Provenance variation in subalpine fir grown as an exotic tree species in Denmark and Iceland


Paper I: Damage by *Neonectria neomacrospora* and *Adelges piceae* in provenance trials of subalpine fir (*Abies lasiocarpa*) in Denmark. Forest Pathology.

Paper II: Provenance variation in adaptability and Christmas tree characteristics in subalpine fir (*Abies lasiocarpa*) planted in Denmark and Iceland. Scandinavian journal of forest research.


The Department of Geosciences and Natural Resource Management
Faculty of Science
University of Copenhagen
Denmark
Distribution of subalpine fir

- **Northern limit 64° 30’ N**
- **Southern limit 32° N**
- South eastern Alaska / central Yukon Territory
- Through British Columbia along east slopes of the Coast Range to the Olympic Mountains of Washington, along both slopes of the Cascades to southern Oregon.
- Extends into interior valleys of British Columbia
- From Oregon, distribution more eastern and continental at high elevations in Idaho, Montana, Wyoming, Utah, Colorado New Mexico and Arizona,
Two varieties of subalpine fir are recognised

Corkbark fir (*A. lasiocarpa* var. *arizonica* (Merriam) Lemmon)
- Scattered mountain populations in southern Colorado, Arizona, New Mexico
- White, corky bark and blue needles

Subalpine fir (*A. lasiocarpa* var. *lasiocarpa* (Hook.) Nutt.
- Northern part of distribution area down to northern Colorado
- Brown bark and usually green needles
Experiance with subalpine fir in Iceland

- First planted in 1900
- Some different provenances planted in 1939-1992 with variable result (Skagway-Alaska, Sapinero-Colorado)
- Subalpine fir likes shelter (is shade tolerant) in the first years
- Grows slowly first year and weed control is needed
- 2-3 years old plants should be used (fp24 – 150 cm3)
- Flat areas with high risk for frost should be avoided
- Forming is necessary to rise the number of valuable Christmas trees.
The joint Nordic provenance test, established 1999

- 26 provenances, from most of the distribution area
- Located at three sites in Denmark and one site in each of Finland, Norway and Iceland.
- Each trial contained 48 blocks with 28 single tree plots in each block

Proposition of regional division by Hansen et al. (2004)
Survival and proportion of Christmas trees

N = north, C = central, E = east, W = west, S = south

The Department of Geosciences and Natural Resource Management
<table>
<thead>
<tr>
<th>Kvæmi nr.</th>
<th>Lif.*Jólatré</th>
<th>Kvæmi</th>
<th>Fylki</th>
<th>Br.gr.</th>
<th>HYS</th>
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<tbody>
<tr>
<td>217</td>
<td>74</td>
<td>White River</td>
<td>Br. Col.</td>
<td>56</td>
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<tr>
<td>199</td>
<td>174</td>
<td>Mt. Rainier N.F.</td>
<td>Wash.</td>
<td>47</td>
<td>-</td>
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<tr>
<td>205</td>
<td>271</td>
<td>Cibola N.F., Mt. Taylor</td>
<td>New Mexico</td>
<td>35</td>
<td>2900</td>
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<tr>
<td>204</td>
<td>232</td>
<td>Cibola N.F., Sandria Crest</td>
<td>New Mexico</td>
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<td>2900</td>
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<td>164</td>
<td>189</td>
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<td>Arizona</td>
<td>34</td>
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<td>170</td>
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<td>34</td>
<td>2900-3200</td>
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</table>

Photos: Rakel Jónsdóttir

205 Cibola/Taylor   204 Cibola/S. Crest
Norwegian material - Hallormsstaður

<table>
<thead>
<tr>
<th>Prov. nr.</th>
<th>Sur.*Tree</th>
<th>Provenance</th>
<th>State</th>
<th>Lat.</th>
<th>Elevation</th>
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<tr>
<td>27</td>
<td>134</td>
<td>McGillivray Lake</td>
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<tr>
<td>72</td>
<td>156</td>
<td>Duffy Lake</td>
<td>British Columbia</td>
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<tr>
<td>12</td>
<td>246</td>
<td>Willow Lake</td>
<td>Utah</td>
<td>39°08'</td>
<td>2900</td>
</tr>
<tr>
<td>19</td>
<td>134</td>
<td>The Meadows</td>
<td>Colorado</td>
<td>37°47'</td>
<td>3100</td>
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<tr>
<td>1</td>
<td>141</td>
<td>Spruce Hole</td>
<td>Colorado</td>
<td>37°06'</td>
<td>3150</td>
</tr>
<tr>
<td>8</td>
<td>112</td>
<td>Agassiz Peak</td>
<td>Arizona</td>
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<td>2925</td>
</tr>
<tr>
<td>5</td>
<td>179</td>
<td>Bearwallow Mt.</td>
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<th>Provenance</th>
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<th>Lat.</th>
<th>Elevation</th>
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<tbody>
<tr>
<td>Arapaho</td>
<td>Colorado</td>
<td>40</td>
<td>3400</td>
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</table>

300 - Arapaho
## Best provenances in Haukadalur, Norwegian material

<table>
<thead>
<tr>
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<th>Br.gr.</th>
<th>HYS</th>
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<td>Willow Lake</td>
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<tr>
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<td>Cerro Pavo</td>
<td>New Mexico</td>
<td>36°03'</td>
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</table>

**Photos:** Böðvar Guðmundsson

22 – Cerro Pavo  300 - Arapaho
Recommended provenances to use in Iceland for next 10 years

1. **Cibola N.F. in New Mexico (204 and 205)**
   - Blue type
   - Corkbark fir showed generally superior results, for survival rate and Christmas tree quality.
   - Difficult to get seed

2. **Arapaho in Colorado**
   - Green type
   - Good branch angle for Christmas tree quality

*For the South- and West coast of Iceland?*

- **White River** from British Columbia?
- **Mt. Rainier** from Washington state?
- Both provenances are tolerate for Neonectria
Breeding of subalpine fir
40 plus trees selected in the trials, mostly from the best provenances

Photos (3): Brynjar

Photo: Böðvar Guðmundsson
Breeding of subalpine fir
Shoots from selected trees grafted on rootstocks at Vaglir in the spring 2015

Photos: Pétur Halldórsson
Recommended provenances to use in Iceland after 10 years

Seed orchards in Vaglir – Þelamörk - Eyjafjörður

Three small seed orchards:
1. Green type at Vaglir, Þelamörk (Arapaho main provenance)
2. Blue type at Vaglir, Þelamörk (Cibola main provenance)
3. Few graftet plants in greenhouse at Vaglir, Fnjóskadal to get some seed as early as possible.
Thanks for listening