and wood density: key properties for structural timber quality. The SilviScan instrument at STFI in Sweden will be used to measure the wood properties.

The project will last for three years (2003–2005) and will be carried out in collaboration between Skogforsk (Norway), METLA (Finland), KVL (Denmark), STFI (Sweden) and Skogforsk (Sweden). The contribution from SNS will amount to 500 000 NOK each year. The project will also be supported by national funds.

Photo: Skogforsk, Sweden

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2. The potential of larch wood for exterior use

Public concern and legislation have imposed restrictions on the use of chemical treatment to avoid biological deterioration of wood. Throughout the Nordic countries interest has turned to species with naturally durable heartwood, e.g. larch, and/or heat treatment as alternatives to chemical preservatives. The overall objective of this project is to improve our knowledge of the durability and weathering properties of untreated larch wood in outdoor above-ground applications, compared to Scots pine, Norway spruce and heat-treated wood. A series of laboratory investigations will be performed, supplemented by a field test of natural weathering. Participants in the project are the Technical University of Denmark (DTU), Lund University in Sweden (LTU), Icelandic Forest Research staff, the Finnish Forest Research Institute (METLA), the Norwegian Forest Research Institute (Skogforsk), the Lithuanian Forest Research Institute and the Swedish University of Agricultural Sciences (SLU). The project will be sponsored by SNS, which will provide 500.000 NOK in each of the three years 2003—2005.

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3. Nordic thinning experiments in Norway spruce

Thinning is a regular component in management programs for Norway spruce, but it can cause major problems. Norway spruce needs thinning in order to reach timber dimensions sufficiently rapidly for economic viability, but thinnings introduce a high risk of windthrow. Thinnings also create opportunities for root rot infections to establish through the stumps. Changing market situations have strong implications for the financial impact of thinnings. For example, reduced wood prices and increased labour costs make early thinnings of small trees increasingly unprofitable. On the other hand, mechanized harvesting and utilisation of wood for energy balances some of these cost problems.

The new project will analyse and evaluate thinning practices for Norway spruce, based on a series of thinning experiments set up in Sweden, Norway and Denmark. The experiments are part of the IUFRO series on thinning of Norway spruce, established in 15 European countries in the late 1960s. The research objectives of the project can be grouped into two main areas:
1) Understanding wood production – interactions between site conditions and thinning practices, and optimisation of harvesting in relation to volume growth
2) Operational silviculture – early final crop tree selection and mechanization.
The project will last for three years and will be led by Professor Jens Peter Skovsgaard at the Danish Forest and Landscape Research Institute. The other participants will be the Swedish University of Agricultural Sciences (SLU) and the Norwegian Forest Research Institute (Skogforsk). SNS will support the project, providing 250.000 NOK in 2003 and 210.000 NOK in 2004 and 40.000 NOK in 2005.

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Photo: Skogforsk, Sweden

4. Information technology and the Nordic forest sector: A pilot study

SNS has granted 50.000 NOK for a pilot study that will assess the impact of information technology on the Nordic forest sector. The project will formulate a research proposal for the period 2004–2006. The effects of IT will be analysed in the whole chain from final product demand back to the forest. At this pilot level, the project will focus on defining and formulating specific research topics that would benefit from co-operation between the Nordic countries.

The project is to be coordinated by Lauri Hetemäki at METLA in Finland. Other participants are Växjö University in Sweden and the Agricultural University of Norway.

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Computer-aided forest mensuration is only one example of IT use in forestry.

Photo: Skogforsk, Sweden

Forests returning to Iceland

At the time of human settlement over 1100 years ago, birch forests and woodland probably covered 25–40% of Iceland's land area. However, soon after settlement the Icelandic birch-woods were pushed back by clearings and sheep grazing. In the early 20th century they covered only 1% of the land.

Increasing forest area

Organised forestry started with the planting of a pine stand at Thingvellir in 1899. Planting increased in the 1950's, mainly with exotic conifers such as Sitka spruce, Scots pine, lodgepole pine and Siberian larch. Another leap in afforestation through planting took place in the 1990's. At present some 5 million seedlings are planted each year, and the forest area is increasing by 1,000–1,500 hectares per year. The most commonly planted species now are birch and Siberian larch, each accounting for 30% of the total, followed by Sitka spruce (12%), lodgepole pine (10%) and black cottonwood (6%). The remaining 12% of the planted trees represent over 20 species.

Icelandic forests in figures

Natural **Betula pubescens** scrub (<5 m tall)	100,000 ha
Natural **Betula pubescens** forest (>5 m tall)	20,000 ha
Plantations	20–30,000 ha

Most of the plantations are less than 15 years old. About 1/4–1/3 **consists of Larix sukaczewii**, 1/4 of native birch and the rest is made up of about 10 other species including lodgepole pine, Sitka spruce, Engelmann spruce, Norway spruce and black cottonwood.

The figures are estimates given by Thröstur Eysteinsson. There is still no nationwide forest inventory as yet, so it will be some years before "true" figures are available.

Forest Service

The Icelandic Forest Service played a central role in the early afforestation. But, since the 1990s, planting has been handled by other organisations. Six Regional Afforestation Projects have been established to manage the government scheme for afforestation on farms. Each farm afforestation grant covers 97% of establishment costs, including fencing, roads, site preparation, planting and the first thinning. The government funding amounted to 3.5 million USD in 2001. A goal of each regional afforestation project is to afforest 5% of the lowland area (below 400 m a.s.l.) in the next 40 years. It is estimated that within 50 years the forest and woodland area will have doubled from today's 1.3% to 2.5% of the land area.

The first forestry law was passed as early as 1907, and since then the forestry goals have been to protect the native forest and to afforest treeless land. The harsh conditions on Iceland require careful maintenance. For example, harvesting is only allowed through selective thinning.

Breakthrough

Forestry has a short history on Iceland. All wood used for construction has been imported, and until very recently the Icelandic forests were used solely as a source of fuel. However, some of the stands planted with exotic tree species have reached sizes at which they need thinning. Recently, the first truck-load of slender spruce logs was taken out from a thinning and used for making fish drying-racks. The raw material for these racks has been imported from Norway to date.

"We now have large areas of forests from which we can harvest 6–8 m poles in thinnings, says Thröstur Eysteinsson. We are of course far from being self-sufficient in this product, but it is still a break-through for Icelandic forestry".

Currently, Icelandic birch is used almost exclusively for firewood.

Photo: Jörgen Hajek, Skogforsk, Sweden

Forest research in Iceland

Forest research in Iceland is mainly executed by the Iceland Forest Research, a branch of the Icelandic Forest Service. The branch office, located at Mogilsa outside Reykjavik, has 15 employees, seven of whom are researchers. In addition, research is performed by various personnel in other parts of the Icelandic Forest Service, e.g. the extension department.

Trained abroad

Since there is no forestry school and no forestry degrees are awarded at university level in Iceland, all researchers are trained abroad. Four researchers have a PhD degree in forestry, geology or related fields from Sweden or Denmark. Another three researchers have Masters degrees in forestry from Norway or the UK. The head of the research branch is Adalsteinn Sigurdsen. Practical foresters are also trained abroad. At present, 32 foresters or forest technicians are active on Iceland. Most of these have been trained in Norway, but recently large proportions have also been educated in Ekenäs in Finland.

Genetics important

The main fields of research have traditionally been provenance testing and tree improvement, since afforestation of bare land has been a major issue in Icelandic forestry. Forest genetics is still important, but the research has recently been oriented more towards ecology, e.g. the maintenance of natural birch forests.

Carbon storage

The role of the forest in carbon sequestration has also become increasingly important. One researcher is working fulltime on this issue, and several others part time.

"Carbon storage in wood has become an important argument for planting trees", says Deputy director Thröstur Eysteinsson. "We are investigating the potential of tree planting to add to our commitments set by the Kyoto agreement".

Forestry related research is also conducted by the Natural History Institute, the Agricultural Research Institute and the biology department at the University of Iceland.

Sources: "Icelandic forestry in 2002", a report from the Icelandic Forest Service, and personal communications from Thröstur Eysteinsson, Deputy Director at the IFS. Contact: throstur@skogur.is

Photo: Iceland Forest Research.

Scaffolding erected in a 35 year old Larix sibirica *stand at Mjoanes, east Iceland, as part of ICEWOODS, a new research project that will focus on changes in species composition of birds, soil invertebrates and vascular plants that have occurred following afforestation with the introduced Siberian larch as well as changes in carbon sequestration, NPP and soil efflux of carbon.*

New dissertations

Long-term tree breeding program

When a new breeding program is started, one has a unique opportunity to define a management program for the breeding stock that optimises genetic diversity and gain while minimizing inbreeding. **Seppo Ruotsalainen's** dissertation covers these issues for a breeding program with Scots pine. Some of the findings are:

- Sub-lining of the breeding stock according to the genetic value of the plus trees can increase genetic gain and avoid inbreeding.
- If the size of the breeding population increases by 20%, the genetic gain in the second cycle breeding stock can be increased by 10%.
- Forward selection is not usually recommended for practical tree breeding.

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Gene conservation of broadleaved trees

Many European countries have signed the Forestry Convention, which requires gene conservation programs to be developed for broadleaved tree species. An essential question to consider is whether conservation strategies should be specific for each tree species, depending on their genetic structure. **Virgilijus Baliuckas** from Lithuania recently completed his PhD-thesis "Life history traits and broadleaved tree genetics" at SLU in Uppsala. He studied the within- and among-population variation in a large number of broadleaved species in Sweden, complemented with a study on oak in Lithuania. He did not find any strong evidence that the variation structure differs between climax and pioneer species, or between insect- and wind-pollinated species.

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Forest restoration – a new task for forestry

Everywhere we go we are surrounded by the artificial forms of "Nature" man has created to meet his needs. Long ago these areas were virgin forests. Restoration of such forests may become a major new challenge for foresters. Restoration provides new scope for the plant and animal species that once inhabited them. This was the theme for a recently held scientific conference in Denmark. Magnus Löf, SLU, Sweden, one of the organizers, gives brief details about the conference.

Forest areas still in decline

What is forest restoration? The term may be confusing when it is used without a definition. Traditionally, we considered forest restoration as being the process of transforming old open forest to a more productive state or, more recently, restoring natural types of forest to promote biodiversity.

However, the concept of forest restoration is much broader. Forest cover has declined globally from an estimated 6 billion ha of original forest to the present 3.8 billion ha. Forest restoration is the transition from a degraded state to a former natural forest condition. This involves processes such as afforestation, the transition from agriculture to forest. It also involves reclamation, which is the progression from a state of severe human disturbance (e.g. urban areas or surface mining) to forest, and rehabilitation: the transition from a degraded forest (e.g. one with low biodiversity or recreational value) to a more sustainable forest.

Global perspective

About 130 persons from Asia, North and South America and Europe participated in the conference. Invited speakers from various organisations, including the US Forest Service, IKEA Trading and Design, Yale and Berkley universities and several European universities presented highly interesting material on the concept of forest restoration and the practice of forest restoration around the globe.

The conference was sponsored by IUFRO Working Parties 1.17.02 and 1.05.08, the Danish Forest and Landscape Research Institute, the US Forest Service and the Swedish University of Agricultural Sciences.

Chairmen of the conference were Palle Madsen (Denmark) and John A. Stanturf (USA). Programme chairs were Emile S. Gardiner (USA), Katrine Hahn (Denmark), Magnus Löf (Sweden) and Peter Matthesen (Denmark).

The proceedings are compiled in Report No. 11, 2002, from the Danish Forest and Landscape Research Institute – Proceedings of the IUFRO Conference on restoration of boreal and temperate forests. Documenting forest restoration knowledge and practices in boreal and temperate ecosystems. Compiled by Emile S. Gardiner and Lynne J. Breland. Selected papers from the conference will also be published in a separate issue of the scientific journal *Forestry*.

Restoration of farmland into forests becomes a new challenge.

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