



Faculty of Science



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

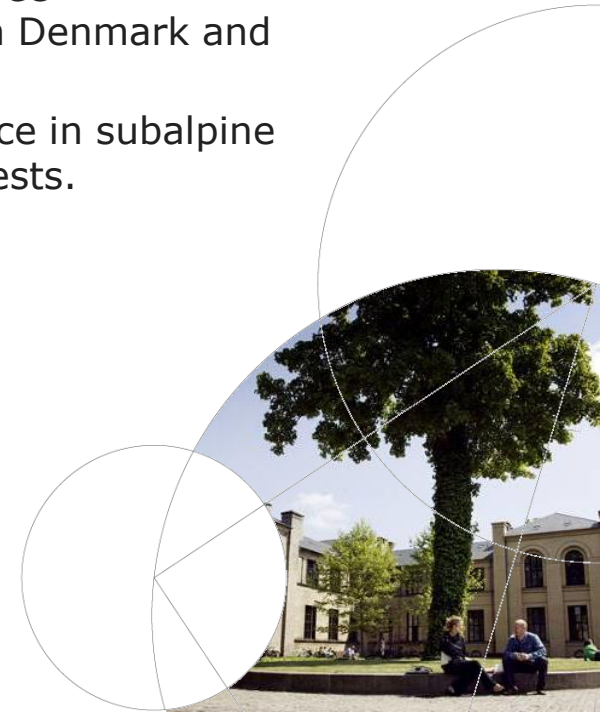
Ph.D. thesis, Brynjar Skulason

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.

Paper III: Provenance variation in phenology and frost tolerance in subalpine fir (*Abies lasiocarpa*) planted in Denmark and Iceland. Forests.

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



Photo: Ole Kim Hansen



Photo: Brynjar

Subalpine fir (*A. lasiocarpa* var. *lasiocarpa* (Hook.) Nutt.

- Northern part of distribution area down to northern Colorado
- Brown bark and usually green needles

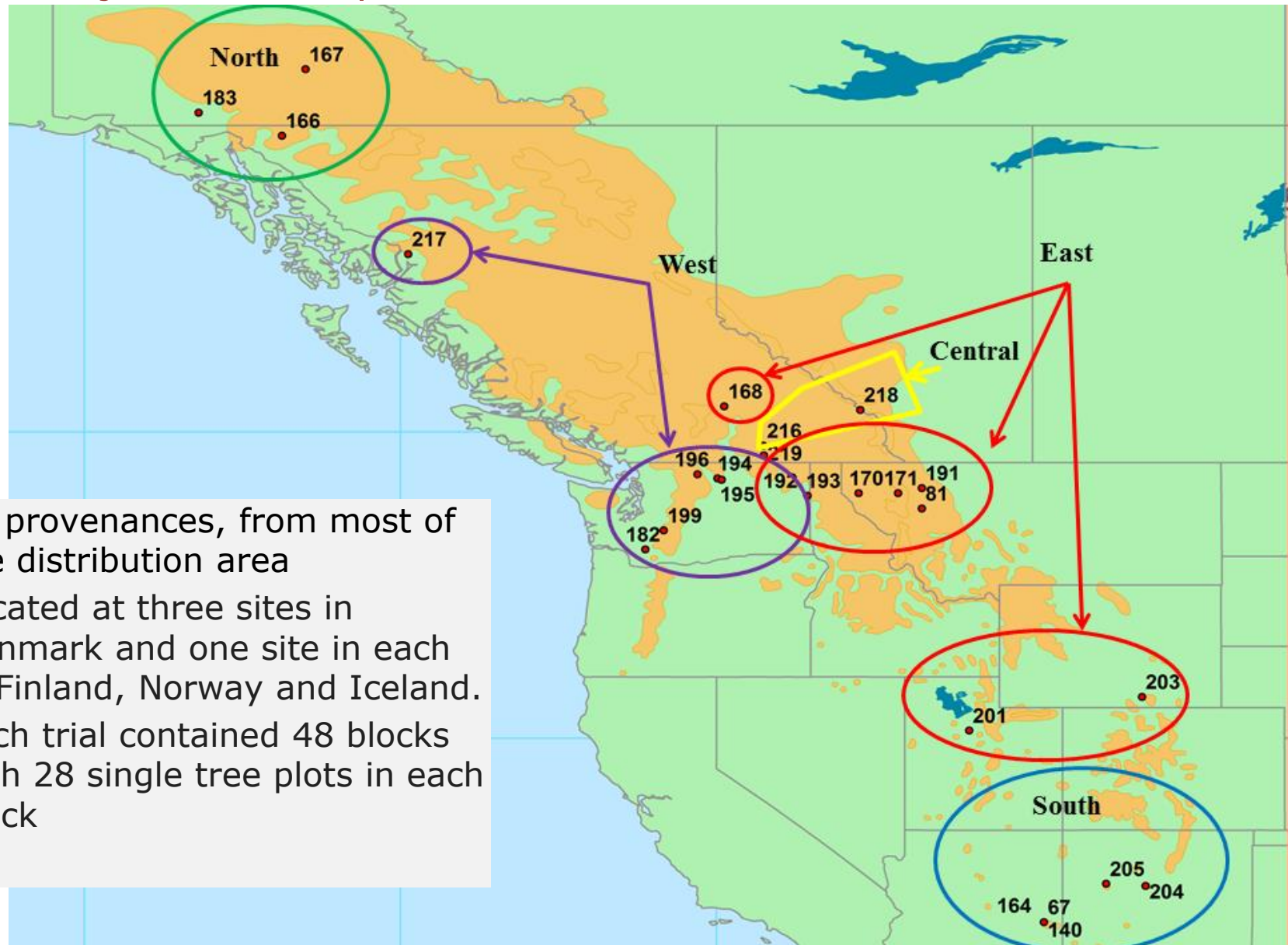


## Experiance with subalpine fir in Iceland

- 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.

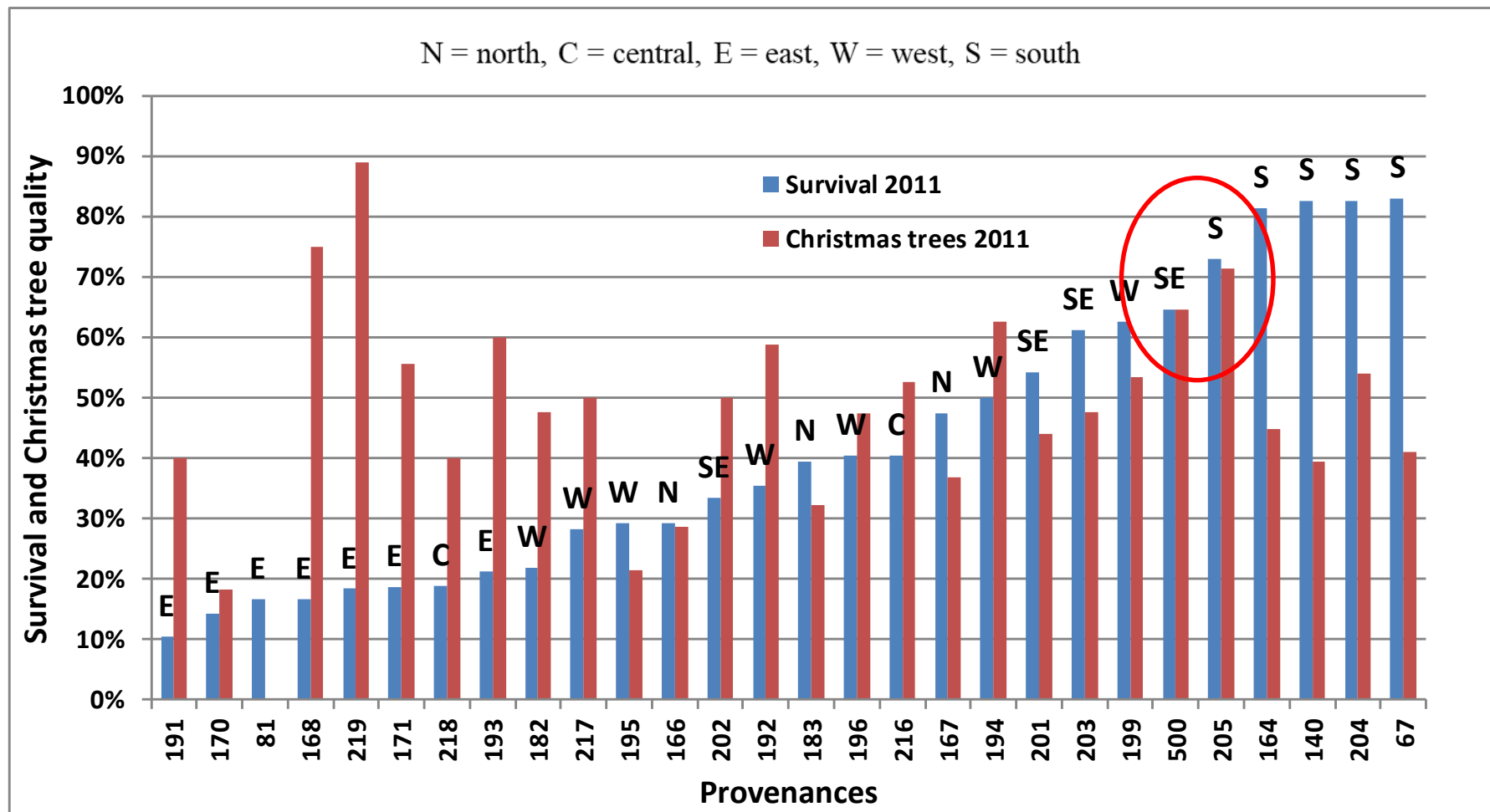


## The joint Nordic provenance test, established 1999

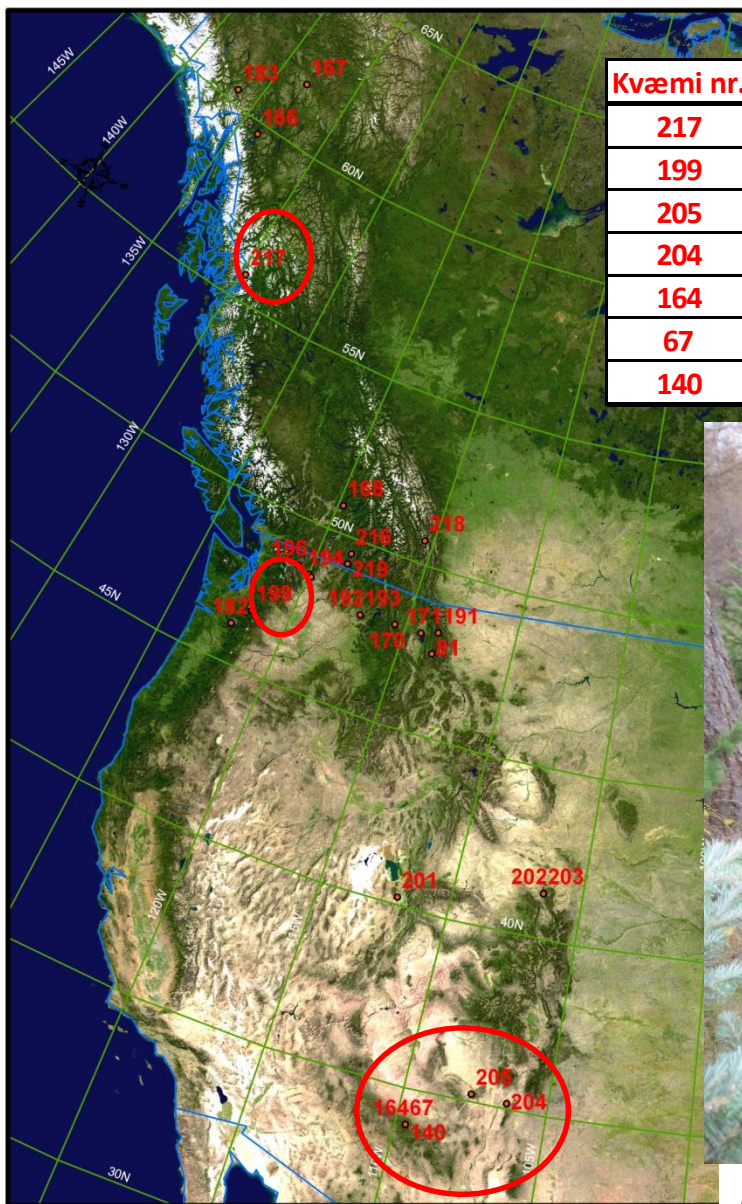


- 26 provenances, from most of the distribution area
- Located at three sites in Denmark and one site in each of Finland, Norway and Iceland.
- Each trial contained 48 blocks with 28 single tree plots in each block

## Survival and proportion of Christmas trees



## Danish material-Hallormsstaður



Kvæmi nr.	Lif.*Jólatré	Kvæmi	Fylki	Br.gr.	HYS
217	74	White River	Br. Col.	56	320
199	174	Mt. Rainier N.F.	Wash.	47	-
205	271	Cibola N.F., Mt. Taylor	New Mexico	35	2900
204	232	Cibola N.F., Sandria Crest	New Mexico	35	2900
164	189	Apache N.F.	Arizona	34	2900-3200
67	177	Apache N.F.	Arizona	34	-
140	170	Apache N.F.	Arizona	34	2900-3200

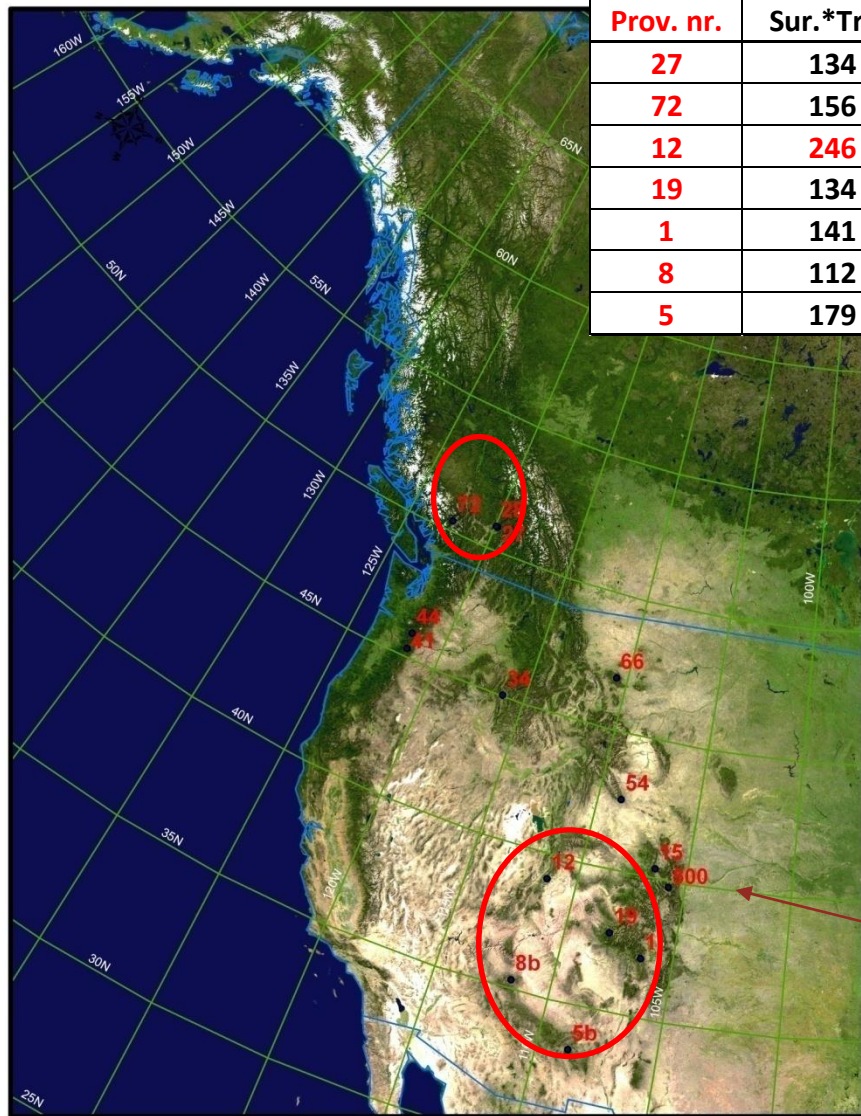


Photos: Rake! Jónsdóttir

205 Cibola/Taylor

204 Cibola/S. Crest

# Norwegian material - Hallormsstaður



Prov. nr.	Sur.*Tree	Provenance	State	Lat.	Elevation
27	134	McGillivray Lake	British Columbia	50°52'	1400
72	156	Duffy Lake	British Columbia	50°23'	1500
12	246	Willow Lake	Utah	39°08'	2900
19	134	The Meadows	Colorado	37°47'	3100
1	141	Spruce Hole	Colorado	37°06'	3150
8	112	Agassiz Peak	Arizona	35°20'	2925
5	179	Bearwallow Mt.	New Mexico	33°27'	2950

Provenance	State	Lat.	Elevation
Arapaho	Colorado	40	3400

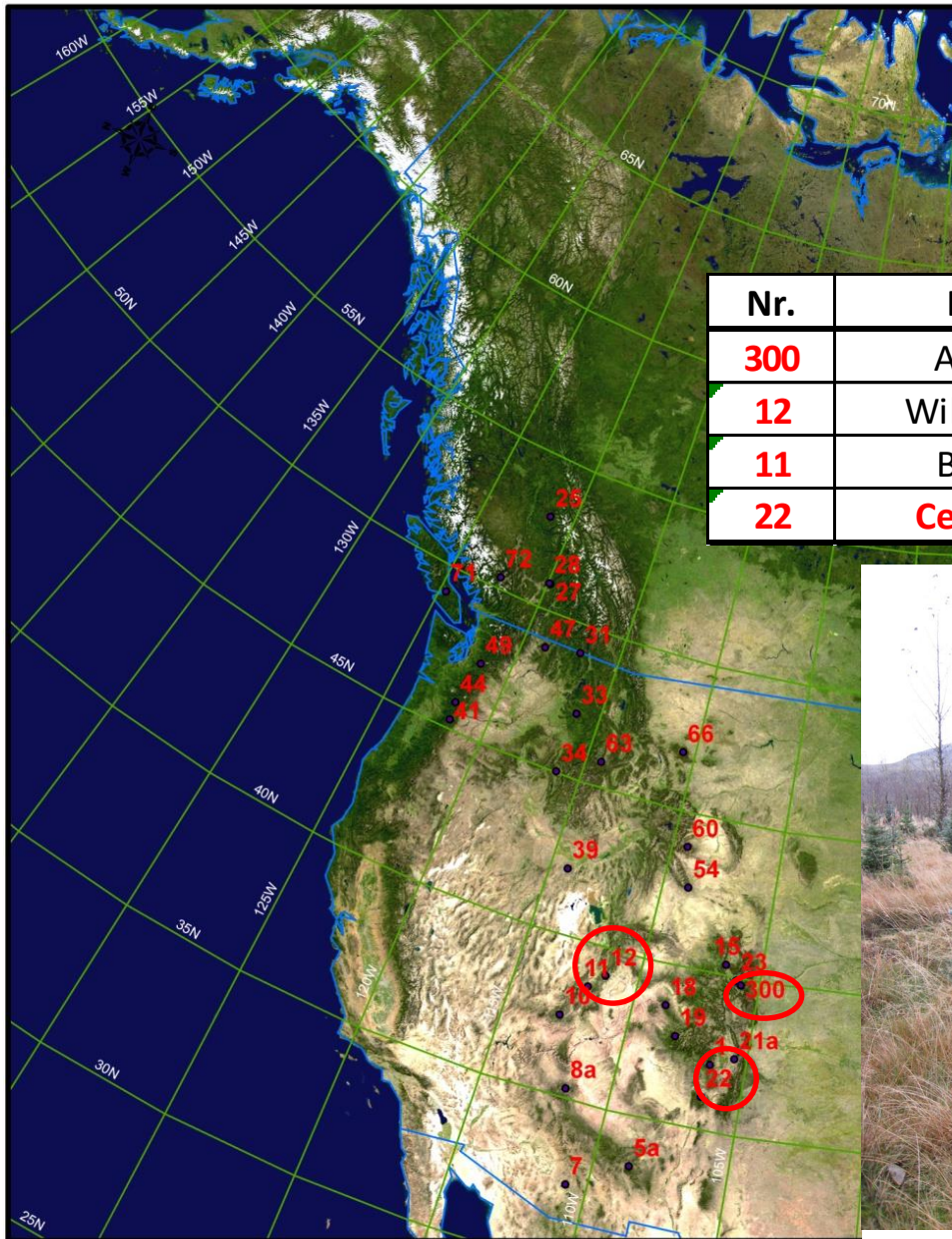


300 - Arapaho



# Best provenances in Haukadalur, Norwegian material

Nr.	Kvæmi	Fylki	Br.gr.	HYS
<b>300</b>	Arapaho	Colorado	39°47'	3350
<b>12</b>	Willow Lake	Utah	39°08'	2900
<b>11</b>	Big Lake	Utah	38°39'	2870
<b>22</b>	<b>Cerro Pavo</b>	<b>New Mexico</b>	<b>36°03'</b>	<b>2900</b>



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



Else Möller and Cibola (205). Photo: Brynjar

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

- **White River** from British Columbia ?
- **Mt. Rainier** from Washington state ?
- Both provenances are tolerate for Neonectria



Photo: Brynjar



## 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 grafted plants in greenhouse at Vaglir, Fnjóskadal to get some seed as early as possible.



