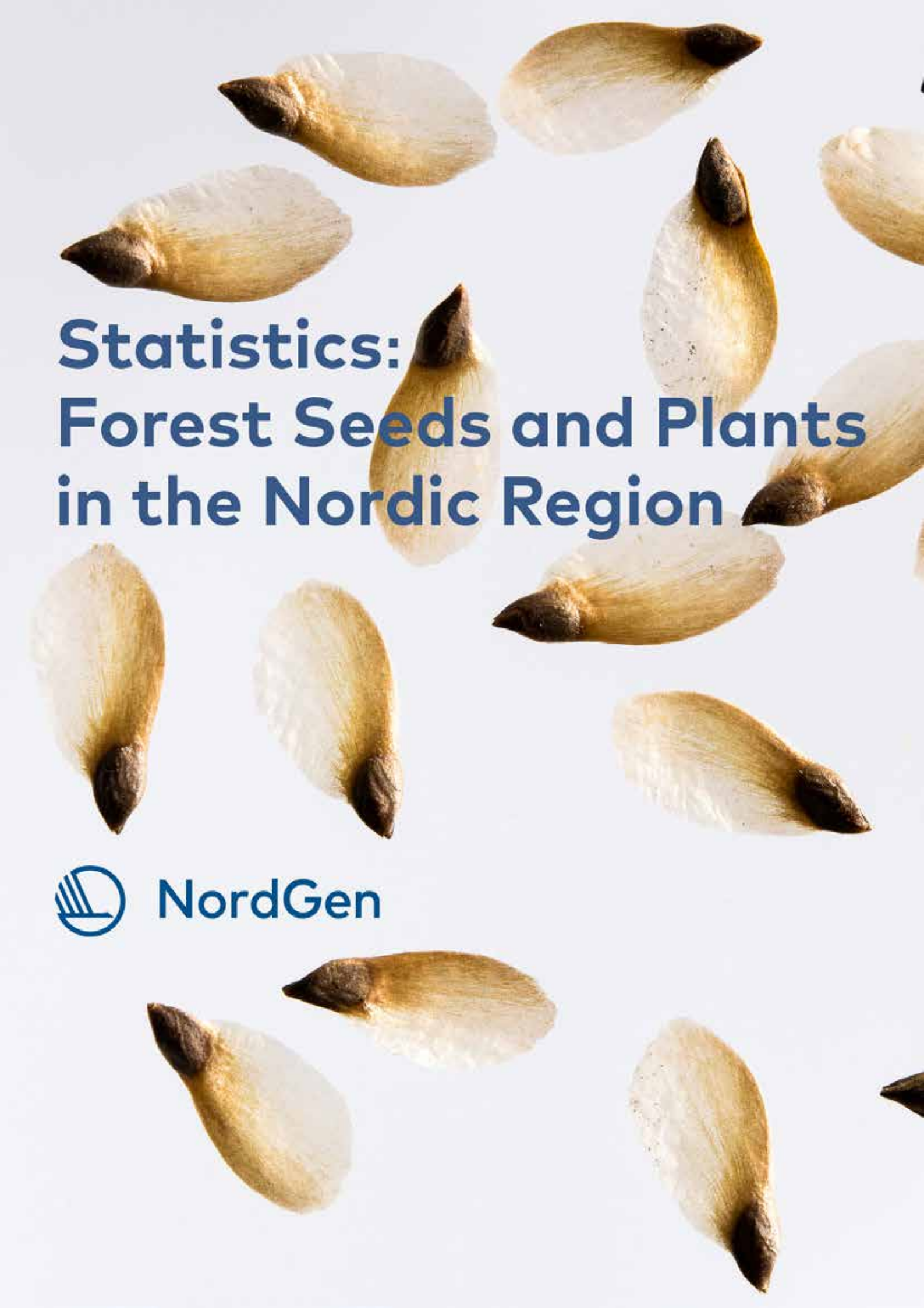

Statistics: Forest Seeds and Plants in the Nordic Region

NordGen

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Preface

This is the first edition of a report on statistics on forest seeds and plant material in the Nordic countries. The report is primarily based on country reports (2013-2020), from the Nordic cooperation, through NordGen Forest Regeneration Council. In addition, the statistics has been complemented by data from Skogsstyrelsen (SE), LUKE (FI), Icelandic Forest Service (IS), Finnish Food Authority Ruokavirasto (FI), Naturstyrelsen (DK) and Skogfrøverket (NO).

It varies which periods we had data from for the different countries and which type of data that was available. The latest data included are from 2019. In this edition we have tried to find comparable species groups and types of data to report. For this first version of the report the aim is to make use of the data which are already at hand. For future reports more coherent data is expected.

Top photo: John Yngvar Larsson/NIBIO.

Spruce plants, photo: Erling Fløistad/NIBIO.

Authors

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Please contact NordGen Forest if you are interested in further statistics, see "About This Publication" for contact information.

Spruce plant, photo: Inger Sundheim Fløistad.

Seeds and Seedlings for Forest Regeneration in the Nordic Forestry

In the Nordic countries, forests have always played an important role. Forests provide wood and bioenergy, protection against wind and erosion, support biodiversity and act as carbon dioxide sinks, as well as important arenas for outdoor recreation and human health. When it comes to climate change, the forest is especially important because it binds carbon dioxide throughout its lifetime. In addition, timber can replace other materials that give large emissions when produced.

For all these purposes, it is important to keep a healthy and resilient forest, with sufficient genetic diversity for adaptation to climate change. Sufficient regeneration with the proper seed and plant material is crucial.

Forest regeneration after harvest may be executed differently in the Nordic countries, and for the various species, either by natural regeneration using seed-trees, by direct sowing or by planting of seedlings[1]. For the main commercial species, planting of seedlings based on genetically improved seeds are used when such seeds are available.

This report aims at giving an overview of the use of seeds and seedlings in the Nordic countries, with key statistics from Denmark, Finland, Iceland, Norway and Sweden.

Top photo: Erling Fløistad/NIBIO.

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NordGen Forest

NordGen Forest is a Nordic body dedicated to forest regeneration, plants, seeds and genetic resources. Our main goal is to contribute to the establishment of the best possible Nordic forests for the future, through knowledge exchange and dialogue. NordGen Forest is supported by two networks, the NordGen Forest Regeneration Council and the NordGen Forest Working Group on Genetic Resources, each with members from all the Nordic countries.
NordGen – the Nordic Genetic Resource Center – is a Nordic organisation dedicated to safeguarding and sustainable use of cultivated plants, farm animals and forest trees.

1. Seedlings are in this context very young trees, perhaps one or two years old, that have been grown from seeds in a nursery.

Seed and Seedling Production

Top photo: Michael Angeloff/NIBIO.

Choice of species for forest production varies across the Nordic region based on which tree species are naturally occurring and which thrive and produce under different climatic conditions. This, and the fact that data are scarce, makes comparisons difficult across countries. For some species and countries, data are put together, for others, data are presented for single countries only.

Seedlings in Sweden, Finland, and Norway

As an overview of the most important species in the production chain for the different countries the amount of seedlings delivered to the forestry in 2019 is shown below (Figure 1).
In Finland, Sweden and Norway the two conifers Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*) make up most of the plant production for forestry. Norway spruce makes the biggest share for commercial production of these two due to the large extent of natural regeneration and direct seeding of pine. Sweden has the largest forest area while Norway has the smallest among these three countries.

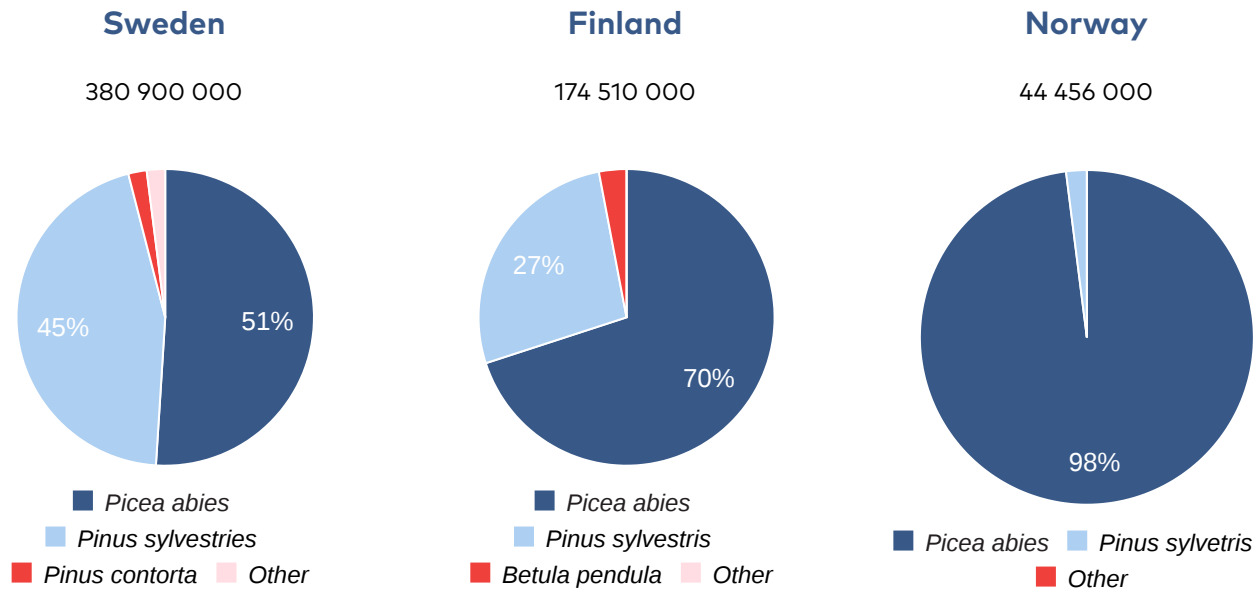


Figure 1

Percentage of seedlings delivered to Swedish, Finnish and Norwegian forestry in different species categories in 2019. Imported seedlings are not included for Finland. Seedling statistics for Denmark is not available.

Seedlings in Iceland

The main species used for afforestation in Iceland is the native birch (*Betula pubescens*). Silver birch (*Betula pendula*) may be an alternative in lowland areas with increasing temperatures. Seeds are collected in the wild or from planted trees. Other important species in Iceland include *Larix sibirica*, *Larix decidua* and the hybrid *Larix sibirica x Larix decidua, Populus trichocarpa, Pinus contorta, Picea sitchensis, Picea glauca* and *Abies lasiocarpa* (Christmas trees).

Birch forest, photo by Katri Himanen/Luke.

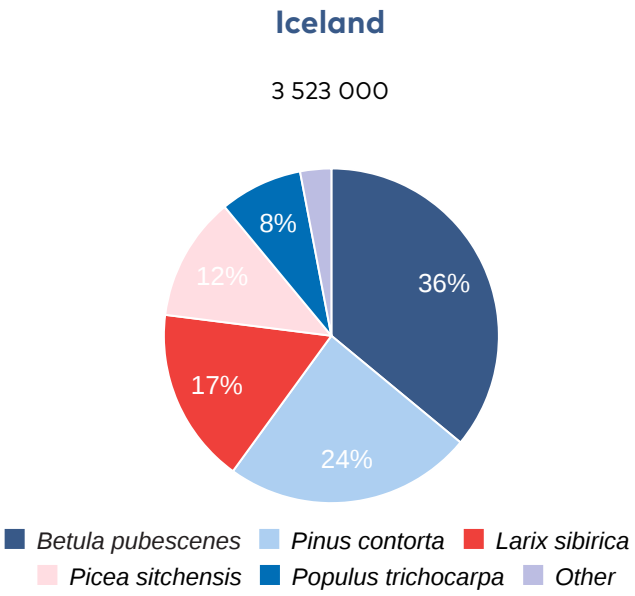


Figure 2

Percentage of seedlings delivered to Icelandic forestry in different species categories in 2019.

Afforestation in Iceland

The forestry sector in Iceland aims to increase the forest cover from slightly above 1% to 12% within the year 2100. After a steady increase in the number of planted forest seedlings since 1990, a significant obstacle for the afforestation project has been the economic recession starting 2008, causing the seedling market to decline.

After years of cutbacks the afforestation budget started to increase again, a development that must be seen in connection with the plan to reduce carbon emission by increased sequestration and meeting the goals of the Paris Agreement on Climate change. A plan for mitigation of climate change was announced in 2019. It aims at doubling afforestation and revegetation efforts. A system for trade of carbon sequestration is expected to cause a higher private financing of forestry in Iceland in near future.

Seedlings in Denmark

Seedling statistics for Denmark is not available. As an overview of the most important species in the Danish forestry, the proportions of the total forest area covered by each species are presented in the pie chart below. It is important to note that the conifers are planted and introduced species, whereas for instance beech (*Fagus sylvatica*) and sycamore (*Acer pseudoplatanus*) often are regenerated naturally. Furthermore, the use of seedlings per area would be much higher for short-rotation Christmas trees (e.g. *Abies* species) than for typical long-rotation species such as oak (*Quercus spp*).

Spruce in bloom, photo Dan Aamild/NIBIO.

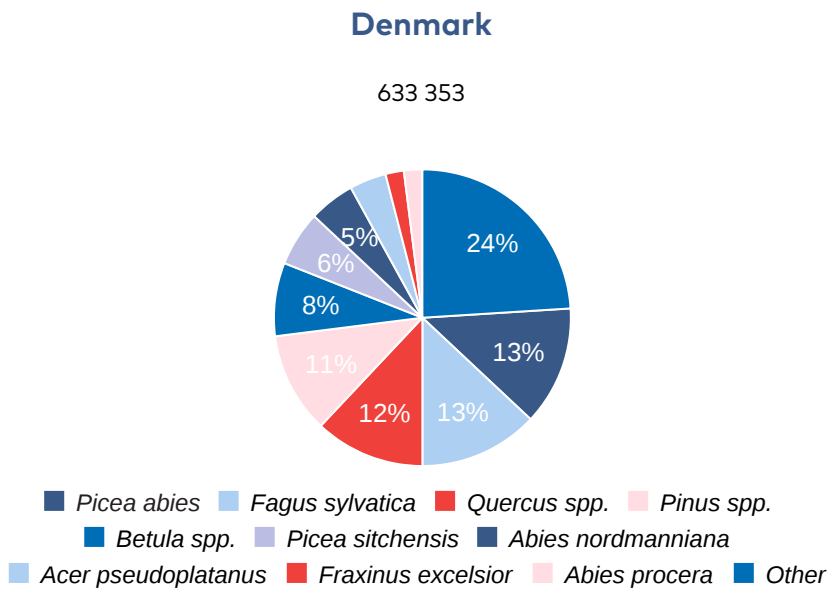


Figure 3

Forest area (in hectares) occupied by the different tree species in Denmark (Nord-Larsen, Johannsen et al. 2020).

Spruce, Pine and Birch (2006-2019)

The deliverance of seedlings to forestry for Norway spruce (*Picea abies*), Scots pine (*Pinus sylvestris*) and birch (*Betula spp.*) is presented for the years 2006-2019 for Norway, Sweden and Finland (Figure 4).

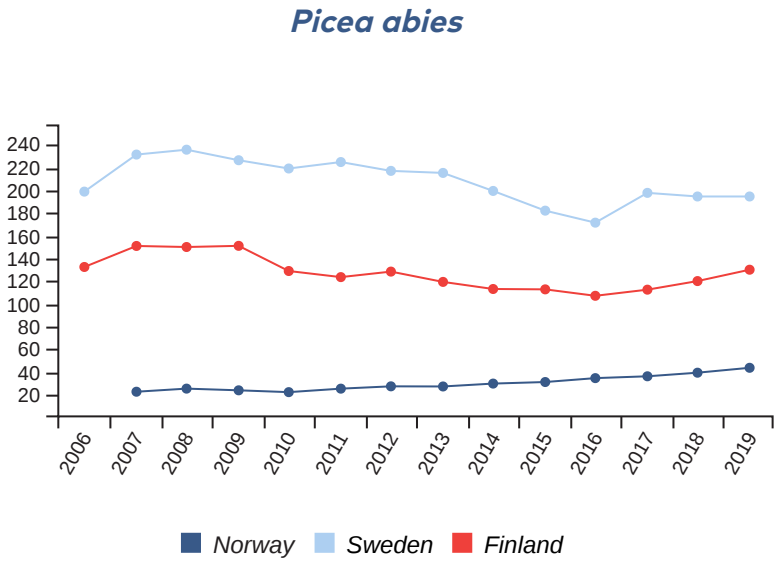
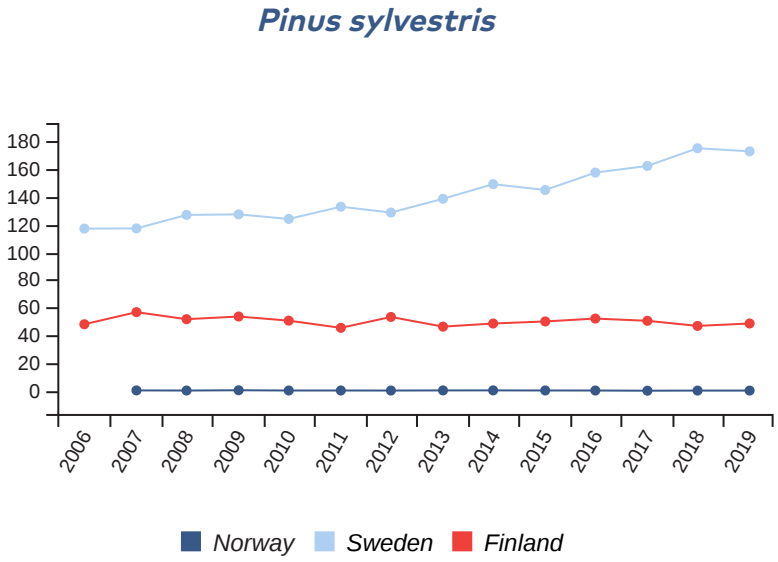


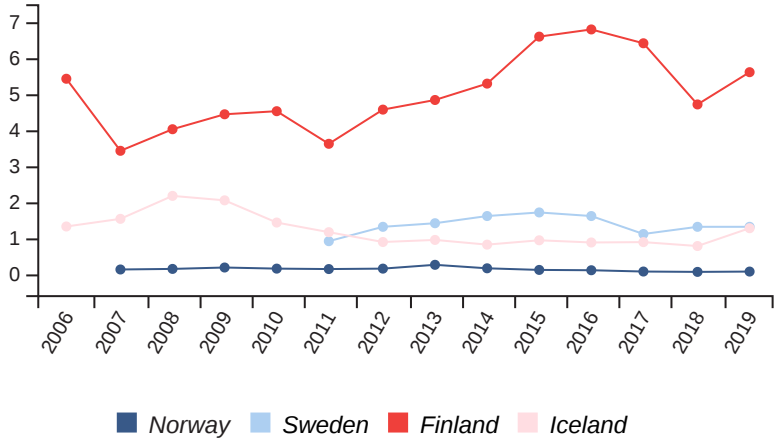
Figure 4

Number of million seedlings of Norway spruce (Picea abies), Scots pine (Pinus sylvestris) and birch (Betula spp.) delivered to the forestry/planted in each country and year. The category birch (Betula spp.) contains aggregated numbers for all species of birch where data were available. The low numbers of pine seedlings in Norway is due to the fact that pine traditionally has been regenerated naturally.



Natural regeneration of pine plant. Photo: John Yngvar Larsson/NIBIO.

Betula spp.



Birch with male and female flowers. Photo: Dan Aamild/NIBIO.

Forest for Climate Mitigation in Norway

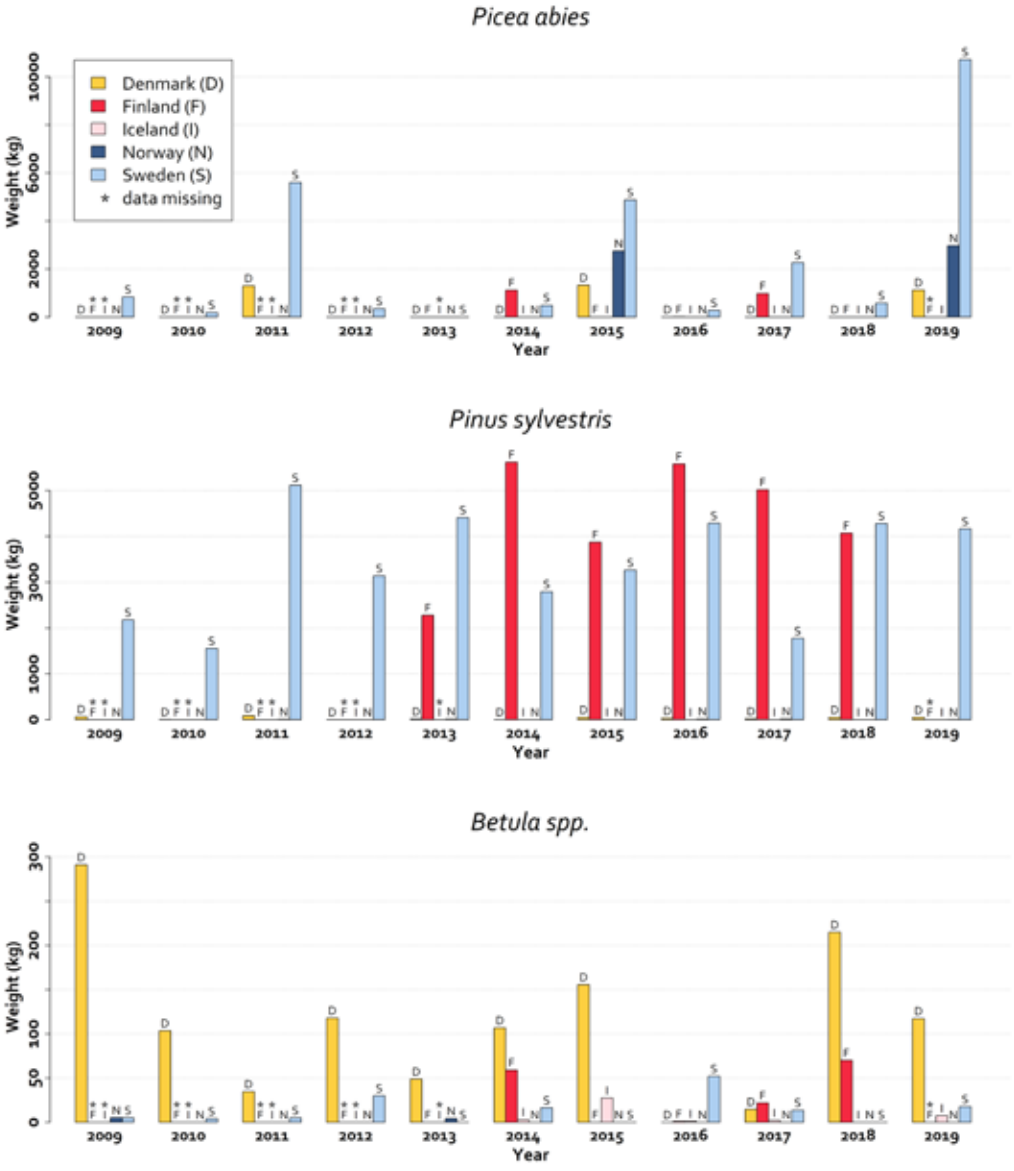
In 2016 NOK 33 mill was allocated to climate mitigation measures within the forest sector in Norway. The funds were divided into three different uses; denser planting of forest, fertilization and breeding. There was a shortage of spruce seedlings in Norway the same year. Political aim and increased funding for climate mitigation measures, including denser planting of forest, caused a growing demand for seedlings.

In Sweden, scots pine has steadily increased in use during the last decade. One reason for this is probably the decline in reforestation by natural regeneration that has been noted during the same period. Drought and forest fires in 2018 caused low reforestation activities that year and destruction of millions of seedlings.

Seed Production in the Nordic Countries

The seed production for Norway spruce (*Picea abies*), Scots pine (*Pinus sylvestris*) and birch (*Betula spp.*) is presented for the years 2009-2019 (Figure 5).

Top photo: Spruce seeds, Dan Aamlid/NIBIO.



Norway spruce does not produce seeds every year, and every now and then there is a substantial seed production in good *seed years*. Seed production is more frequent in Scots pine (Figure 5).

In Norway, the price of improved seed orchard seed was raised by 50% in 2016, based on the inclusion of a breeding fee. As mentioned above in chapter *Seedlings,* political will caused a demand for both seedlings and seed, and the sale of spruce seeds increased strongly in 2016 and the proportion of sold seeds from seed orchards increased to 90% in 2017.

For spruce in Finland, there was a poor seed ripening in autumn 2013. There was a good crop of Norway spruce in 2012. The last good crop before that was in 2006. Due to an exceptionally large crop of *Betula pendula* in 2012, no seed was harvested in 2013. The 2012 crop of birch was the largest in 30 years. There was a drop in the proportion of birch seeds produced in seed orchards in 2016, and storages of such seeds were almost empty. There was a poor seed crop of Norway spruce in 2016.

In Sweden the production of Norway spruce seed in 2015 was good, whereas in 2016 it did not meet the demand. Seed production of Scots pine was normal in 2015 and 2016.

In Denmark a large harvest of *Fagus sylvatica* was obtained in 2009 and 2019, and there was a normal harvest in 2011. The danish seed orchards of *Abies nordmanniana* contributes increasingly to the seed supply. Good quantities were obtained in 2009, 2014 and 2019.

Figure 5

Seed production for Norway spruce (Picea abies), Scots pine (Pinus sylvestris) and birch (Betula spp.) in countries and years (year of ripening/harvest). Data were not available for Finland in 2019 and before 2013, and for Iceland before 2014. When comparing these species by mass seed production it is worth noting that birch seeds weigh considerably less than seeds of spruce and pine (e.g. around 1/10).

Succulent spruce shoots (*Picea abies*), photo: Dan Aamild/NIBIO.

Seed Quality

All seeds produced in the EU must come from officially approved and registered basic material, such as seed orchards or seed stands. A Master Certificate is issued to each seed lot after collection and is required for marketing forest reproductive material. It assures that seeds are collected from an approved basic material and include information on the type of basic material, phenotypic and genetic quality and origin of the material. Forest reproductive material coming from countries outside the EU may be imported to and marketed in the EU if it affords the same assurances as the material produced in the EU, based on the OECD Certificate of Identity or Certificate of Provenance.

Seeds and Seedlings Crossing Borders

Apart from the national production of seedlings, there has also been a market for imported material, mainly of Norway spruce (*Picea abies*), between the Nordic countries as well as from Germany and the Baltics (Figure 6). The amount of imported plants varies among years and countries and may constitute a significant proportion of the total number of planted seedlings. For instance, in Sweden the import of plants varied between 35 and 53 million plants per year in the period 2009-2015, which is roughly 10 to 15 percent of the annual number of plants used. Imported plants are sometimes produced with seeds from the country which receive the plants. In those cases, there is no import of foreign genetic material. Iceland does not import seedlings due to plant health risk issues.

Seeds on the other hand are subject to some import in all the Nordic countries, and Iceland imports, or has imported, seed of many exotic tree species, the most important of which are *Pinus contorta*, *Larix sp.*, *Picea glauca*, *Picea sitchensis*, *Picea abies*, *Pinus sylvestris, Alnus sp., Betula pendula* and *Abies lasiocarpa*. *Picea abies* and *Pinus sylvestris* are important species whose seeds are subject to import/export among Nordic countries, but also species of for instance *Larix* and *Quercus* have been traded.

Top photo: John Y. Larsson/NIBIO.

Young seedlings in a small cultivation chamber. Photo: Lars Sandved Dalen/NIBIO.

Figure 6

The illustration gives an idea of the trade to and within the Nordic countries during the last decade. Graphic: Claes Uggla.

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Cover photo: Dan Aamlid/NIBIO.

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Nord-Larsen, T., et al. (2020). Skovstatistik 2019: Forest statistics 2019, Institut for Geovidenskab og Naturforvaltning, Københavns Universitet.

NordGen

The Nordic Genetic Resource Centre (NordGen) is the Nordic countries' gene bank and knowledge center for genetic resources. NordGen is an organisation under the Nordic Council of Minister and works with the mission of conserving and facilitating the sustainable use of genetic resources linked to food, agriculture and forestry.

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