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Picea abies in Northrhine-Westphalia

Abstract: The Sauerland region of southern Westphalia has the most economic stands of Norway spruce in the state of Northrhine-Westphalia (Germany). As shown by historical research and genetic analysis, the seeds for these stands were imported from Thuringia around the year 1880. Therefore, the two states are collaborating closely to secure the genetic variety of the spruce and develop new sources of seed supply. The survival of the Hochsauerland Norway spruce is now under threat: these stands have already been harvested or are due for harvesting shortly, in addition, many of the older stands were destroyed by the gale “Kyrill” in 2007, and only a few stands have remained. Since its foundation, the Forest Gene Bank of Northrhine-Westphalia has taken the following measures to preserve the gene pool of the Hochsauerland spruce and conserve it in the long term: storage of seed from 100 representative trees in all the most valuable stands of spruce (since 1985); establishment of seed orchards; and establishment of replacement stands. Thanks to those measures, the genetic information of the Norway spruce stands of Thuringian origin has been secured, and substantial stocks of seed are available for reforestation.

Additional key words: Sauerland region, Norway spruce, survival, gene resources, seed storage, seed orchards

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Introduction

In the state of Northrhine-Westphalia, approximately 310 500 ha are occupied by Norway spruce. This accounts for about 36% of the area under forestry cultivation, which makes spruce the most important species of tree from a purely economic point of view (Table 1).

The high proportion of spruce is entirely due to human cultivation. Historically, the woodland of Northrhine-Westphalia was dominated by a mixture of beech and oak until man began to over-utilise these stocks for economic ends and later to replace them with coniferous species which produce a higher yield (Schulte 2003).

The most economic stands of Norway spruce in Northrhine-Westphalia are located in the Sauerland region of the state. Historical research and genetic analysis have shown that the seed for these stands

was imported from Thuringia around the year 1880. Northrhine-Westphalia is therefore working closely with the state of Thuringia in order to secure the genetic variety of Norway spruce and develop new

Table 1. Tree species cultivated in Northrhine-Westphalia (percentage by area; total forestry area = 915 800 ha)

Tree species	%
Oak	15
Beech	16
Other deciduous species, high U	6
Other deciduous species, low U	12
Poplar	3
Spruce	36
Pine	8
Larch	3
Douglas fir	1

sources of seed supply. The survival of the Hochsauerland Norway spruce is under threat. These stands have already been harvested or are due for harvesting shortly. In January 2007, the gale known as "Kyrill" did extensive damage to the forests in Northrhine-Westphalia. Many of the existing older stands of Hochsauerland spruce were destroyed, and only a few stands have remained.

An outline history of spruce in Northrhine-Westphalia

Spruce first made its appearance in Northrhine-Westphalia in the 18th century through artificial cultivation, i.e. in a landscape and region where it was not a native species. The cultivation of spruce in Northrhine-Westphalia is documented from the middle of the 18th century. The cultivation of coniferous wood is ordered in a wood, forest and boundary ordinance of 1771 in the Lippe region, and as early as 1750 a number of "spruce gardens" are mentioned in a description of the woodland in this area. In 1756, a forester named Feige mentions a plantation of spruce (also in the Lippe area), while in 1768, Fischbach reports the purchase of spruce seed from the principality of Gotha. In the Wittgenstein region, the first known import of spruce seed took place in 1746. According to this source, Prince Friedrich Karl married Frederike von Schwarzburg zu Sondershausen, who brought an unknown amount of spruce seed with her. In the northern Sauerland area, spruces are mentioned for the first time in 1755/56 as being in the possession of the Freiherr von Weichs, near Eslohe. In 1771, spruce seeds were purchased for the Bishopric of Münster, and in Kleve the purchase of seeds from Königsberg is recorded in 1773 (Hesmer 1958). Initially, the spruce seed material was obtained from the southern area of Lüneburg Heath and other random parts of Germany. Established suppliers are not mentioned until the 19th century.

Today, the southern part of Westphalia has particularly high stocks of spruce. In the Sauerland and Siegen-Wittgenstein regions, spruce completely dominates the landscape, occupying over 60% of the forest area. It is there that the spruce stands are located which are particularly interesting from a genetic point of view and for the harvesting of seed material. In northern Sauerland, much seed was purchased from the southern and western parts of the Harz hills in the 19th century, as well as from dealers in Darmstadt. However, it is now very difficult to demonstrate the origins of the older spruce stands. On the other hand, for southern Sauerland and Wittgenstein, historical research and isoenzyme analysis have shown that for much of the 19th century the seed used for woodland planting and rearing in nurseries came from the forests in Thuringia (Rogge et al. 2006). According to in-

voices, receipts and other archived documents, the seed purchased in the years between 1841 and 1875 came almost exclusively from Thuringia. A company known as Hehns (or Helms) & Söhne in Grosstabarz near Gotha supplied particularly large amounts of spruce seed. In the same period smaller amounts of spruce seed were also purchased in southern Germany, especially from dealers in Darmstadt. Supplies were obtained from them in years when the pine-cone and seed harvests in Thuringia were poor. An interesting fact is that the decision to purchase seed from a certain supplier was dictated not only by the quality of the material (plant yield), but also by the appearance of spruce stocks already reared with seed from that particular supplier (Hesner 1958). After 1880, spruce seed continued to be bought from Hehns & Söhne in Tabarz, but preference was increasingly given to the suppliers in the Darmstadt area (Hesner 1958).

Preservation of the genetic resources of valuable spruce in Northrhine-Westphalia

Approved seed stands

After 1970, the Norway spruce stands in southern Sauerland, Siegen and Wittgenstein (some of which were over 120 years old) attracted the attention of the Forestry-Administration Authority in Northrhine-Westphalia in view of their high quality, the fineness of their branches, their apparent resistance to damage by snow, and their general healthy condition. A number of these stands were approved for seed harvesting to supply the forestry industry in the state of Northrhine-Westphalia, and obtained recognition as a distinctive place of origin known as "Hochsauerland".

In an ordinance of 31 May 1972, "Hochsauerland" was officially certified as an area of origin for Norway spruce. Today, the spruce stands are located in the area of origin known as "Rheinisches und Saarpfälzer Bergland", and the stands with the best outward characteristics are approved for reproductive use. The area of origin "Rheinisches und Saarpfälzer Bergland" has 29 stands covering 271.3 hectares at less than 500 metres above sea level ("hill" level), and 41 stands covering 485.9 hectares at 500 metres and more above sea level ("mountain" level; Table 2). Thus, over 92% of the spruce stands approved for reproductive use in Northrhine-Westphalia are located in Rheinisches und Saarpfälzer Bergland, at hill or mountain level. Most of the sites in question are in Sauerland (Rost and Schmitt 1976; Schmidt 1977; Schulte 2003).

Table 2. Spruce stands in Northrhine-Westphalia approved as Selected Reproductive Stock

Name of area of origin	No. of stands	Area (ha)
84001 Norddeutsches Tiefland [North-German Plain]	2	15.7
84004 Rheinisches und Saarpfälzer Bergland [Rhineland-Saarland and Palatinate Uplands] (hill level)	29	271.3
84005 Rheinisches und Saarpfälzer Bergland [Rhineland-Saarland and Palatinate Uplands] (mountain level)	41	485.9
84006 Weser und Hessisches Bergland [Weser and Hessian Uplands] (hill level)	1	47.6
Total	73	820.5

Storage of seed

Since 1985, the Forest Gene Bank of Northrhine-Westphalia has harvested seed from 100 representative trees in all the most valuable stands of Norway spruce. The seed material from each tree has been prepared and stored separately. In addition, 204 fine specimens which appeared to be resistant to air pollution and damage by snow were selected, and their seed harvested for storage fulfil all the requirements for scientific or reproductive use. Large amounts of seed were also stored as a reserve for emergencies.

Seed orchards

In order to secure the genetic information from the original stands as well as the production of high-quality seed material, Northrhine-Westphalia has established a number of spruce seed orchards. Of particular importance is the collaboration between Thuringia and Northrhine-Westphalia in expanding the genetic base of the origins of Norway spruce in the Thuringian Forest and Hochsauerland.

Replacement stands

The genetic information of the Hochsauerland spruce is preserved in replacement stands established with plants raised from the seed produced by the older stands. As soon as the trees fructify, it will be possible to make the genetic material available at any time.

Conclusion

Since its foundation, the Forest Gene Bank of Northrhine-Westphalia has dedicated itself to secur-

ing the genetic information of Hochsauerland Norway spruce and conserving it in the long term. The main focus of these activities is as follows: storage of seed; seed orchards; and replacement stands. In 2007, the gale "Kyrill" did extensive damage to the forests in Northrhine-Westphalia and destroyed a lot of the valuable stands of Hochsauerland spruce. However, the genetic information of the Norway spruce stands of Thuringian origin has already been secured, and substantial stocks of seed are available for reforestation.

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