

Succession of ectomycorrhizae in different age larch (*Larix Siberica*) forests in East Iceland

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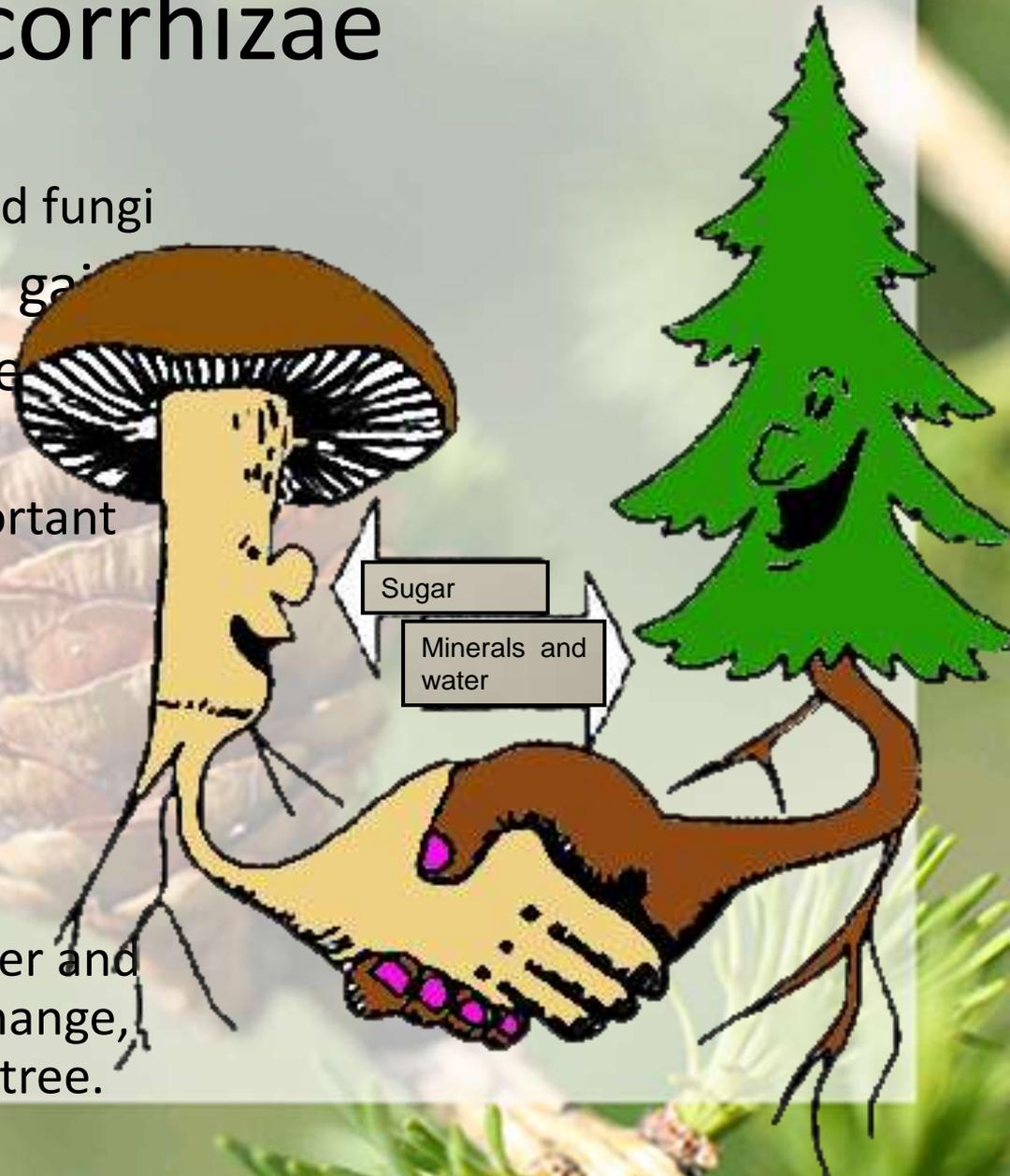
Background



- Since human settlement, in 874, forest cover in Iceland has been reduced from 25% to 1,3%
- Afforestation in Iceland has increased in last decades
- Many exotic tree species
 - ✓ Larch (*larix siberica*)
- In the project ICEWOODS (SKÓGVIST) , changes on species composition and soil nutrients during afforestation, were studied
- Lack of knowledge of soil microflora, for example ectomycorrhizae
- The objectives of this study are to examine long time effects of afforestation on ectomycorrhizae communities in larch forest soils

Mycorrhizae

- Symbiosis between plants and fungi
 - interdependent; each gain benefits from the other
- Ectomycorrhizae is very important for many tree species
 - Boreal and temperal regions
 - Young trees
- Ectomycorrhizae gathers water and nutrients for the tree. In exchange, it gets fixed carbon from the tree.





- http://www.botanicalgarden.ubc.ca/potd/2010/03/mycorrhizal_networks.php

Questions



- Are there some ectomycorrhizal fungal partners for larch in treeless heathlands soils?
- Do young larch plants find ectomycorrhizal partners if they are planted in birch forest soils?
- Are microcosms a good method to study ectomycorrhizal community?
- Is there a different ectomycorrhizal abundance with different age larch forests and if so can it be explained with some soil factors, for example nutrients?

Methods



1. Microcosms

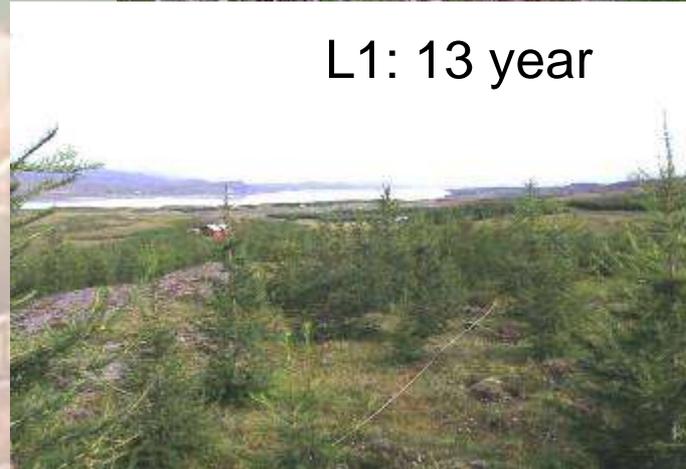
- Soil samples taken in East Iceland 2005
 - Birch forest (21-year-old)
 - Larch forest (13, 21, 40 and 53-year-old)
 - Heath land

Location

L4: 40 year

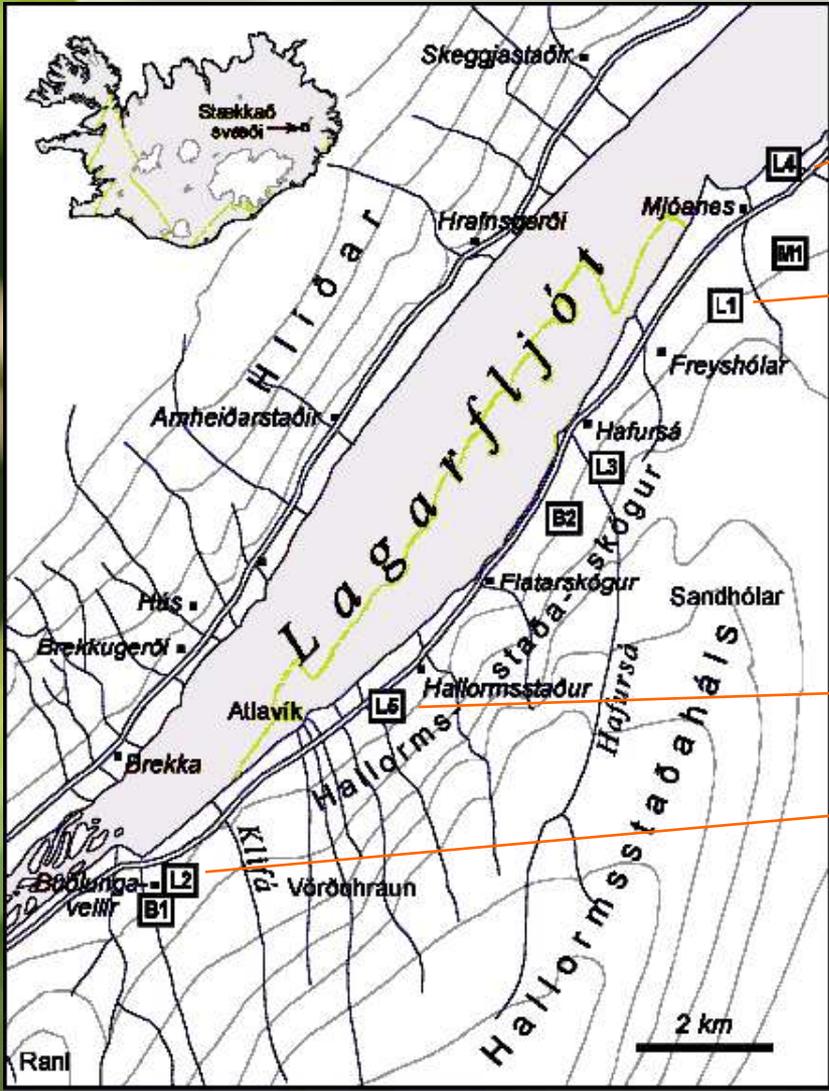


L1: 13 year



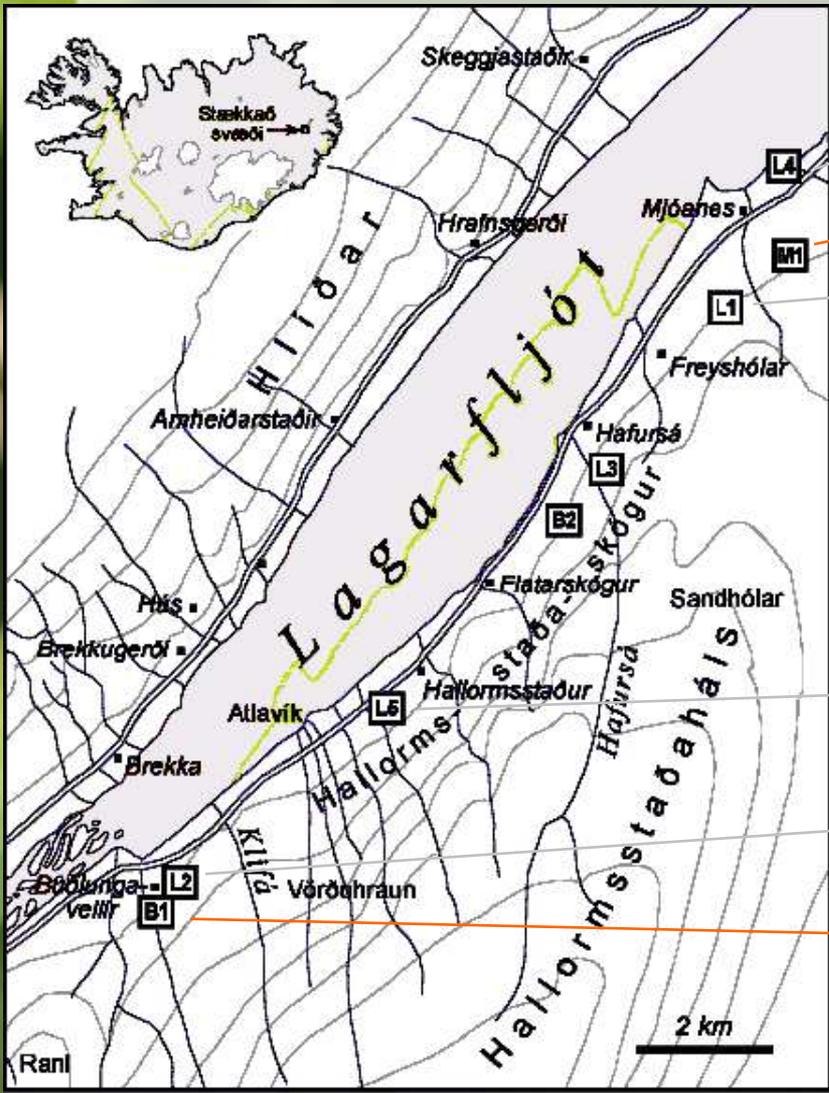
L5: 53-year-old larchforest

L2: 21-year-old larchforest



Map: Lovísa Ásbjörnsdóttir

Study sites: Heath land and birch



L4: 40-year-old larch stand

M1: Heath land

L1: 13-year-old larch stand

L5: 53-year-old larch stand

B1: 21 years



Methods



1. Microcosms

- Soil samples taken in East Iceland 2005
 - Birch forest (21-year-old)
 - Larch forest (13, 21, 40 and 53-year-old)
 - Heath land
- Larch seedlings grown from surface sterilized seeds

Methods



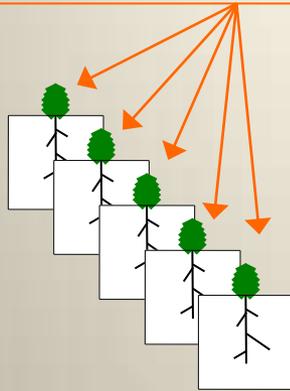
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- Larch seedlings grown from surface sterilized seeds
- Flat microcosms prepared

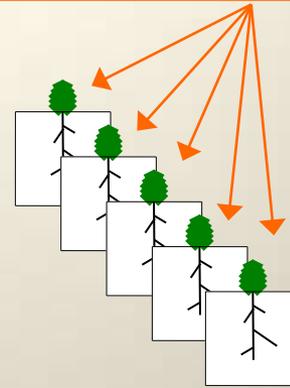




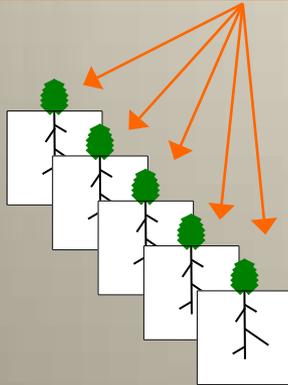
Soil from 13-year-old larch stand



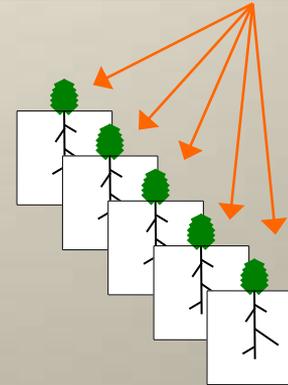
Soil from 21-year-old larch stand



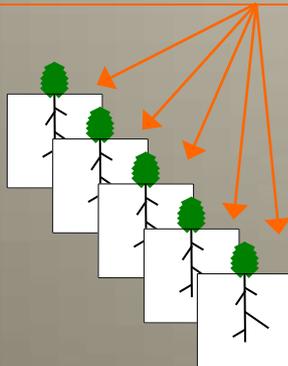
Soil from 40-year-old larch stand



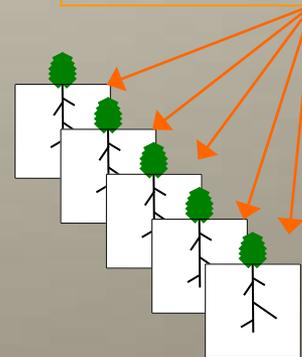
Soil from 53-year-old larch stand



Soil from 21-year-old birch stand



Soil from heath land



Methods

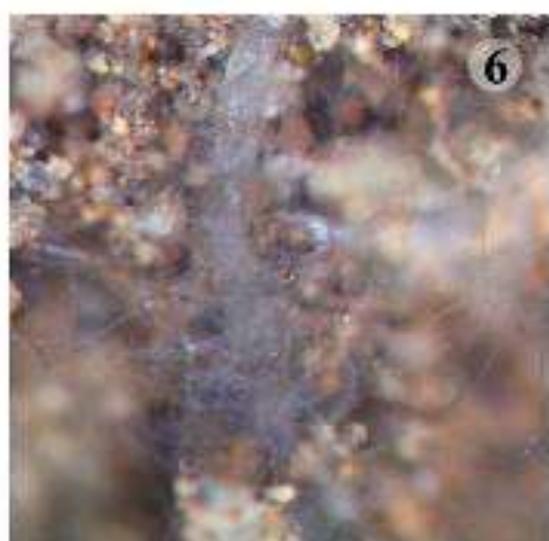
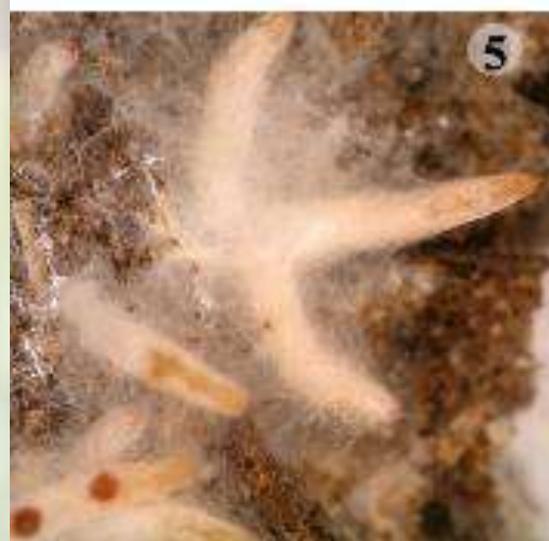


1. Microcosms

- Soil samples taken in East Iceland 2005
 - Birch forest (21-year-old)
 - Larch forest (13, 21, 40 and 53-year-old)
 - Heath land
- Larch seedlings grown from surface sterilized seeds
- Flat microcosms prepared
- Mycorrhizal colonization monitored over six months period
 - Density
 - Diversity (morphological)

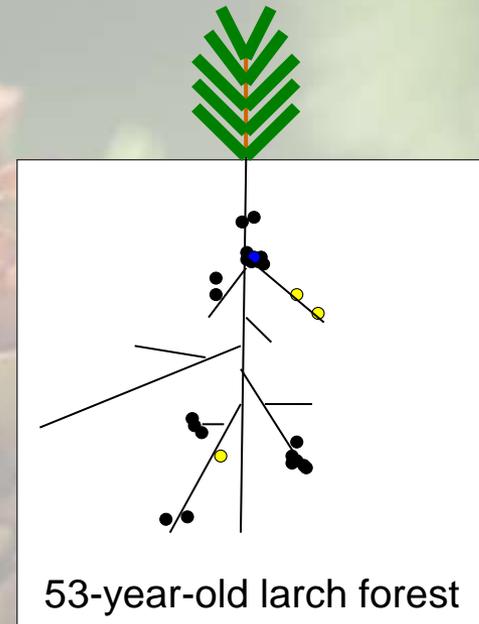
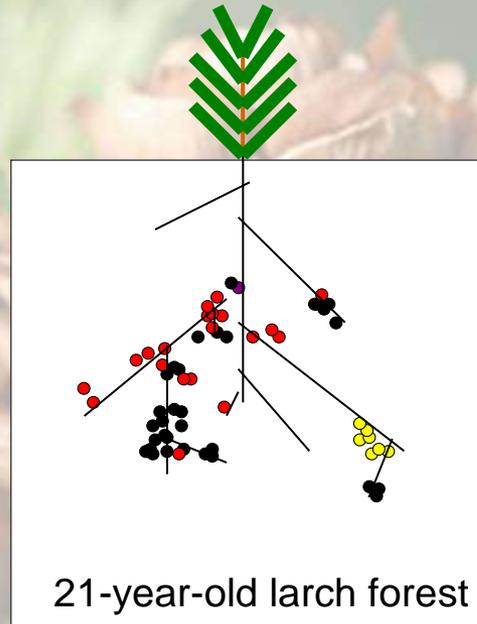
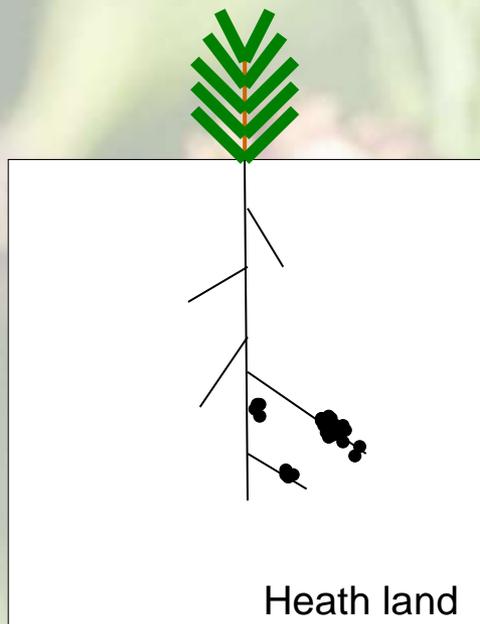
Micorrhizal colonization monitored





After 180 days

Microcosms



● White ● Black ● White-brownish ● Gray(dark)

Methods



1. Microcosms

2. Roots collected from forest

- Soil samples taken from the same four Larch forests (13, 21, 40 and 53-years-old)

Methods



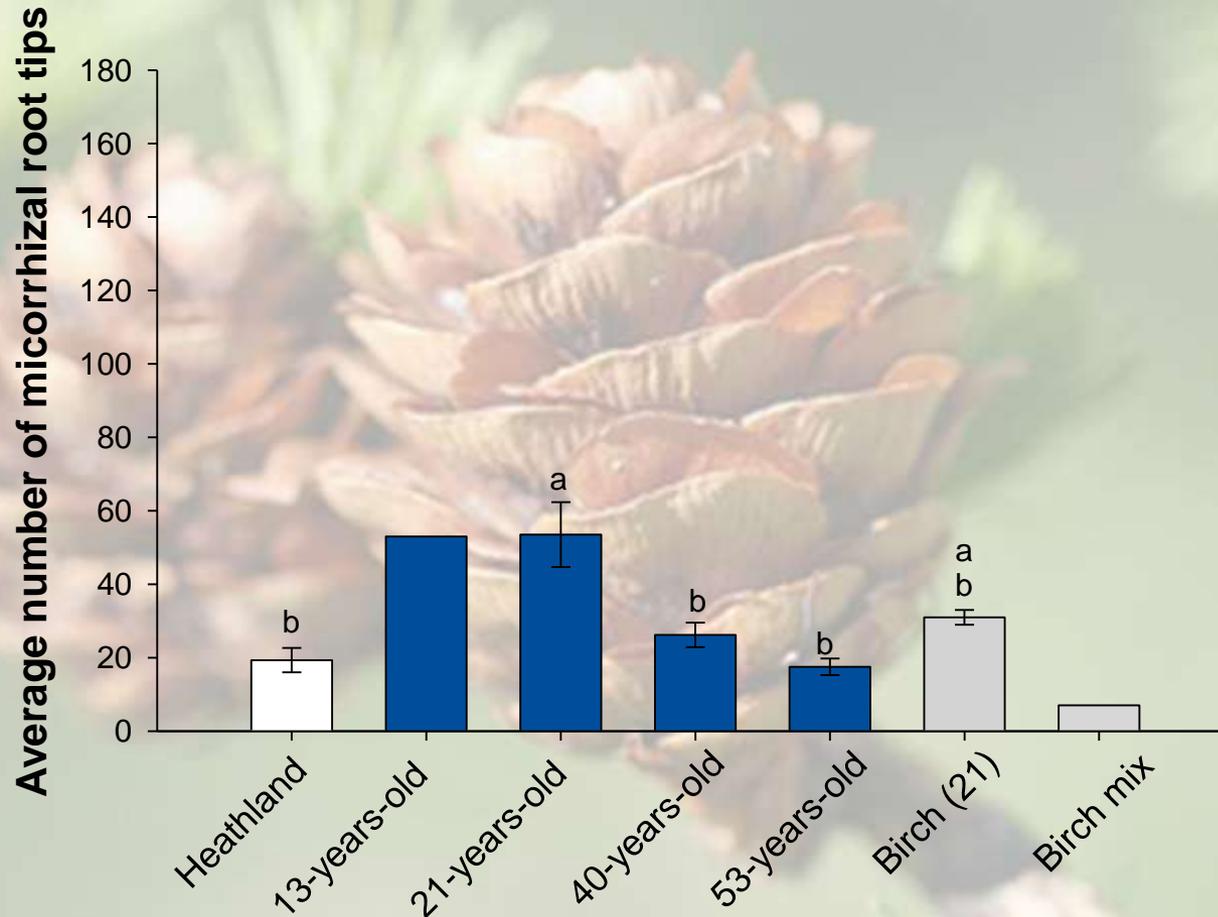
1. Microcosms

2. Roots collected from forest

- Soil samples taken from the same four Larch forests (13, 21, 40 and 53-years-old)
- Tree roots washed, sorted (morphological) and abundance of ectomycorrhiza estimated

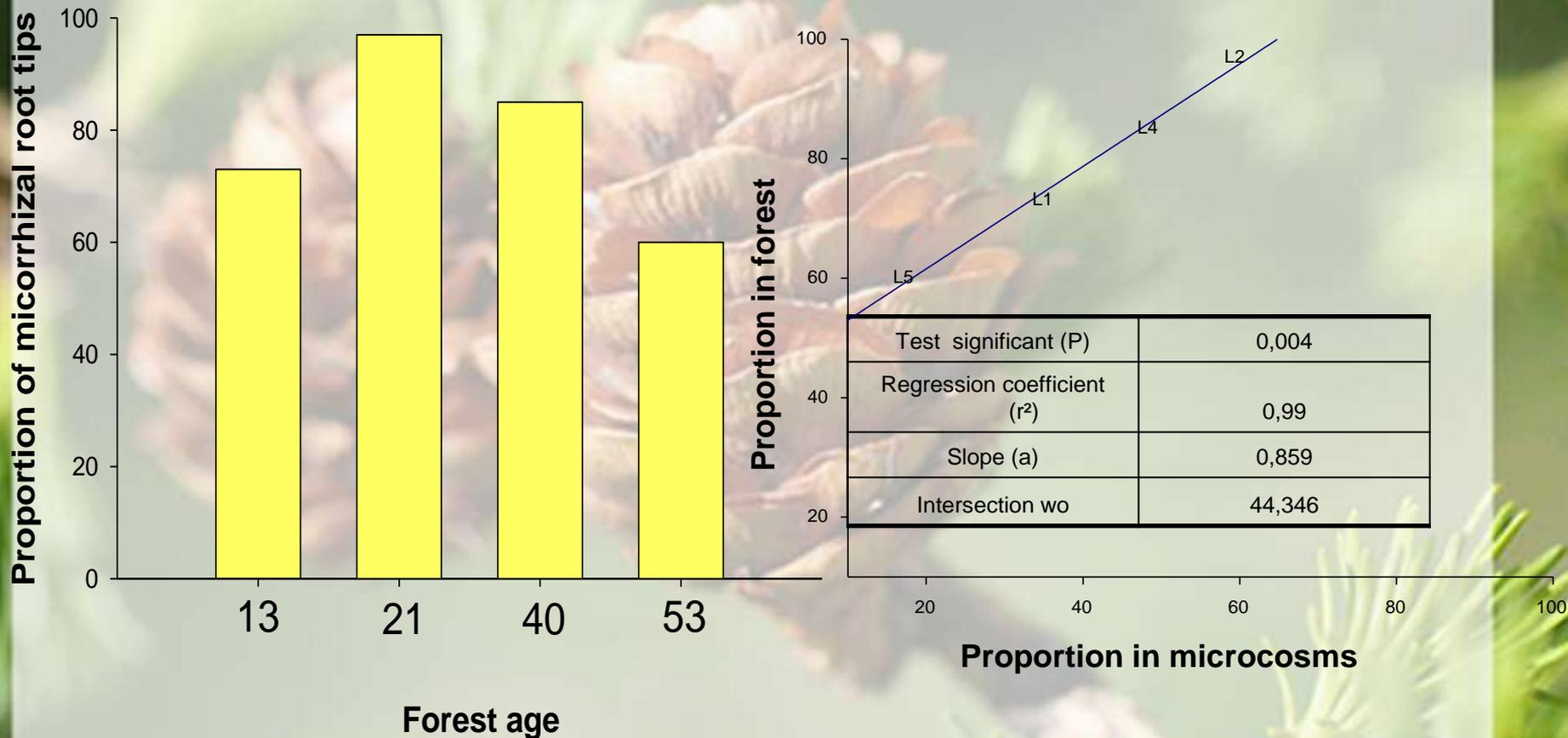
Microcosms

Average number of ectomycorrhizal root tips



Field study

Proportion of ectomycorrhizal root tips



The relation between abundance of mycorrhiza and soil nutrients

- No relation was found between amount of carbon in soil and abundance of mycorrhiza
- Positive relation was found between soil acidity (pH) and abundance of mycorrhiza
- Negative relation was found between amount of nitrogen and phosphorus in topsoil and abundance of mycorrhiza on larch



Summary



- Ectomycorrhizal diversity and abundance changed greatly with forest age
 - Lack of older stage micorrhiza?
 - Older trees don't have as much use for micorrhiza?
- The abundance of mycorrhiza was strongly related to amount of:
 - Nitrogen and phosphorus in the topsoil
 - Soil acidity (pH)
- Ectomycorrhizal abundance was significantly reduced when grown in soil from treeless heath land compared to forest soils
 - Need for ecotomicorrhizal infection

Summary



- Equal ectomycorrhizal abundance was found on larch planted in soils from larch forest and the same age-class of birch forest
- The microcosm was shown to give a good relative estimate of mycorrhizal abundance at different study sites
 - Underestimation in older forests
 - Not good for estimating diversity

Thanks

Bjarni Diðrik Sigurðsson

Edda Sigurdís Oddsdóttir

Iceland Forest Service



The Agricultural University of Iceland



Rannís - The Icelandic Centre for Research

