

## Editor's summary

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

The first four articles are concerned with various aspects of genetic variation in five different tree species.

- The first is by **Jan S. Jensen** and colleagues, who studied the genetic variation in a stand of *Quercus petraea* in Denmark. Morphological as well as allelic characters were measured. The stand is on the margin of the species' European distribution, but even so the genetic variation was as high as in corresponding stands in central Europe.

- The important timber-producing oak *Q. robur*, was the subject of a study by **Virgilijus Baliuckas** and **Alfas Pliura** in Lithuania. Phenological and growth measurements in short-term nursery and field tests were used to estimate genetic variation. Time of bud-flushing was found to be highly heritable and variable, both among- and within- populations.

- **Gösta Eriksson** and a large group of Scandinavian co-authors conducted their genetic experiments in a phytotron. *Acer platanoides* and *Betula pendula* are two species with contrasting distributions and reproductive strategies. Seed sources from different populations were studied with respect to growth and phenology. The observed differences between the two species could be partly explained by their different life-histories.

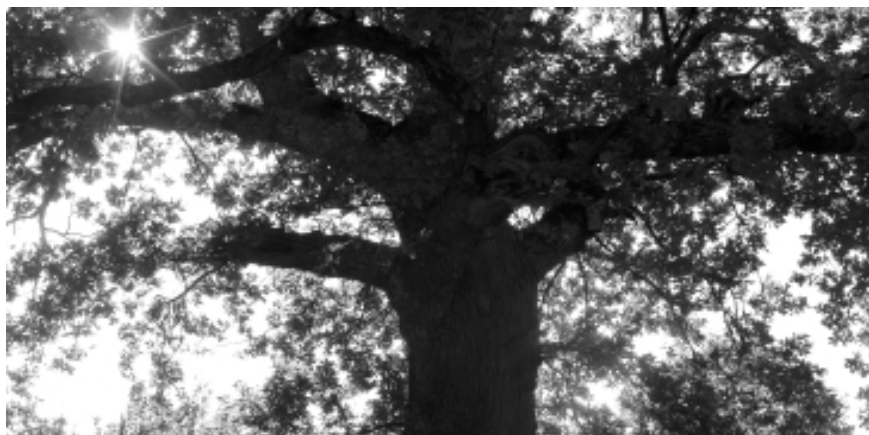


Photo: Arca

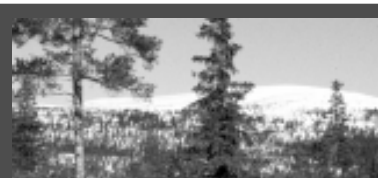
- **Torgny Persson** and **Bengt Andersson** take us back to harsh field conditions again. Tree breeding programs have produced vast datasets from numerous field tests over the years. In this study the authors compile data on the genetic structure in Scots pine in northern Sweden, based on 18 field trials. In most cases, genetic correlation between height and survival was strong and positive. This means that families that are tolerant to frost are also those that grow best.

- Tree roots need oxygen, and if soil aeration is too weak, tree growth will be retarded. **Antti Wall** and **Juha Heiskanen** studied, in a greenhouse experiment, how the soil aeration affected plant growth. They found, among other things, that the optimal porosity of the soil varied with organic matter content.

- **Mattias Pettersson** and his colleagues studied how root rot is spread in Norway spruce roots after thinning. By inoculating root rot spores before thinning, and by leaving some of the inoculated trees unthinned, they could compare the rate of spread of the fungus. The results showed that the inoculated root rot spread at a much higher speed through the root system of the thinned trees. This increases the risk of infection in the remaining stand.

- Young spruce seedlings that have been heavily browsed by roe deer may look depressingly unhealthy at a first glance. However, the trees are surprisingly resilient, and if browsing ceases after the first few years, the seedlings will develop into normal, single-trunked trees. Browsing reduces growth somewhat, but even when severe browsing (or clipping) lasts for three years, the growth reduction corresponds only to one year's height growth. These are some of the results reported by **Jonas Bergquist** and his colleagues.

- Poplar is usually used in short-term coppicing to produce biomass for paper industries. To optimize the length of the harvested stems, it is necessary to know the form of the trees. **Mohammed Benbrahim** and **André Gavaland** established a new function for stem taper in poplar. Unlike many earlier taper functions, it can estimate height at a given diameter, as well as diameter at a given height.



Forest research in the North

Norway

page 291

# Final reports from SNS projects

## Weak growth response to elevated N inputs

Nitrogen added weekly-monthly to spruce stands at an annual rate of 50–55 kg N/ha did not significantly increase the growth of the trees, although non-significant tendencies were observed at one site. Surprisingly large amounts of the added nitrogen were retained by the ecosystem.

These were some of the results from an SNS-sponsored study in two N-limited spruce stands – Gårdsjön in Sweden and Klosterhede in Denmark. The stands had been subjected to elevated (50–55 kg N/ha, year), ambient (13–20 kg/ha, year) and reduced (0–5.6 kg N/ha, year) N-inputs.

The reduced level was achieved by covering the ground with a roof to prevent the natural deposition of nitrogen. Results are now available from the first eleven years since the start of the study. The researchers conclude that “Generally, the forested systems showed a relatively slow response and high resilience to elevated N inputs”.

Project: SNS -72 “Effects of elevated N input to N limited coniferous forest systems”

Contact: Project leader O. Janne Kjønås, [janne.kjonaas@skogforsk.no](mailto:janne.kjonaas@skogforsk.no)

The roof cover at the Gårdsjön experiment was used to prevent natural deposition of nitrogen in part of the area.

Photo: O. Janne Kjønås



## Sub-alpine firs – a growing use as Christmas trees

Use of sub-alpine fir (*Abies lasiocarpa*) from North America as a Christmas tree is expanding in the Nordic countries. A four-year project (1999–2002) sponsored by SNS has helped to improve our knowledge of how to grow the tree and the best varieties to use. The project was a cooperative effort between Iceland, Denmark, Finland and Norway. Some of the main results:

- Southern provenances from Arizona and New Mexico seemed to have the best potential for producing high quality Christmas trees.
- There were relatively small differences among provenances in spring frost hardiness, but northern and eastern provenances were more hardy in the autumn.
- The sub-alpine fir plants are severely affected by weed competition. The best growth can be obtained if the ground is covered with black plastic. Spraying with herbicides is another alternative, but it should be avoided in the spring, since the newly flushed shoots are sensitive to damage by glyphosate.
- Sub-alpine fir retains its needles very well. The results also revealed significant differences among varieties.
- An important finding was that the corkbark fir (*A. lasiocarpa* var. *arizonica*) dies slowly and its needles retain their colour and shine for a long time.

Project: SNS -73 “*Abies lasiocarpa* for Christmas tree production in the Nordic countries”

Contact: Project leader: Adalsteinn Sigurgeirsson. [adalsteinn@skogur.is](mailto:adalsteinn@skogur.is)

## Nutrient dynamics after afforestation

When formerly bare or agricultural land is afforested, nitrogen (N) and phosphorus (P) dynamics will be affected. However, the effects will vary greatly depending on natural conditions, management histories and the degree of air-borne deposition. In a joint Nordic project, sites with extreme levels of nutrient availability were studied to evaluate the potential for N-leaching and the scope for countering nutrient deficiencies after afforestation.

On former agricultural land in Denmark, N and P are commonly found in excessive amounts. In contrast, afforested sites in Iceland are mainly located on land that is severely N- and P-deficient. In Sweden and Finland the situation is intermediate. The common, overall results for Denmark, Sweden and Finland support the notion that land-use history has a strong influence on soil characteristics, with long-lasting effects. However, nitrate leaching on former agricultural soils only occurs in areas where N deposition is high (>15 kg N/ha/year). Common results for Iceland and Finland strongly suggest that there is a need to fertilize in order to alleviate nutrient deficiencies and imbalances at problem sites. Foliar analyses can be used to predict fertilizer requirements. The results suggest that fertilizer treatments should be tailored to site types and tree species.

Project: SNS-67 “Stability and turnover of nitrogen and phosphorus after afforestation”

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## Norwegian forest research in brief ➔

### A rural country

In the two previous issues of News and Views, forest research in Iceland and Finland have been portrayed. The subject of this issue's portrait is Norway: a narrow, hilly country, with a long coastline, where fishery and the oil industry may be the commercial sectors that first come to the outsider's mind. However, Norway is also a forested country, with a productive forest area of 7 million hectares and a forest industry that employs 30,000 people. Furthermore, it is a country

where many people live outside the larger cities, and often come into contact with small-scale forestry and farming enterprises. Thus, it is not surprising that forest research plays a relatively large role in the country.

### Funding

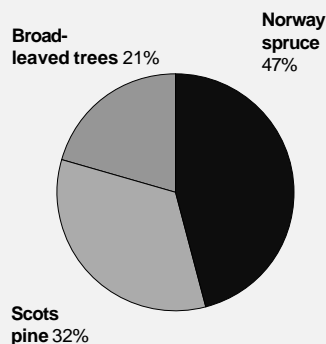
The Forest Research Council of Norway coordinates much of the national research funding. Through its forestry program, 11 million NOK per year is devoted to research. The wood program has a budget of 42 million

NOK per year. Most of this sum is dedicated to product development and innovation. An important research fund is administered by the forest owners association, which supplies 10 million NOK per year for research that improves the profitability of Norwegian forestry. New money is added to the fund through a fee of 0.50 NOK per m<sup>3</sup> harvested timber.

*www.forskningsradet.no*

### Norwegian forests in figures

- Productive forest land: 7.5 million hectares
- 79% of the productive forest area is owned by some 120,000 private forest owners. Companies own 6%, State 9% and other owners 6%.
- Average size of property: 57 hectares
- Growing stock: 650 million m<sup>3</sup> today (300 million in 1920)
- Annual increment: 22 million m<sup>3</sup>
- Annual harvest: 8.4 million m<sup>3</sup>
- Annual wood imports: 13 million m<sup>3</sup>



### Forest industry

- Sawnwood production 2–2.5 million m<sup>3</sup>
- Total turnover: NOK 12 billion (1.6% of GDP for mainland Norway)
- Employees in the forest industry sector: 33,000 (1.8% of employees in mainland Norway)
- Exports: NOK 13–15 billion (10% of total exports from mainland Norway)

Source: [www.skoginfo.no](http://www.skoginfo.no), [www.nijos.no](http://www.nijos.no)

## The Agricultural University of Norway

Through its *Department of Forest Science*, the Agricultural University of Norway is the only academic institution in Norway that studies and offers courses in forestry at the university level.

The department has around 50 employees, 40 of whom are researchers or teachers. In September 2003, it will be merged with the *Department of Biology and Nature Conservation* to form the *Department of Ecology and Natural Research Management*, which will be a large unit with 110 employees.

The research is presently organized into three units: silviculture, forest technology, and resource economics and planning. High priority is given to the following research areas:

- Environmentally sound methods of wood production

- Conservation of biological diversity
- Balancing the production of commercial and non-commercial forest goods.
- Wood utilization, particularly saw milling, use of hardwoods, small-scale technology and special products.
- Contribution of the forest sector to business and rural development.

The department closely cooperates with the Norwegian Forest Research Institute. It is located on the same campus in Ås, outside Oslo, and uses publications from the Institute to disseminate its research results.

The budget of the Department is 21 million NOK. Two thirds comes directly from central government, and the rest from the Research Council of Norway or other sources.

### Graduate studies

Each year, 25 students start the 5-year program in forestry at the Agricultural University of Norway. In addition, another 20 students who have completed a 3-year-program at regional colleges continue by taking a 2-year program at the university.

The students specialize in forest ecology, technology or economics.

### Recent dissertations from the Agricultural University of Norway

- Janne Kjønnaas, Carbon storage in the boreal region and strategies to counteract increases in greenhouse gases in the atmosphere.
- Ståle Størdal, The economics of timber sales – studies of the Norwegian roundwood market.

Further info: [www.nlh.no](http://www.nlh.no)

## Examples of ongoing forest research at the University

### Laser scanning

The Department of Forest Sciences has a broad research portfolio, in which remote sensing and other methods of inventory are strongly represented. Laser scanning is a relatively new technique that has great potential in the forestry sector. By scanning the terrain quickly and with high precision from an aircraft, much more detailed information can be obtained than is possible from satellite

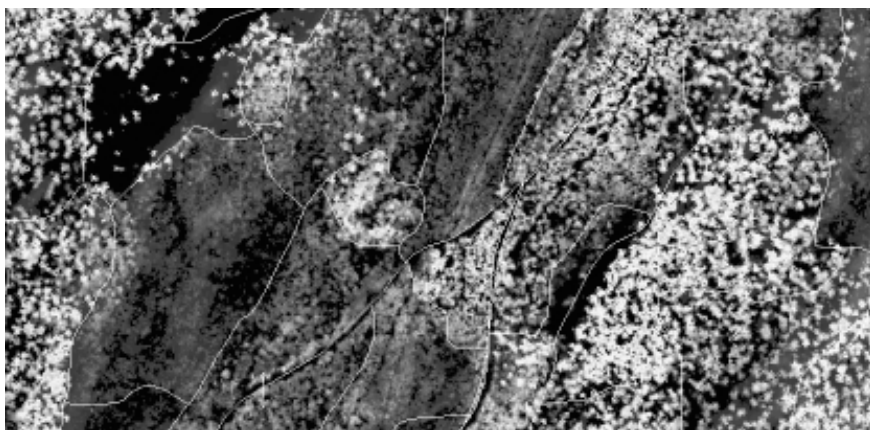
images. The laser equipment “reads” “swathes” of earth by generating (and monitoring) 10,000 laser pulses per second, while the aircraft flies at normal speed. With the aid of GPS in the aircraft, the position of each of the pulses is known with a precision of 30–40 cm.

For further information, contact [erik.naesset@isf.nlh.no](mailto:erik.naesset@isf.nlh.no).

### Responses to climate change

A new program has been set up at the Agricultural University with the aim of learning more about the capacity of trees to survive and adapt to climate change. The total budget of 22 million NOK over five years is being shared by several research partners, both within and outside the Agricultural University. The research is focusing on the fundamental processes controlled by photoperiod and temperature, down to the gene level.

The contact person at the Department of Forest Science is Aksel Granhus [aksel.granhus@isf.nlh.no](mailto:aksel.granhus@isf.nlh.no)



A forest map based on areal laser scanning. The lighter the colour is, the higher is the forest. The white lines are borders between stands.

## The Norwegian Forest Research Institute – Skogforsk

The Norwegian Forest Research Institute (Skogforsk) is an independent institute that is accountable to the Ministry of Agriculture. Skogforsk was established in 1917 and has about 120 employees, most of whom work at the headquarter in Ås, outside Oslo, but there is also a research station in Bergen. The mission of the institute is to be a leading provider of information for government, industry and the general public, working towards sustainable management of forest resources. The research is divided

between two units, each covering a wide variety of research topics. Biodiversity, climate change, forest damage, genetics and physiology are important subjects in the Department of Forest Ecology and Environment. Meanwhile, the Department of Production, Techniques and Processing covers subjects such as silviculture, forest operations, logistics and economy, bioenergy and Christmas tree production.

[www.skogforsk.no](http://www.skogforsk.no)

### Example of ongoing research at Skogforsk

#### Effects of climate change on spruce bark beetle dynamics

An example of the wide variety of projects currently being pursued at Skogforsk is the research related to spruce bark beetles. A general temperature increase may lead to a northward expansion of the areas in which the spruce bark beetle can complete two generations per year. This could increase the damage they do to trees. Observations from 23

years of monitoring in southern Norway are used to model the response of the beetle to climate.

Contact: [bjorn.okland@skogforsk.no](mailto:bjorn.okland@skogforsk.no)



## The Norwegian Institute of Wood Technology (NTI)

NTI is an independent research institute, established in 1949. It serves 160 member companies representing the Norwegian sawmill and timber industries. As well as undertaking research, the NTI performs various quality control and laboratory tests. Its laboratories are accredited for testing mechanical and chemical properties of wood-based products, and it is heavily involved in quality assurance procedures related to the timber trade. The Institute has an annual turnover of NOK 27 million, and 37 employees. [www.treteknisk.no](http://www.treteknisk.no)

## Norwegian Institute for Land Inventory (NIJOS)

NIJOS is the major supplier of data on soil, forest, outfield and landscape resources in Norway. Through national forest inventory and forest health monitoring programs it provides data used for planning in the forest industry and the development of environmental policies.

[www.nijos.no](http://www.nijos.no)



## Clippings from Norwegian forest research

### Timber imports introduce pest risks

Timber from Russia and the Baltic countries contains many species of beetles and fungi. This was a finding in a study of five boat-loads imported to Norway. Most of the species were previously known from Norway, but five of them were new.

One of the new species is known to cause damage in Finnish forests, and the researchers recommend further controls on timber imports.

Source: Aktuelt fra skogforskningen 4/03.

### Trees have an effective immune defence

Conifers have a twofold defence system towards blue-stain fungi introduced by bark beetles:

- a) "a standing force" consisting of thick layers of cork and lignin in the outer bark, together with terpenes, phenols and tannins in the wood.
- b) an inducible system, activated when the tree is under attack. Phenols and tannins are then directed to the affected wood. Mechanical barriers containing cork are also rapidly constructed.

Source: Glimt fra skogforskningen 5/2003

### Forestry affects the capercaillie population

The capercaillie (great wood grouse, Tetrao urugallus) is a quite common bird in the Norwegian forests. The population is estimated to amount to some 200,000 birds in the spring, though it varies substantially between years. Predators, such as fox and marten, are the major regulating factors, though harsh weather conditions may affect the mortality of the chicks considerably in some years.

Harvesting and other silvicultural activities affect the capercaillie population, but mainly indirectly through their influence on the predator populations.

Source: Glimt fra skogforskningen 3/2002

## Increased demand for wood in Europe

**There are good prospects that the demand for wood as a raw material for sawn timber, paper and energy will increase strongly in Europe, despite increases in the use of recycled paper, which today constitutes 42% of the raw material for paper production.**

Bioenergy currently provides 2.7% of the energy consumed in Europe. However, the goal of the EU is to increase this figure to 12%. When it comes to sawn timber for building purposes, many countries both inside and outside the EU are funding advanced projects to stimulate the use of wood. Holland, for instance, aims to increase the amount of wood used in building construction by 20%, at the expense of non-renewable materials. France is striving to increase the use of wood by 25% in 10 years, and the

Swiss program "Holz 21" aims for a 20% increase in five years. The forest stock in Europe has increased substantially in recent decades, and the harvest could be increased by 50% while keeping within sustainable limits. So, raw material seems to be available that could meet the predicted increases in demand.

*Source: www.trae.dk*

*Recycled paper is a growing source of raw material for the paper industry. Even so, there is still a growing need for wood in Europe.*



## New Swedish seed orchard programme —more than \$12 million investment

**The leading players in the Swedish forestry sector have agreed to collaborate on a new crop of seed orchards.**

The new orchards will create future stands that will achieve 15–20% higher production than in today's stands grown from seed of best unbred provenance, and 10% higher production than that in stands grown from the seed orchards that are starting to produce seed now.

It is estimated that establishing and managing the new orchards will cost

more than US\$12 million over 20 years.

The board of the Forestry Research Institute of Sweden has given the go-ahead for the production of a plan for the new seed orchards. It should include the seed requirements of Skogforsk members in different parts of the country, how and where orchards are to be established, and a schedule based on the demand for seed and the rate at which the breeding should progress.

Skogforsk will have overall responsibility for the establishment of the new



seed orchards, while the major forest owners and seedling nurseries will appoint a joint board for coordination of the programme at the national level.

The local and regional members will then be responsible for their respective shares of the orchards.

*Source: Skogforsk News No. 1 2003*

## Contact News & Views

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- short
- relevant to the Journal
- interesting for the readers.

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