

Metsä

Tieto

Osaaminen

METLA

Hyvinvointi

The history of cultivation of exotic trees in Finland

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Punkaharju

Photos by Teijo Nikkanen,
unless otherwise stated

Reasons for cultivating exotic tree species

- A.** They have higher volume growth than the native ones
- B.** They have better resistance against adverse environmental factors or damaging agents than the native ones
- C.** They have some special qualities or produce some special substances/commodities/values which the native ones are missing

Earliest introductions

- The fruit trees (apple, pear, plum...) before 1600
- In 1700's there were endeavours for replacing imported products with native ones
- → exploring foreign countries for promising species
- → experimenting with foreign species
- The Royal Academy of Turku (Åbo) was central in this work
- The work was guided by the spirit of mercantilism and the Enlightenment

Silk production as an extreme case

- Silk production was developed in Sweden and Finland with support from the Crown
 - growing of mulberry trees (*Morus* sp.)
- Gadd hypothesised that mulberry trees could become acclimatised to northern conditions with time
 - Also other crop plants originate from more southern latitudes
 - warm climate in the middle of 1700's
- Kalm's exploration to North America 1747-51
 - one aim was to introduce a climate resistant mulberry tree to Finland

M. G. H.
BEWIS
TIL MÖIJELIGHETEN
AF

SILKES-AFWE- LENS INFÖRANDE I FINLAND,

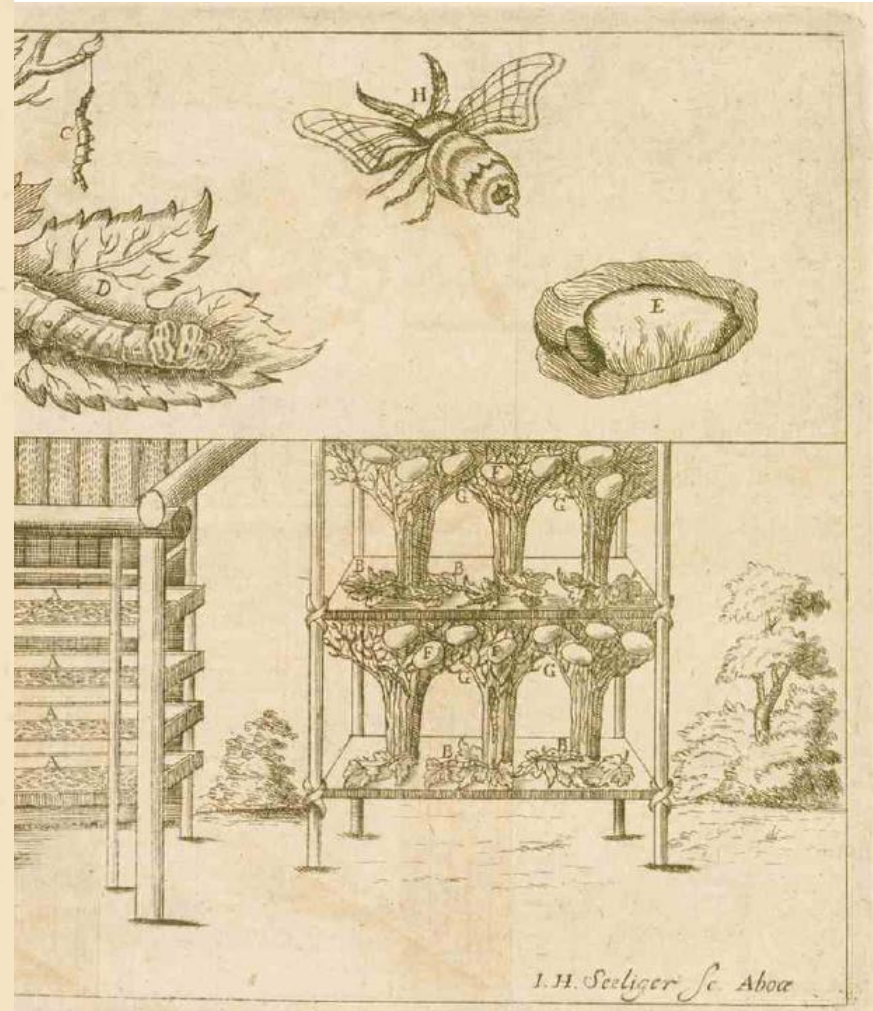
MED WEDERBÖRANDES SAMTYCKE,
UNDER
KONGL. OECONOMIE-DIRECT. CHEMIE-PROFESS.
Och LEDAMOTEN AF KONGL. SWENSKA
WETTENSKAPS-ACADEMIEN,

HERR PEHR ADRIAN
GADDS
ANFÖRANDE,

FÖR LAGER-KRANTSSEN UTREDDE,
OCH TIL ALLMÄN GRANSKNING, I ÅBO ACADE-
MIENS ÖFRE LÄRO-SÄL, PÅ WANLIG TID F. M.
DEN 21. JUNII 1760. ÖFWERLEMNADÉ,
AF

CHRISTOPHER HERKEPÆUS,
TAWAST-LÄNNING,

ÅBO, Tryckt hos DIRECTEUREN och Kongl. Boktryckaren
i Stor-Förstendömet Finland, JACOB MERCKELL.



Manor houses and parsonages as cradles for gardening in Finland

- Practically all had some ornamental and kitchen gardens
- Fleming in Suitia: ordered in 1539 apple and pear trees from Estonia
- In 1683 horse chestnut in Turku area (Tillandz' list)
- In 1700's use of exotic conifers started in landscape parks (English style)

1800-

- In early 1800's private experimenting (*Larix*, *Pinus cembra* ssp. *sibirica*, *P. nigra*, *Abies balsamea*, *A. sibirica*, *Thuja occidentalis*...)
- Also very susceptible species were tested (e.g. ebony)
- In Finland the development was governed by its connections to Russia
 - *Russian species dominant*
- In 1840's larch plantations in Kitee and Karjalohja
- In 1860's establishment of Forestry Institute in Evo
 - A. G. Blomqvist leading figure in establishing exotic plantations
- Railway stations hot spots for exotic plantings

Organising the management of state forests in 1859

- One task for the new body was to establish "model parks" where introduced exotic tree species were to be cultivated (§ 11)
- Forestry schools started practical work with exotic trees
 - Siberian larch – Raivola example
 - Siberian stone pine (*Pinus cembra* ssp. *sibirica*) as substitute food (= "bread pine")



A row of Siberian firs at
Tuomarniemi forestry
school

Photo: T. Tasanen

Pinus cembra trees...

... and a nutcracker



1800-

- Planting of exotic tree species was spreading from Evo also to other state forests
 - A.G. Blomqvist guiding the work
- Planting was often done on burned soils (commonly in connection with slash and burn cultivation/ swidden cultivation)
- Mixed plantations
- Sowing together with agricultural crop or planting after harvesting
- In late 1800's also western species were planted (*Pinus strobus*, *Abies balsamea*)

The first plantation of exotic trees in Punkaharju – Siberian larch 1877



2010

Photo: T. Nikkanen

The turn of centuries 1800/1900's

- Private enthusiasts in late 1800's
- Private arboreta
 - Mustila as a prime example:
 - Established in 1901 by A. F. Tigerstedt
 - Large stands
 - Selection of species and provenance according to climate
 - New species: *Pinus contorta*, *Picea omorika*...
- There arouse scientific interest for cultivating exotic tree species: publications, textbooks

Nursery in action at Tuomarniemi forestry school in 1913



Photo: Tuomarniemi forestry school photo archive

Price list of the nursery at Tuomarniemi forestry school in 1912



Hinnasto.			
Puulaji	Ikä	Keski- pituus cm.	Hinta Smk. Kpl. 100:lla 1,000:lla
Havupuuta.			
Abies balsamea. Balsamikuusi	2 2	10	0:08 6:—
Abies Pichta (sibirica). Pihtakuusi	4 2	20—30	0:10 8:— 70:
S:a	2 5	40—60	0:12 10:— 90:
Larix Europæa. Europalainen lehti- kuusi	3	30—40	0:05 4:—
S:a	3/3	60—80	0:18 15:—
S:a	2 3/3	80—120	0:30 25:—
Larix sibirica. Siperialainen lehti- kuusi	3 2	40—80	0:30 25:—
S:a	3 5	100—200	1:— 75:—
Picea Engelmannii. Engelmännin kuusi	2 3/3	15—30	0:20 17:—
Picea excelsa. Kotimainen kuusi	2	6	2:—
S:a	3	10—20	3:—
S:a	3 2	20—25	4:50 40:—
Pinus cembra. Cembrämänty	2 4	15—30	0:30 25:—
S:a	2 5	30—50	0:40 35:—
Pinus montana. Vuorimänty	3	10—15	—:50 4:—
S:a	3/3	20—30	0:08 6:—
Pinus silvestris. Kotimainen mänty	2	6	2:50
Lehtipuuta.			
Acer platanoides. Tavallinen vaahtera	1 2	20—40	0:08 6:—
Caragana arborescens. Siperialainen herne- puu	2	30—40	0:05 3:—
Fraxinus excelsior. Tavallinen saarni	2 2	15—25	0:07 5:—
Tilia parvifolia. Pienilehtinen lehmus	2 2	10—25	0:06 4:—
Ulmus montana. Suurilehtinen jalava	2 2	40—70	0:10 8:—

Seven exotic conifer species on sale

The bloom of exotic cultivation in early 1900's

- Cultivation experiments by FFRI
 - Heikinheimo
- Seed procurement companies (e.g. AB Proveniensiens)
- Exploration to Canada by Kujala
- Experimenting with *Pinus contorta* by forest companies
 - Raw material for pulp making with sulphite process

Tree species trials by Heikinheimo

- Prof. Olli Heikinheimo in Forest Research Institute started a large systematic programme for testing exotic tree species in late 1920's
- 110 species
- 300 hectares
- 700 000 seedlings
- 3+ test locations
- 3 main reviews of the results: 1956, 1984, 2000

Seed from the similar climatic areas

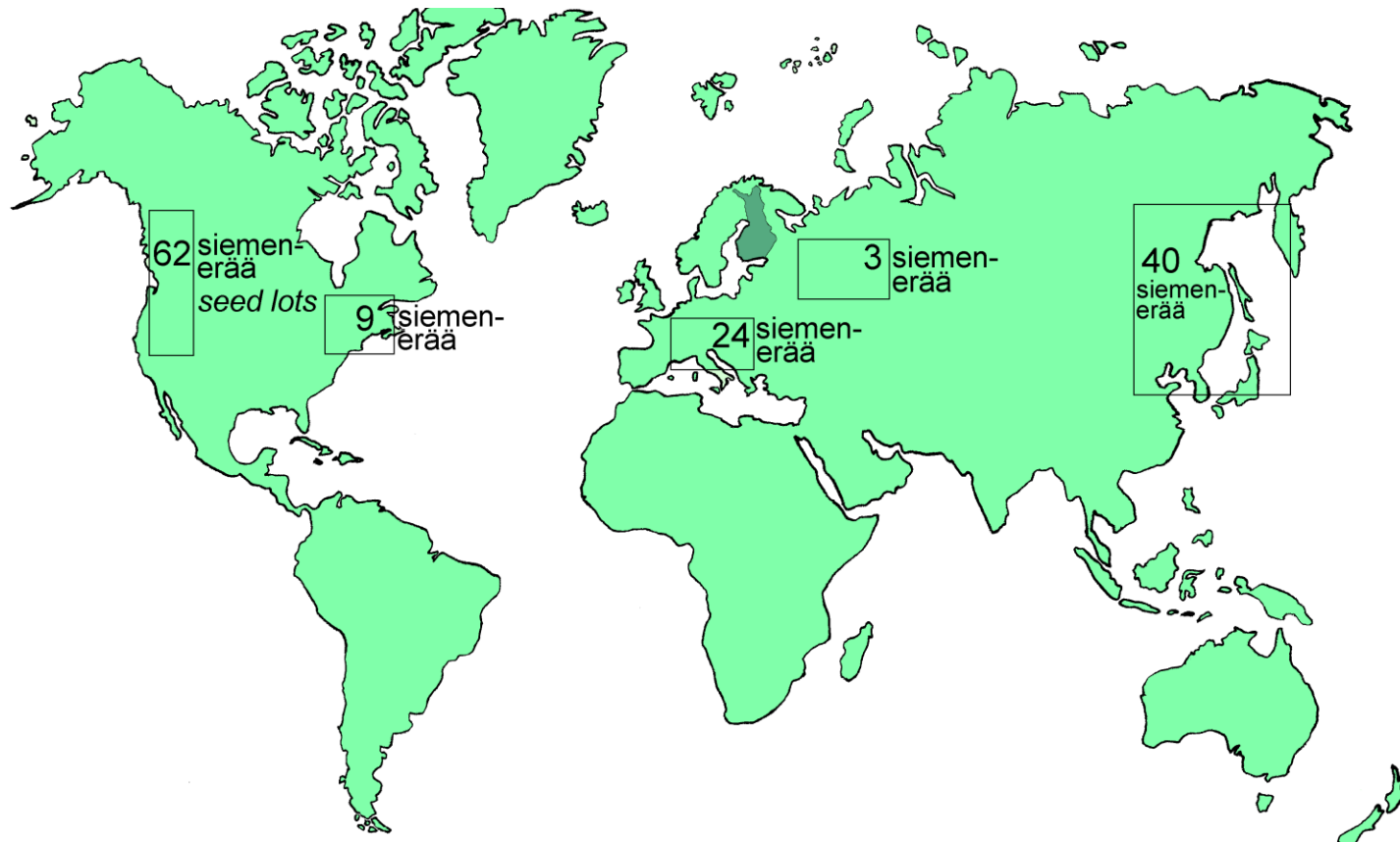
Seed for the trials was obtained from different parts of the world:

of 176 seed lots used in conifer trials 27 were from Europe

40 from East Asia

71 from North America

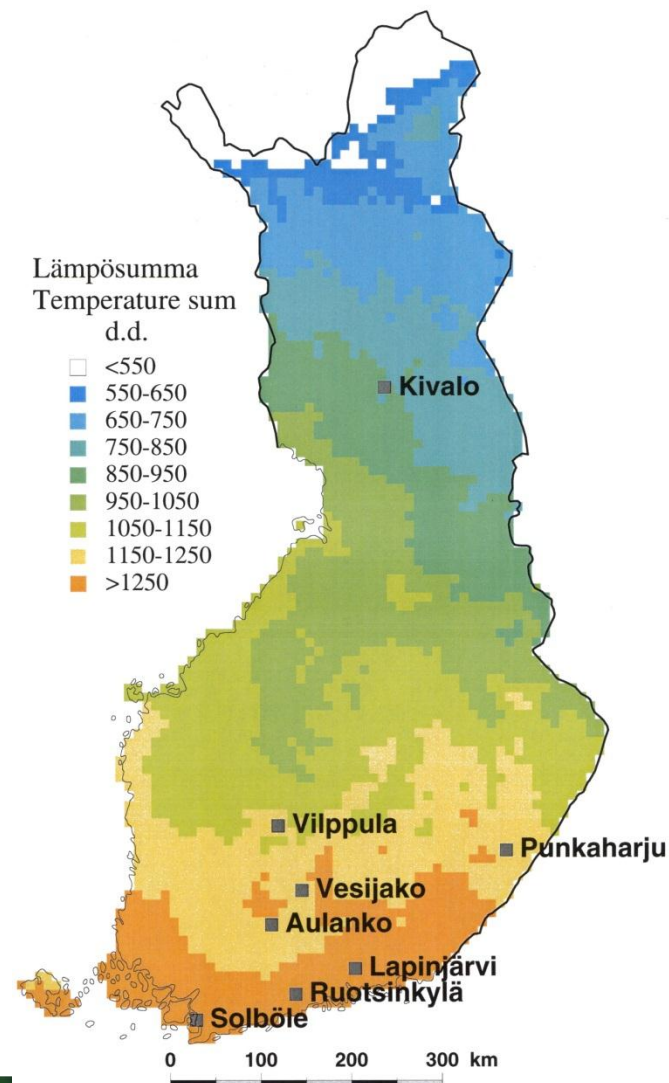
and 38 from unknown seed sources



Heikinheimo's plantations in 8 reseach areas

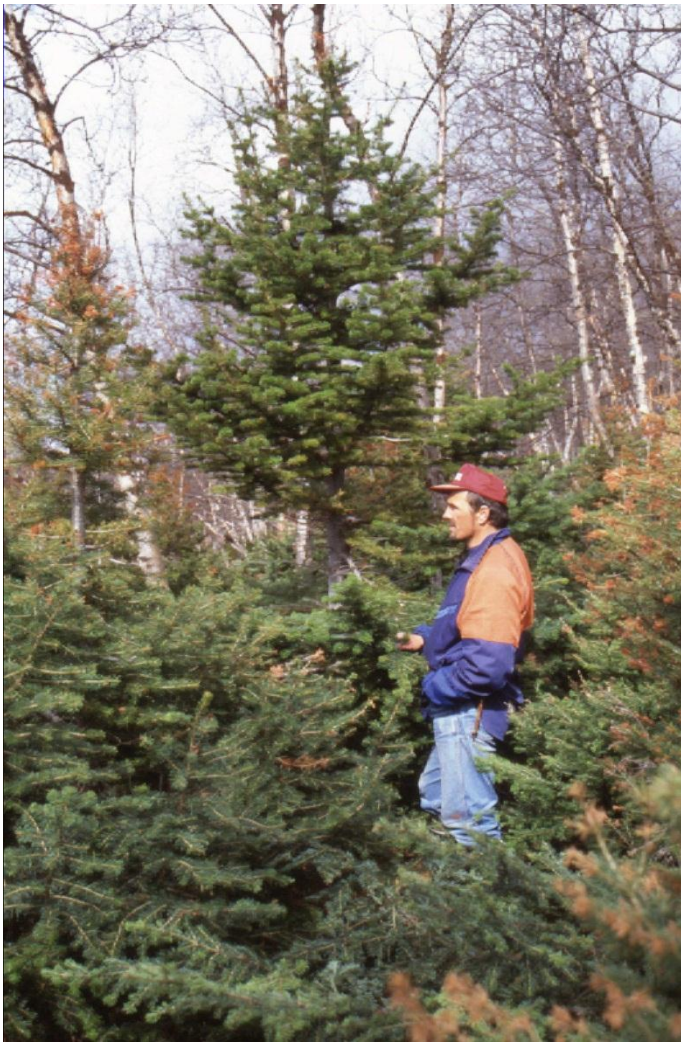
Solböle	185
Ruotsinkylä	180
Punkaharju	201
Lapinjärvi	5
Aulanko	10
Vesijako	11
Vilppula	3
Kivalo	10
Σ	605 plantations ~300 ha

In the inventories in years 1996 - 1997 there still existed 492 of these plantations



Later experiments by Metla

- Tree breeders established large number of experiments in all parts of the country (1960 →)
- Cooperative experiments
 - Nordic experiments with North American species (1990's)
 - SIBLARCH project (~2005)
- Updating Heikinheimo's plantations (1990's)



Subalpine fir (*Abies lasiocarpa*) in a 34 years old experiment on the slope of mountain Saana



Tamarack (*Larix laricina*) in a 19 years old Nordic experiment in Kolari

Photos: S. Ruotsalainen

Raivola

= Lintula = Lindulovskaja rosca

- Established in 1738 by a German forester Fockel in SE-Finland close to St. Petersburg
- Initiative from tsar Peter the Great for producing timber for the Russian navy
- Later enlarged several times finally to cover an area of about 20 ha
- Regarded as the most magnificent cultivated forest in Northern Europe
 - Max. 1284 m³/ha (1994)

Tourist photos from Raivola/1

(by S. Ruotsalainen)



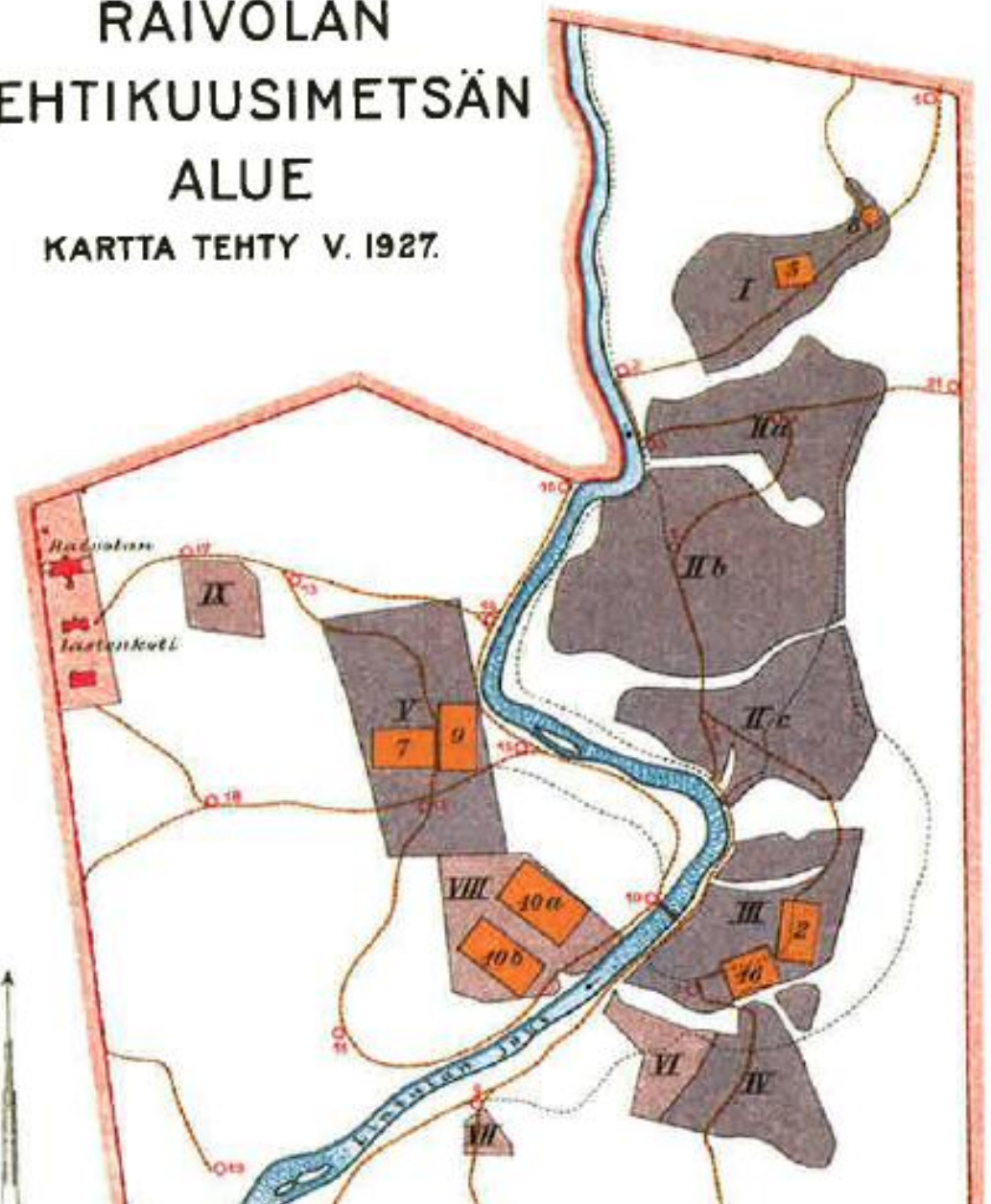
Tourist photos from Raivola/2

(by S. Ruotsalainen)



RAIVOLAN LEHTIKUUSIMETSÄN ALUE

KARTTA TEHTY V. 1927.



The influence of Raivola

- Stand was (almost) forgotten for one hundred years
- Finnish forestry teacher A. G. Blomqvist "found" it in 1869 and was greatly impressed by it
 - Wrote several reports about the forest
 - Started cultivation of Siberian larch in Finland
 - Advocated especially the use of Raivola seed source
 - Siberian larch growing in Finland mainly belongs to the "Raivola landrace"
 - Plus trees selected from the 2nd generation Raivola stands in Finland (128 plus trees)
 - Seed orchards established with this material (currently 7)
- Raivola larch has proven to be good growing and very adaptive: grows well in whole Finland, northern Sweden, Iceland...

Good performance of Raivola landrace

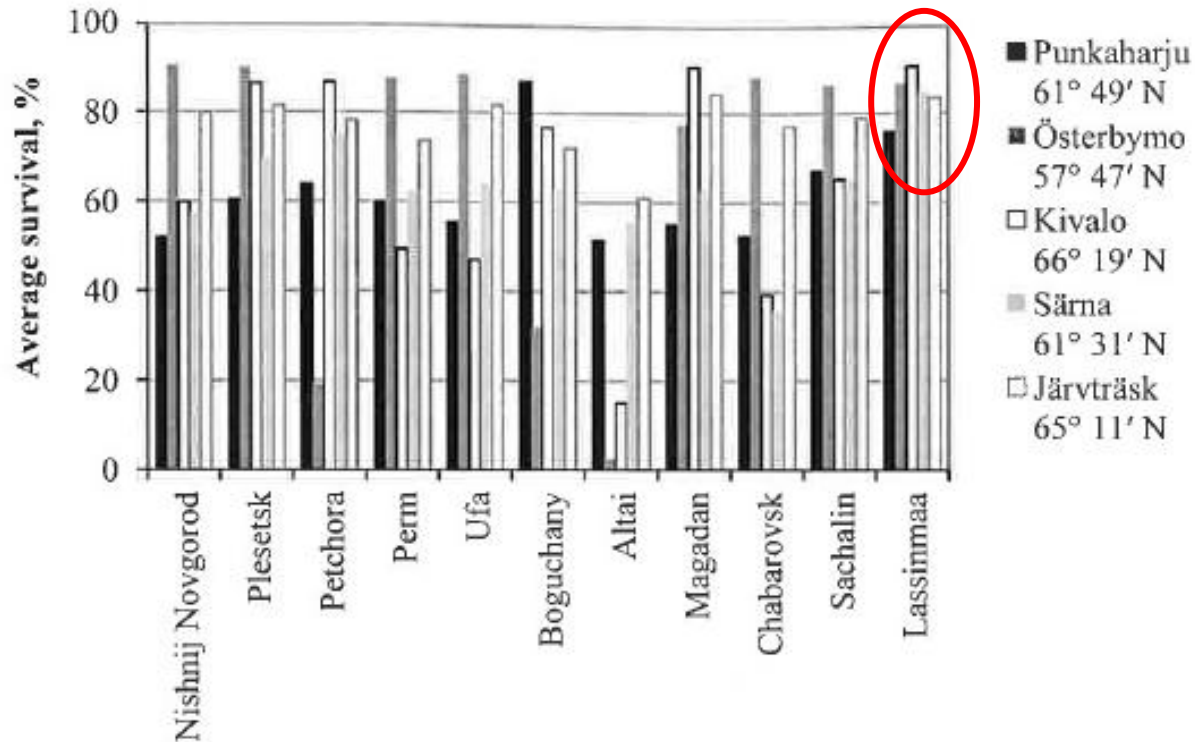


Figure 13. Average height growth (top panel) and survival in Finnish (Punkaharju, Kivalo) and Swedish (Österbymo, Särna, Järvträsk) field trials after four growing seasons. Results from Swedish trials are according to Karlman and Martinsson (2007).

From Lukkarinen 2013

Raivola – question of its origin

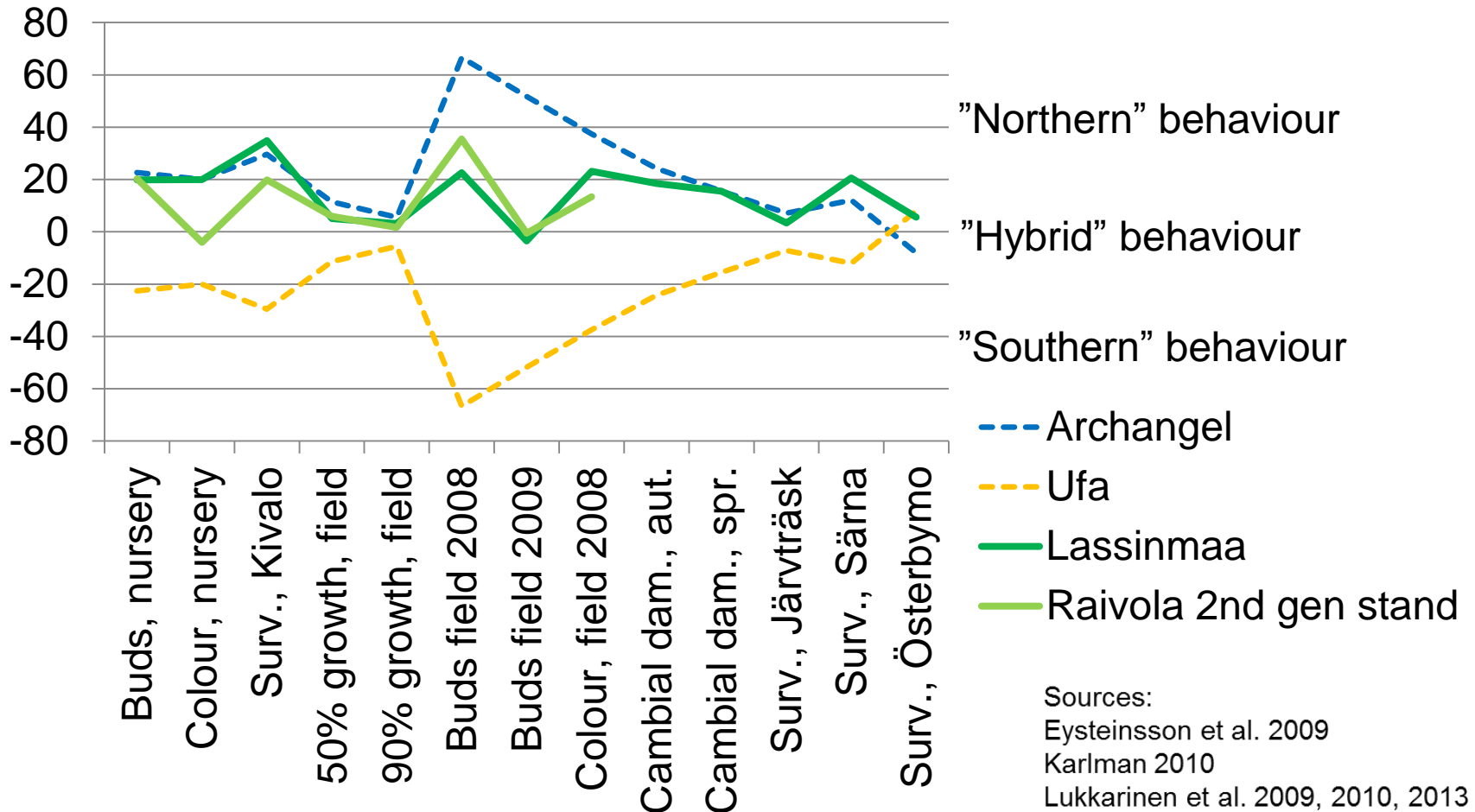
- Fockel got seeds for his first cultivation from the river valley Dvina, 200 km south from Archangelsk (~63° N)
- The origin of the later cultivations is not known - **or is it...?**
- Mayr (1900) claims that the enlargements had been done with seed from southern Ural, Ufa (~55° N), but...
 - Mayr's report contains several errors in other details
 - Current Russian scientists do not refer to Ufa as a seed source to Raivola

Theories about the origin of "Raivola" larch



The performance of Raivola seed source compared to its putative ancestors in SIBLARCH material

Deviations from expected hybrid value



Explanations for the good performance of the "Raivola larch"

- Originates from climatically variable area close to White sea
- Result from early "plus tree selection": cones collected from trees felled to be used as masts?
- Hybrid between Archangelsk and Ufa provenances?

What is "Raivola"

- What is the land race "Raivola" cultivated in Finland?
 - Plus trees selected in Finland have also at least 5 other origins than "Raivola"
- The early plantations probably contained several provenances from Russia
 - In late 1800's Evo delivered several hundreds of thousand plants of larch
 - Difficulties to obtain seed from Raivola, thus other sources were also used

Seed orchard 309

Lassinmaa






Species: *Larix sibirica*
 Owner: Metsähallitus
 Established: 1974
 Municipality: Jämsä
 Location: 62°04'N, 25°09'E, 107 m

Temperature sums:
 Seed orchard 1136 d.d.
 Origin 880 d.d.
 Utilization area 750 - 1050 d.d.

Category: **Qualified**

Number of clones: 47
 Area: 15,6 ha
 Spacing: 3,5 x 7 m
 Number of grafts /ha: 78
 Thinned: 2008e

Further information:

-  Seed orchard
-  Utilization area
-  Plustree
-  2-5 plustrees
-  More than 5 plustrees
- 1-6 Region of provenance

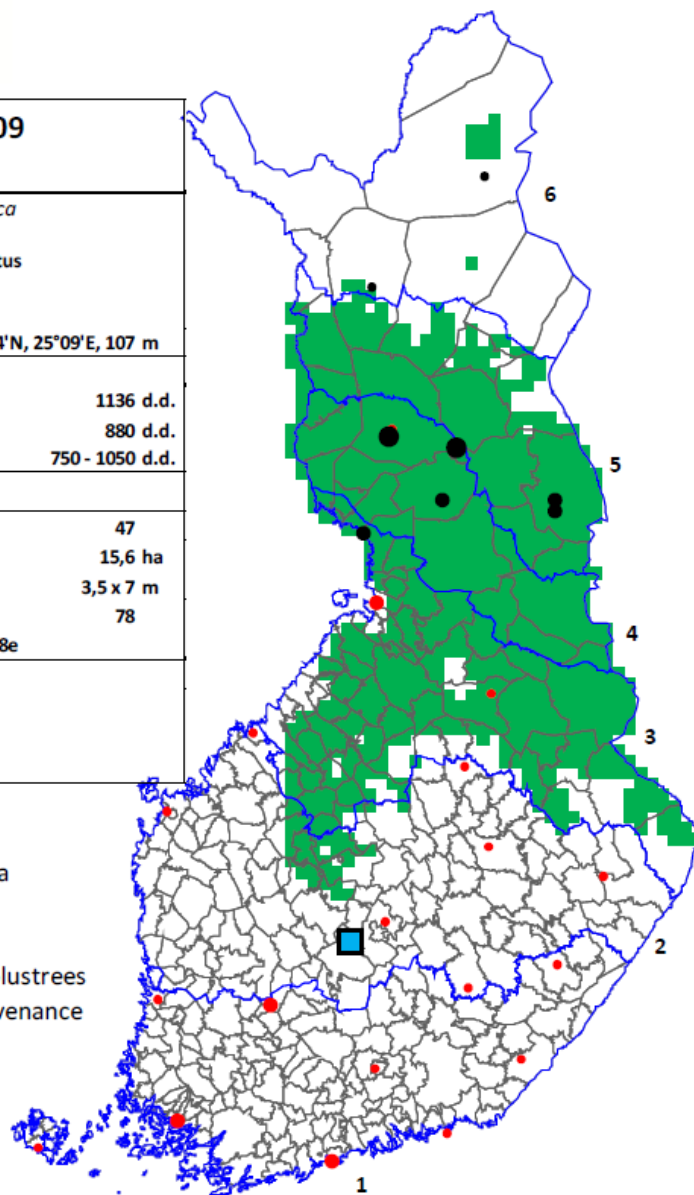







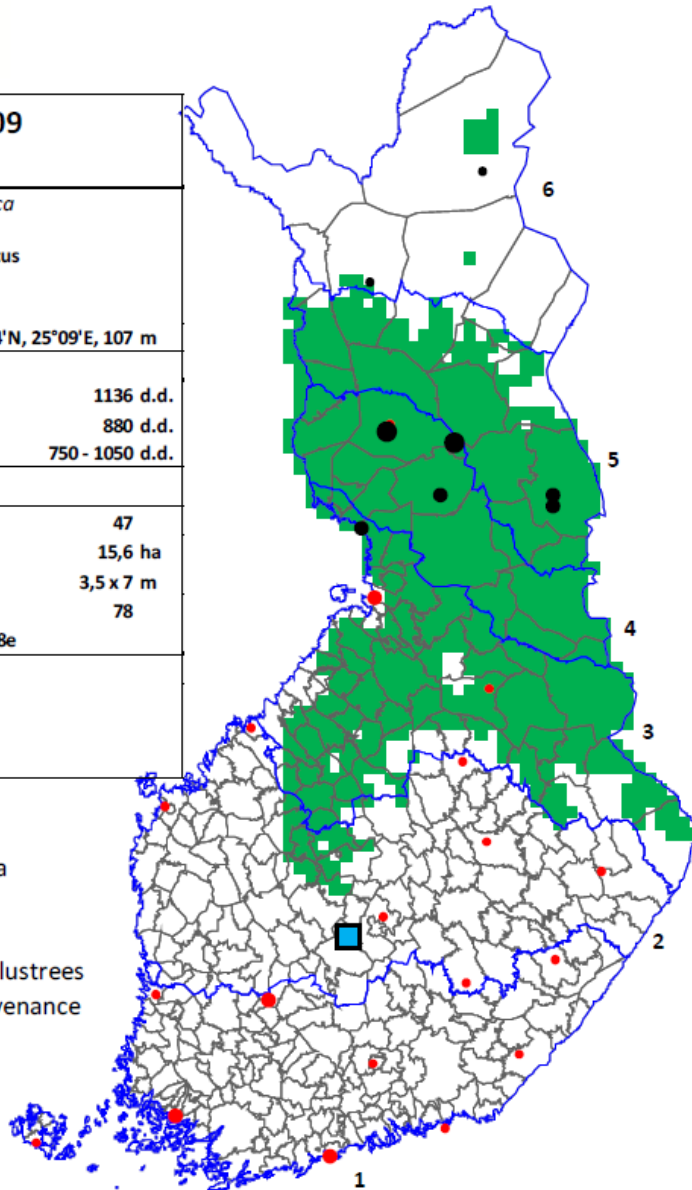
Photo: S. Stranius

Seed orchard 309

Lassinmaa

Species:	<i>Larix sibirica</i>
Owner:	Metsähallitus
Established:	1974
Municipality:	Jämsä
Location:	62°04'N, 25°09'E, 107 m
Temperature sums:	
Seed orchard	1136 d.d.
Origin	880 d.d.
Utilization area	750 - 1050 d.d.
Category:	Qualified
Number of clones:	47
Area:	15,6 ha
Spacing:	3,5 x 7 m
Number of grafts /ha:	78
Thinned:	2008e
Further information:	

-  Seed orchard
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-  More than 5 plustrees
- 1-6 Region of provenance



Seed orchard Lassinmaa

Origin	% of grafts
Raivola	47
Pinega	30
Unknown	23

Whole Finnish breeding material

Origin	Number of plus trees		
	Breeding population		Seed orchards
	No.	%	No.
Raivola	65	51	60
Archangelsk	5	4	4
Pinega	18	14	16
Novosibirsk	9	7	5
Sverdlovsk	7	5	0
Kuibysev	3	2	3
Unknown	21	16	21
Sum	128	100	109

Lodgepole pine

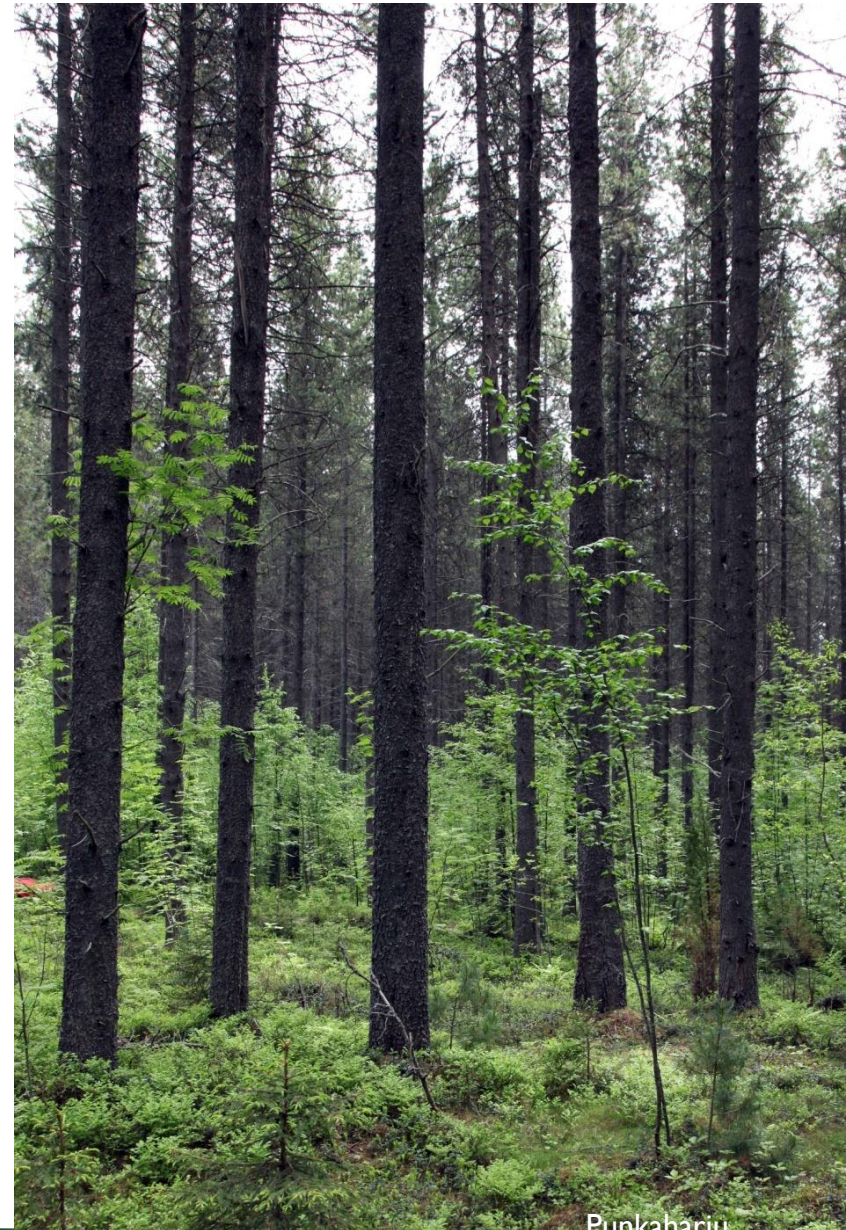
Pinus contorta ssp. latifolia

The amount of seedlings delivered to forests
in 2005, 2006, 2007, 2008, 2009
was **31110 300 2000 4240 0**

Before 1940's some 300 ha was planted

Although lodgepole pine has been studied a lot, and it is known to grow better than Scots pine in certain habitats both in Southern and Northern Finland, the use of it in Finnish forestry has always been low

Total area of lodgepole pine forests in Finland is estimated to be about 10 000 hectares



Punkaharju

Lodgepole pine in central Finland, 13 yrs old



Photo: S. Ruotsalainen

Funkkarin ju

Douglas fir

Pseudotsuga menziesii

The amount of seedlings delivered to forests in 2005, 2006, 2007, 2008, 2009 was **23700 16000 7980 2890 4890**

Total area of Douglas fir forests in Finland is estimated to be about 500 hectares

In Punkaharju Research forest
420 m³ saw timber was cut in 2008



Punkaharju

Black spruce

Picea mariana

The amount of seedlings delivered to forests in 2005, 2006, 2007, 2008, 2009 was **60100 22800 7500 11600 25700**

Black spruce is used in forestry on peatlands in Northern Finland

Black spruce is also used for landscaping and in Christmas tree plantations



20 years old black spruce
experiment in Kolari (67 °N)



Photo: T. Tasanen

Reasons for using some exotic tree species in Finland

Species	Time of use	A. Higher volume	B. Higher resistance	C. Special values
Morus sp.	1700-			X
Crataegus coccinea	1700-			X
Larix sibirica	1700-			X
” ”	1800-	X		(X)
Pinus contorta var. latifolia	1920-			X
- - ” - -	1970-	X		
Pseudotsuga menziesii	1900-	X		(X)
Picea mariana	1970-		X	

Dilemmas with exotic tree species

- Few species is a benefit: management, cuttings and industrial processes are easier
- Few species is a problem: risks are higher for diseases, other disasters or changes in markets
- Difficult to introduce a new species, especially if it needs separate processing
 - Minor interest for cultivation, if marketing difficult
 - Minor interest for developing processes, if there is not enough timber available

The future of exotic trees in Finland

- Currently of no practical importance
 - 0.1 % of area and volume (NFI 10)
- Current forest certification does not encourage the use of them
 - Risk for naturalising? – **small to modest**
- If climate changes, are better adapted species needed?
- If demand for wood increases, are more productive species needed?