

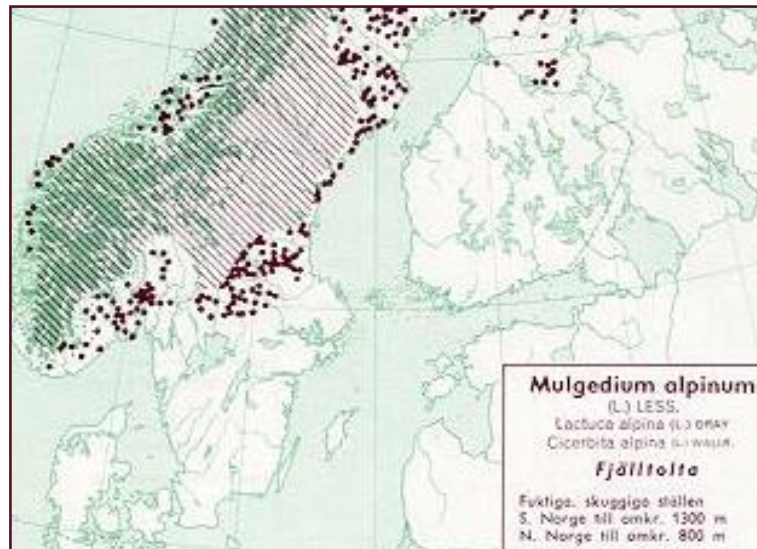
# Climate and land-use change interactions – RA7

Kristoffer Hylander's cases

Institutionen för Ekologi, Miljö och Botanik  
Stockholms Universitet



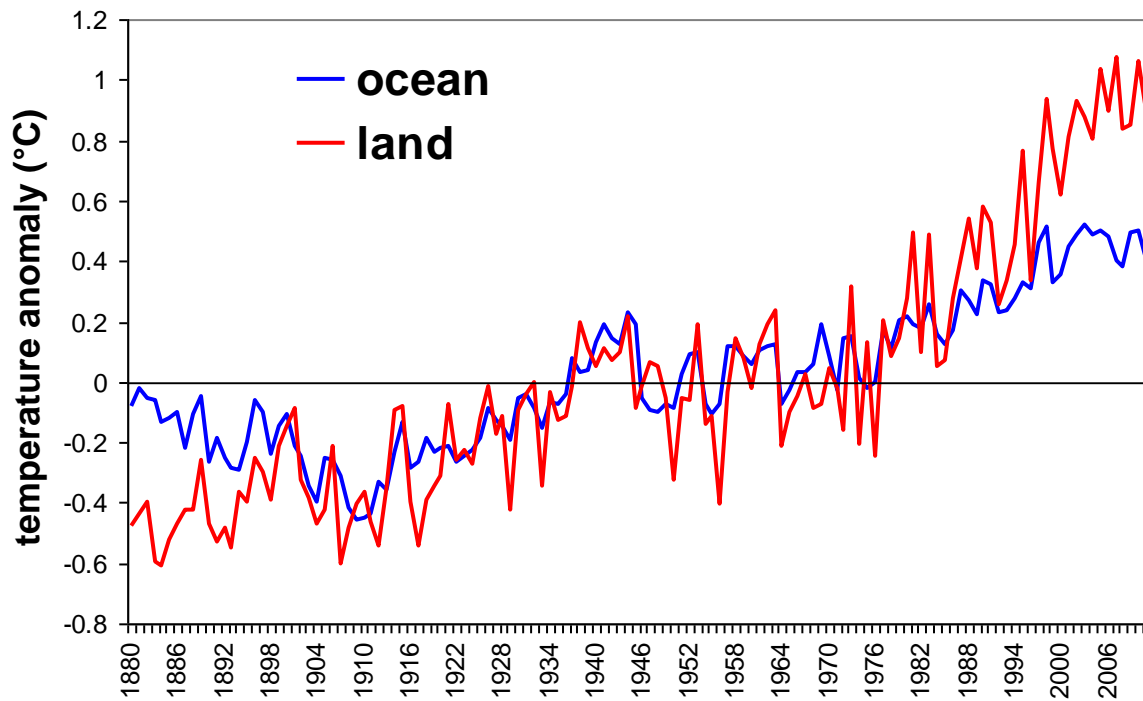
Bolin Centre for  
Climate Research



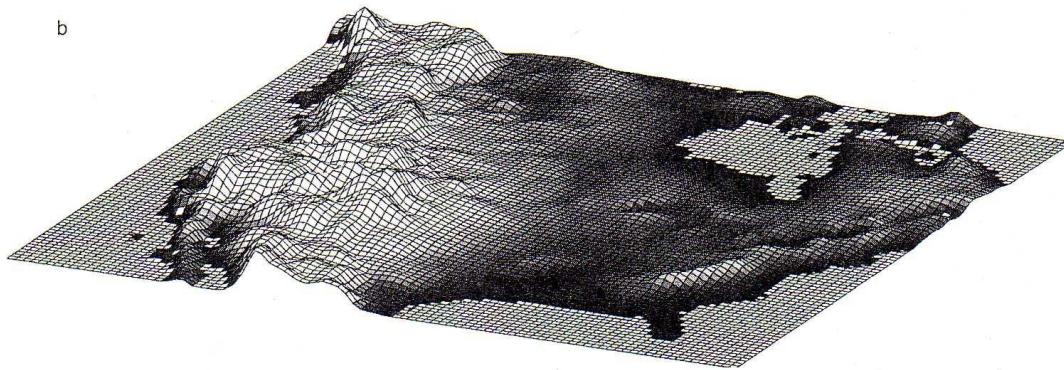
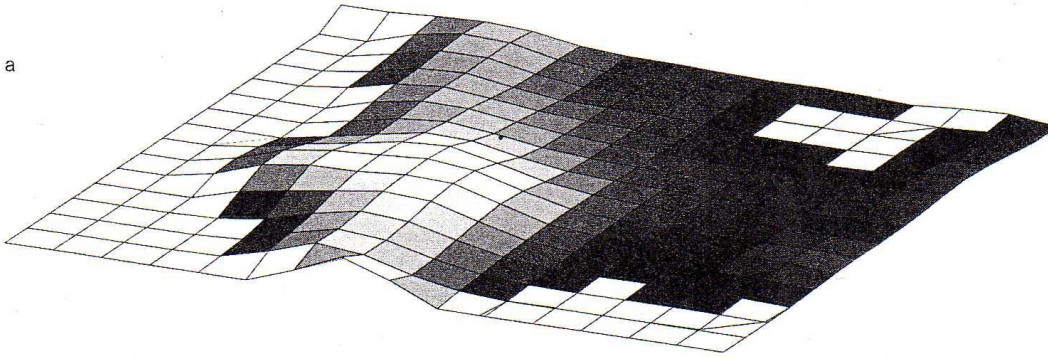
1. Micro-refugia in boreal forest
2. Coffee agroforestry in Ethiopia

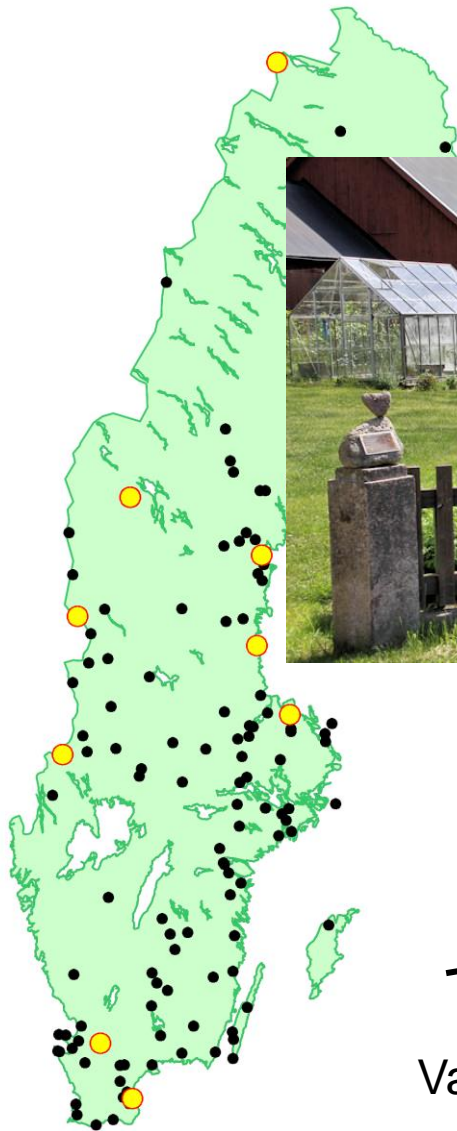


# Scaling down climatic variables



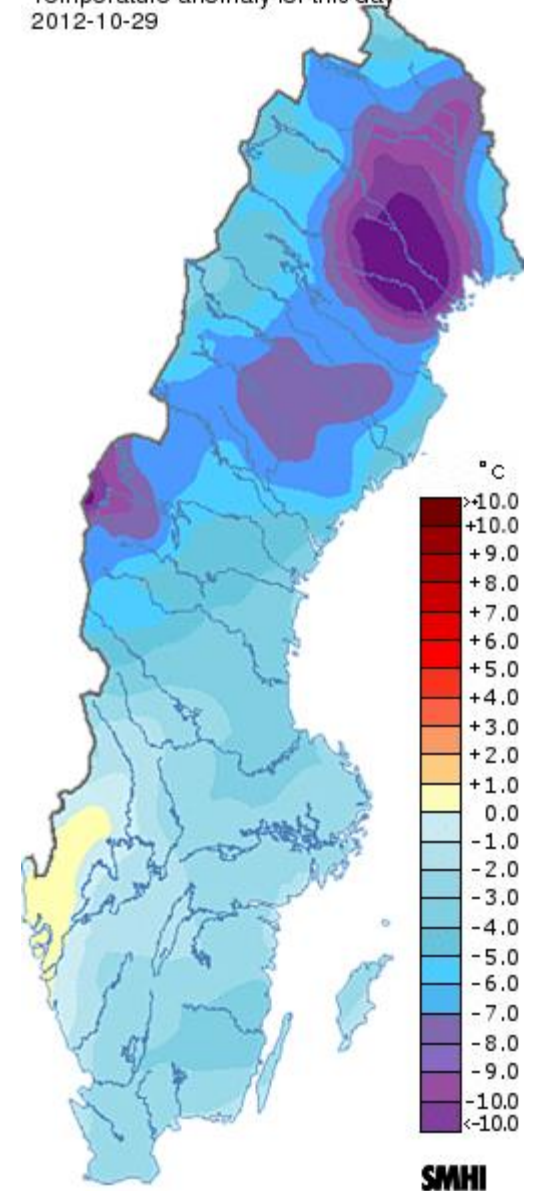
What is the possible resolution?  
Is that relevant for organisms?





Various interpolation techniques

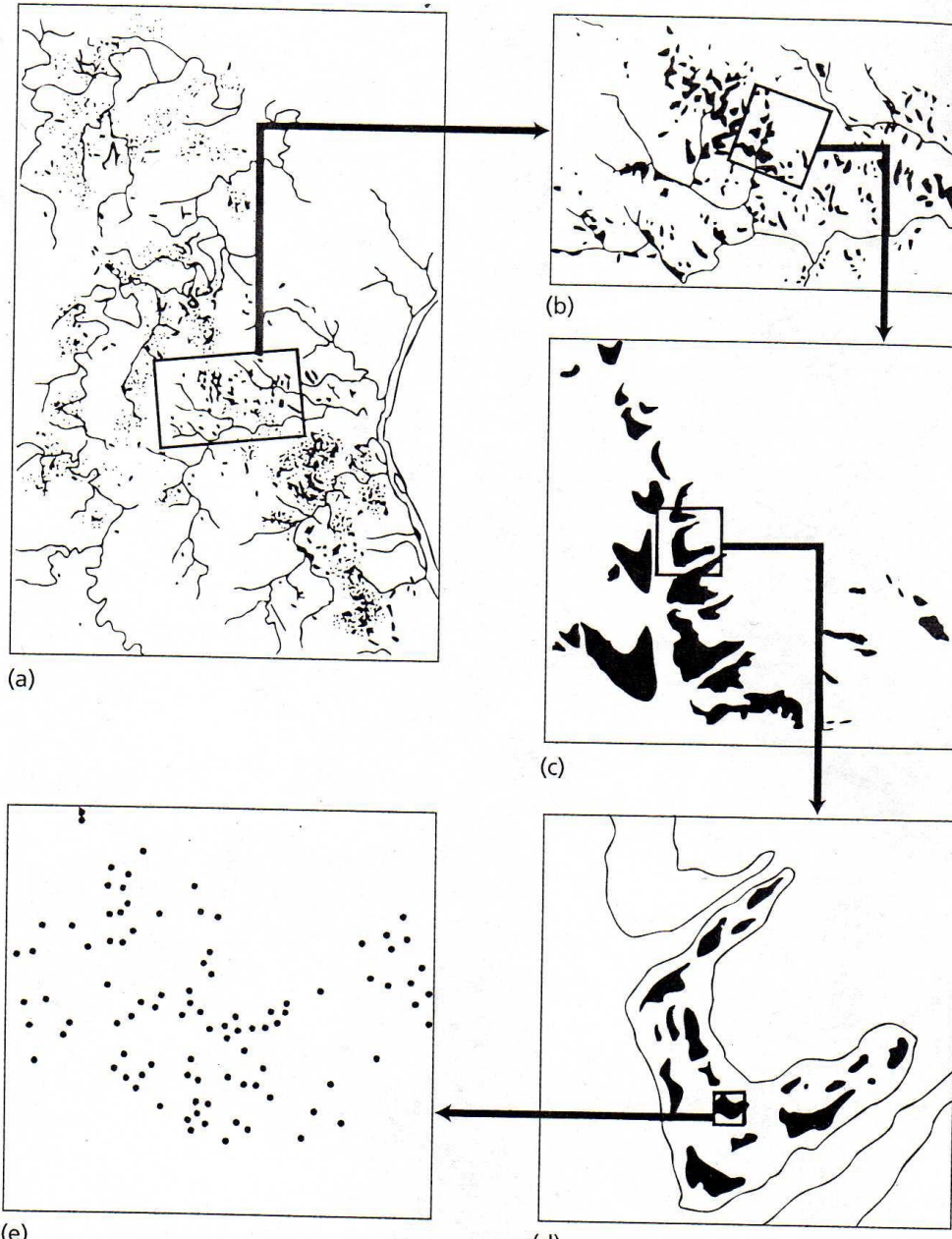
Daglig temperaturavvikelse  
Temperature anomaly for this day  
2012-10-29



**What about even smaller scales?**

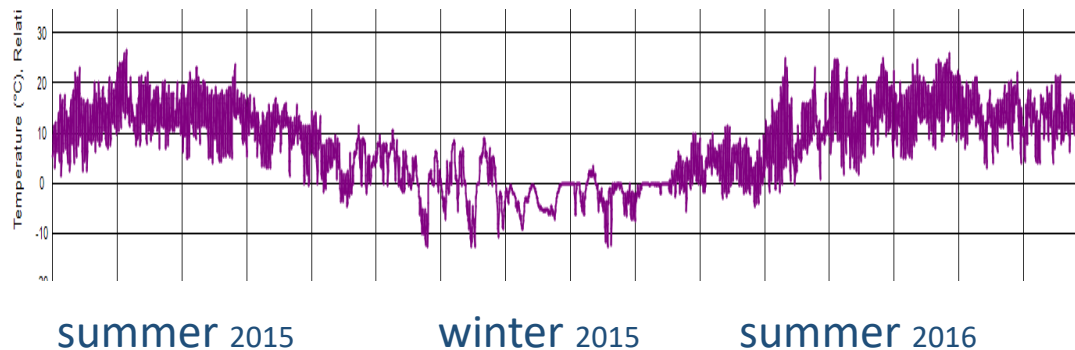


# Plant distribution at different scales



# Measure microclimate in forests

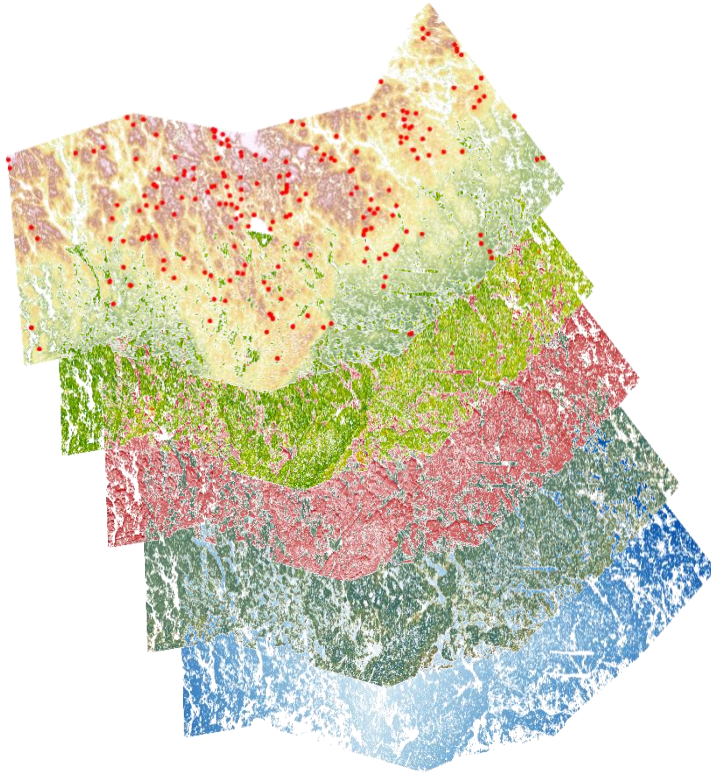
200 loggers measured temperature close to ground



Data and pictures from Caroline Greiser

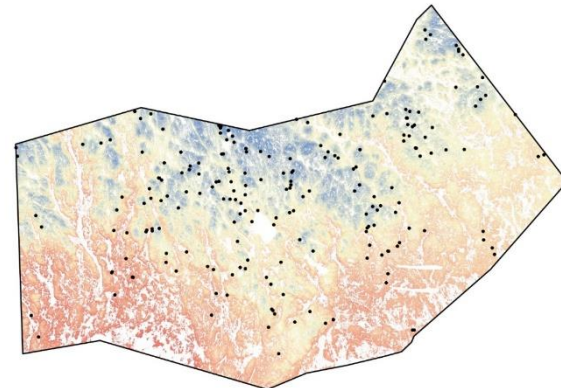
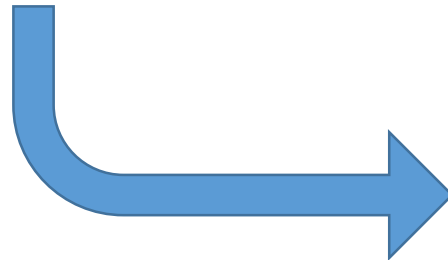


# Microclimate maps



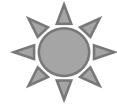
With help of terrain and forest maps we created microclimate maps

- 25 m resolution
- for Tmin och Tmax
- for different months

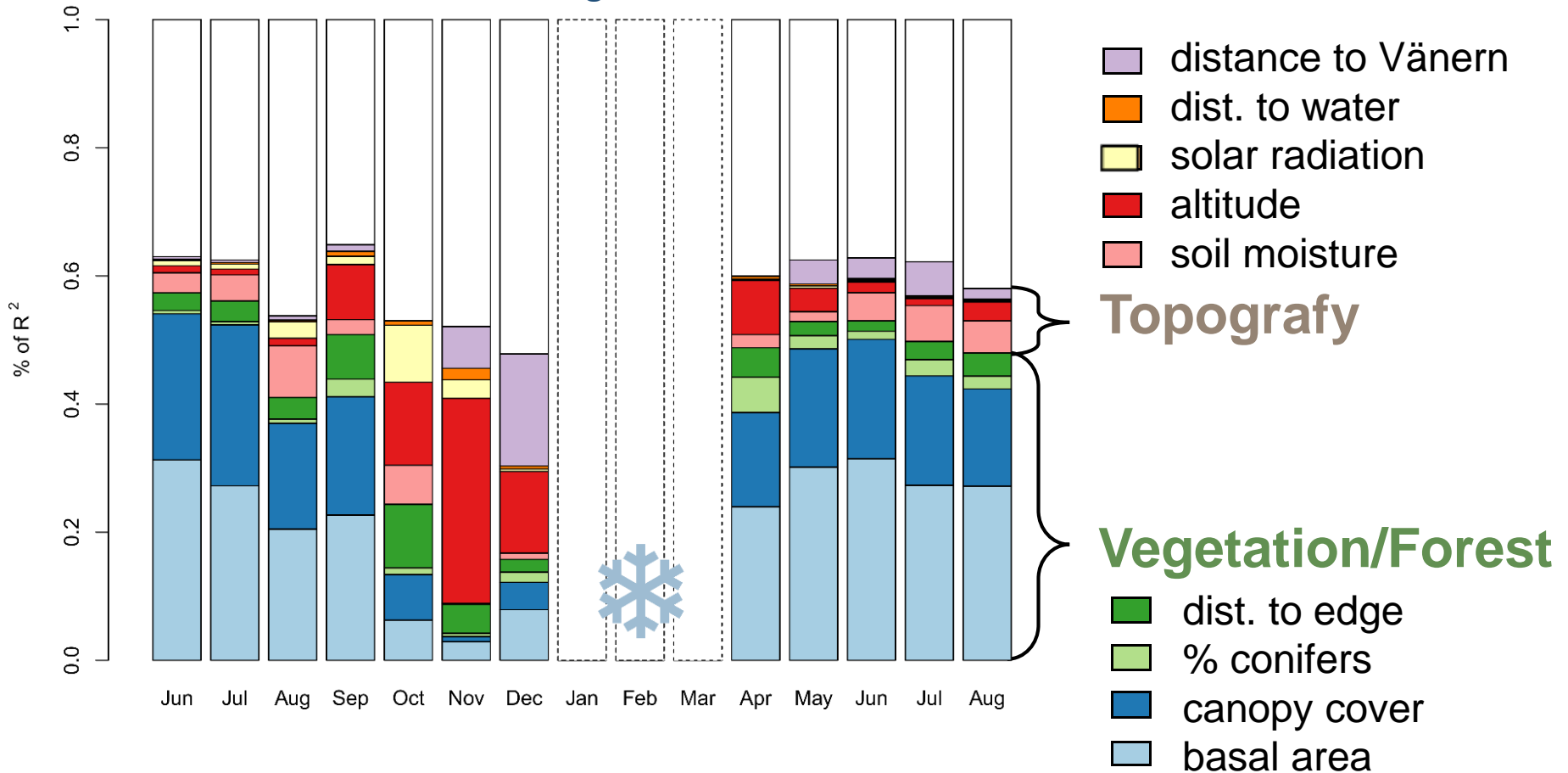


0 25 50 100 Kilometers

# What affects the microclimate?

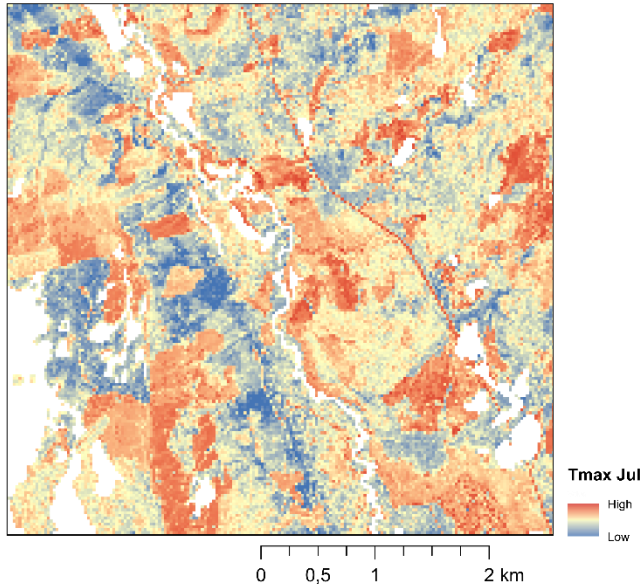


Relative weight of variables

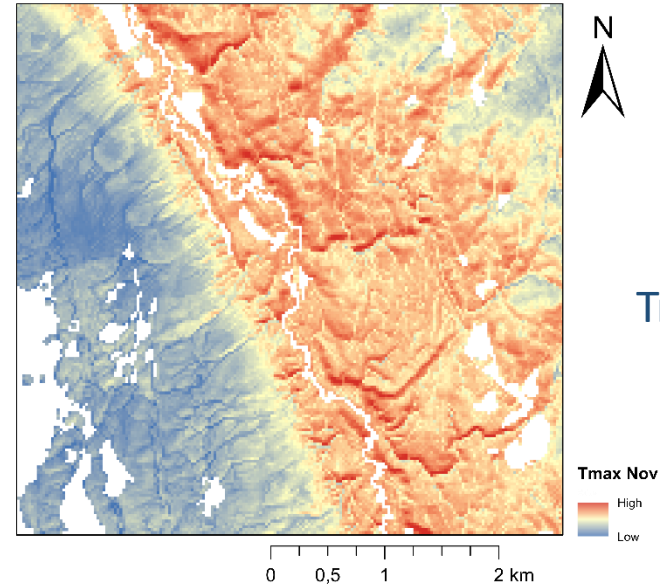


# Different drivers of variation in different periods

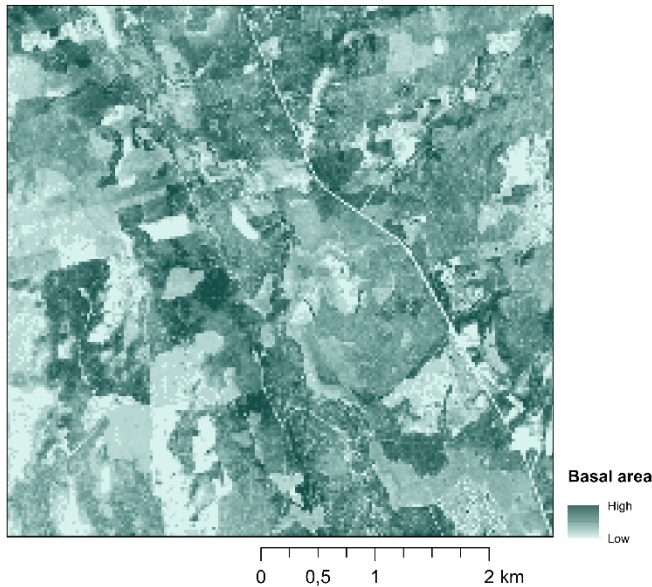
Tmax Jul



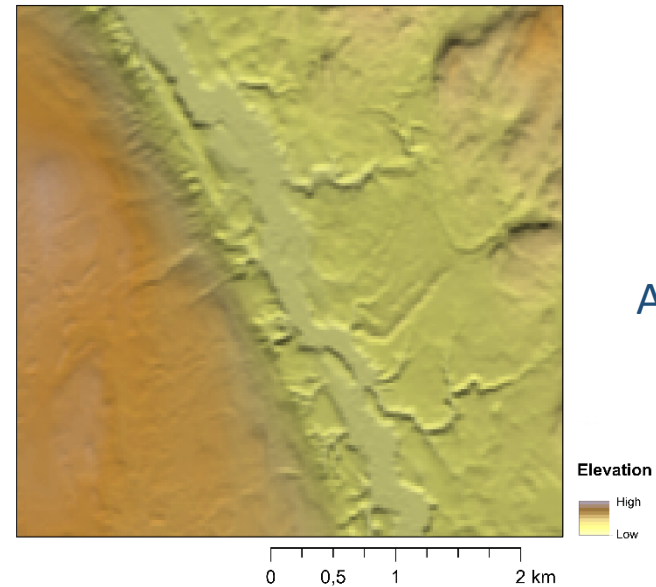
Tmax Nov



Skogstäthet  
(grundyta)



Altitud



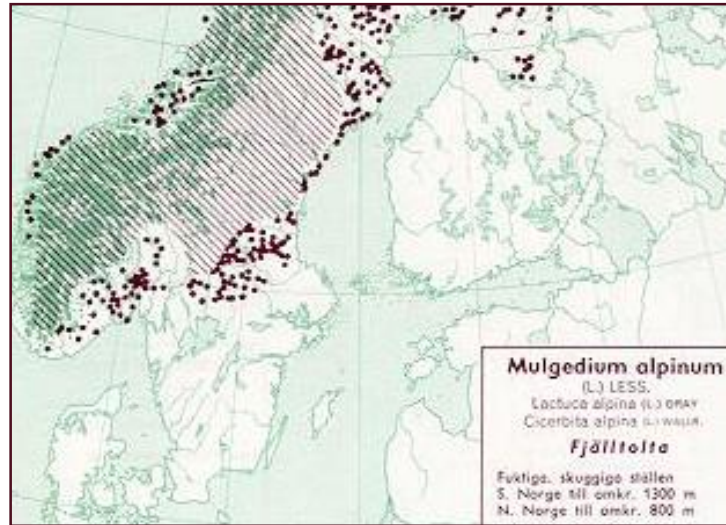
# 100 edge populations of Northern species

Southern distribution border

6 bryophytes

1 lichen

5 vascular plants



*Nordlig fjädermossa*



*Skogslummermossa*



*Grov husmossa*



*Bollvitmossa*



*Norrlandslav*



*Spädstarr*

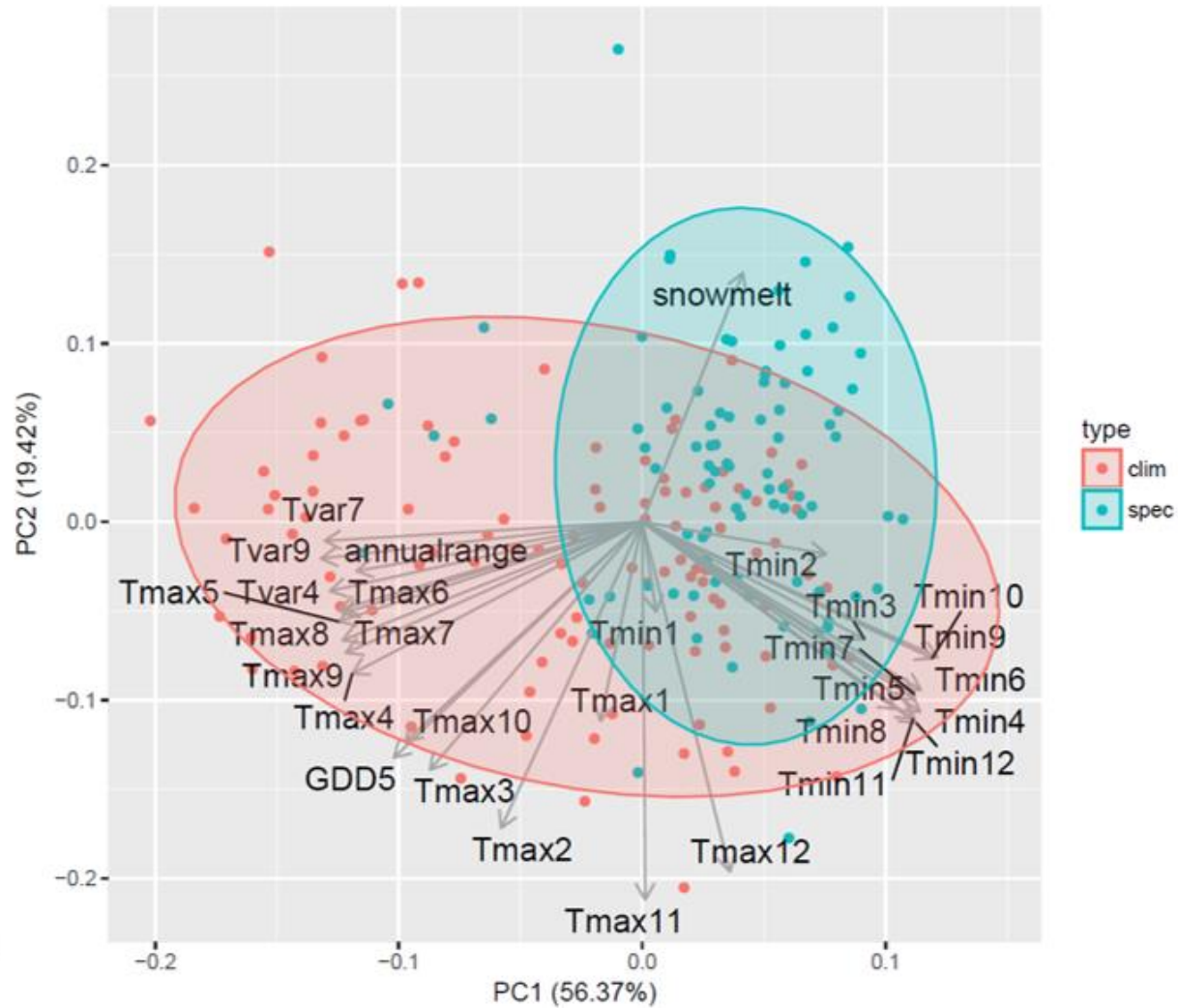


*Spindelblomster*



*Torta*

# Composition of climate at Northern species locations



# Microrefugial capacity?

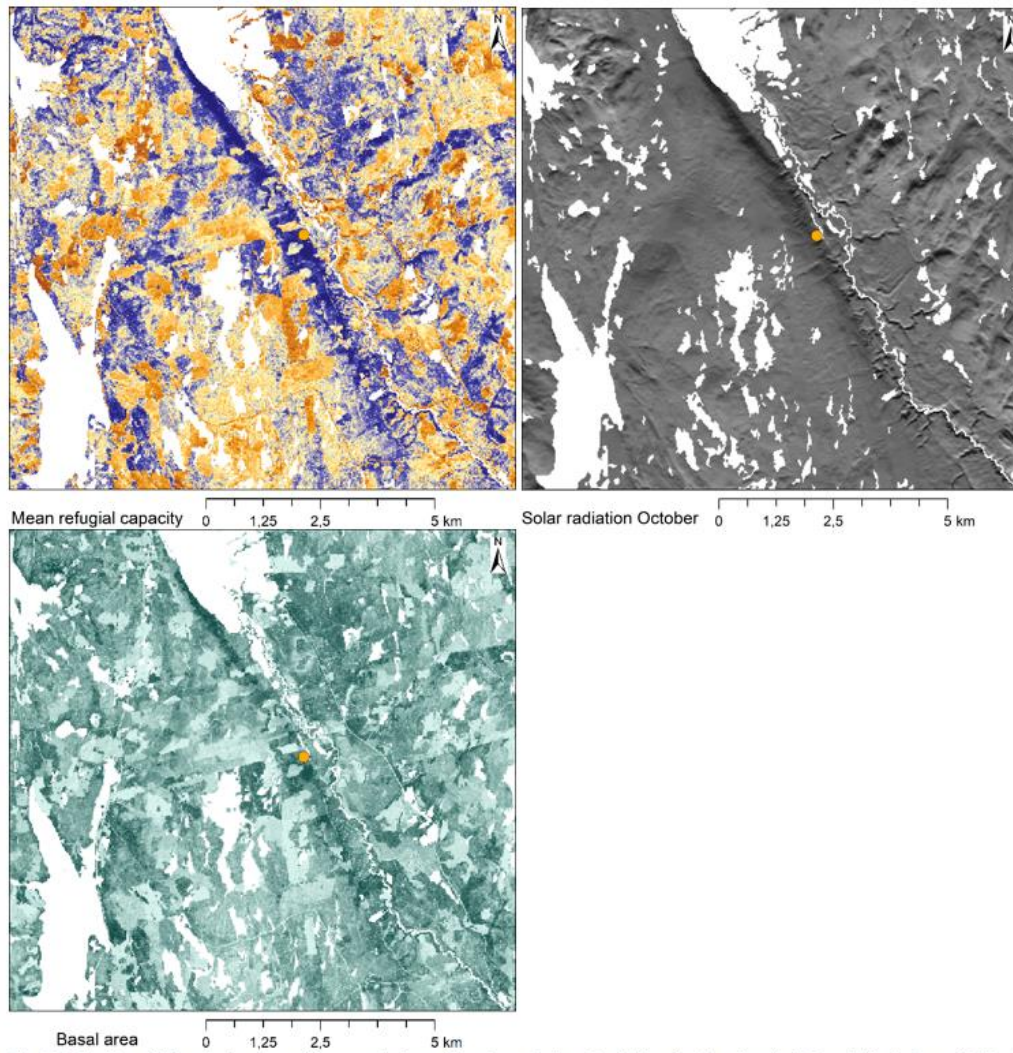
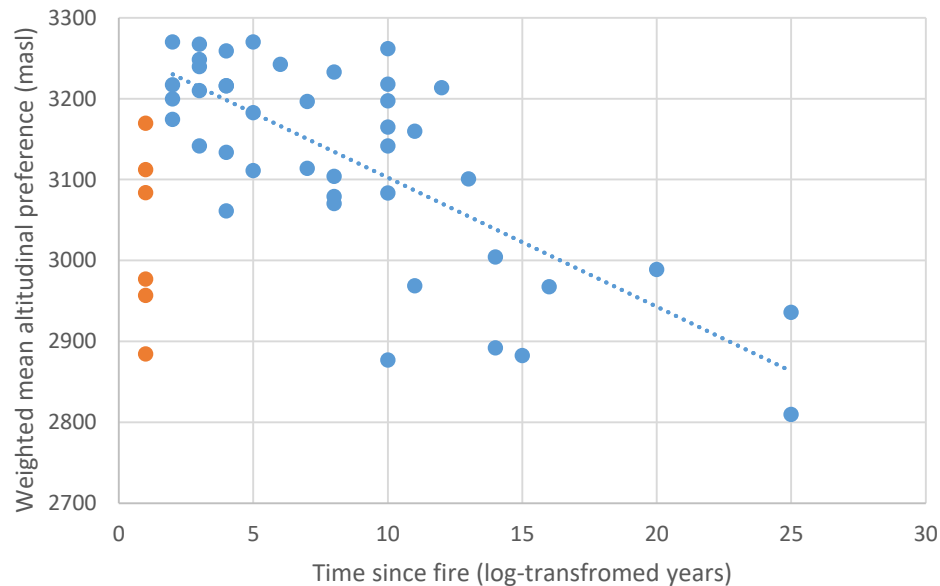


Fig. S 6. Section of the study area with a population of *Lactuca alpina*. Top left: refugia potential. Top right: Solar radiation in October. Bottom left: Forest basal area.

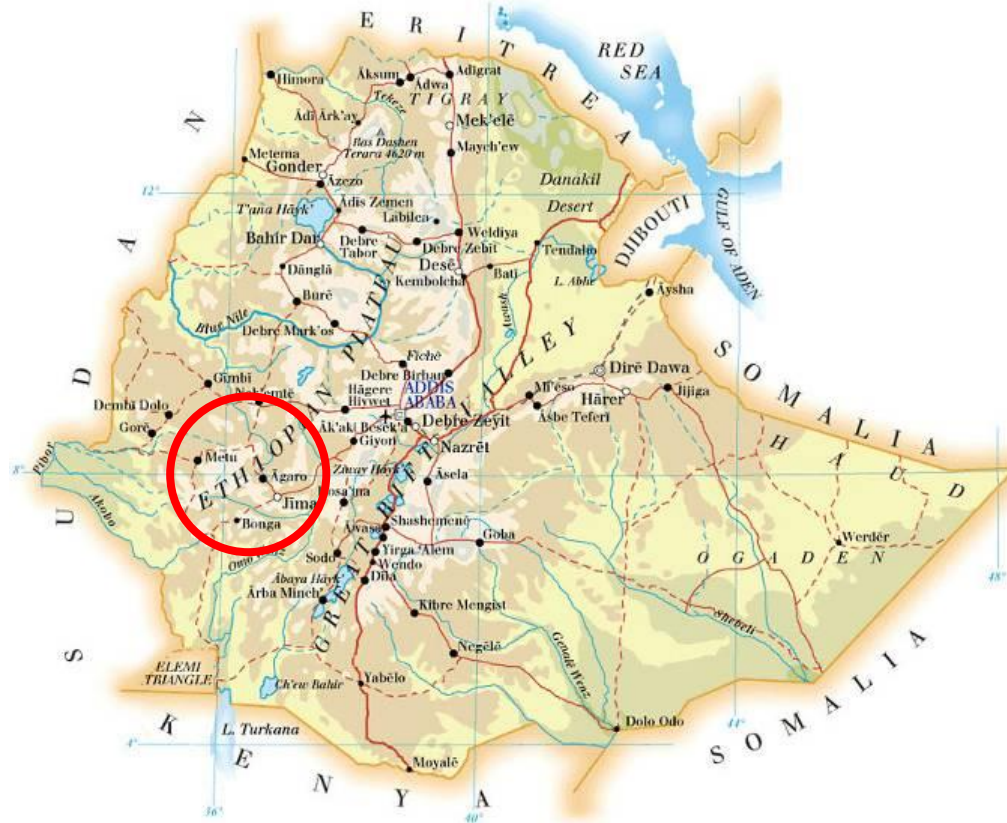
# What about biotic interactions?

High altitude species move downward when released from competition in Bale mountains, Ethiopia



Weighted mean plant altitudinal preference for plots which differ in time since fire. A regression line is superimposed for the plots that burnt >1 years before the inventory.

# Coffee, biodiversity and climate in Ethiopia











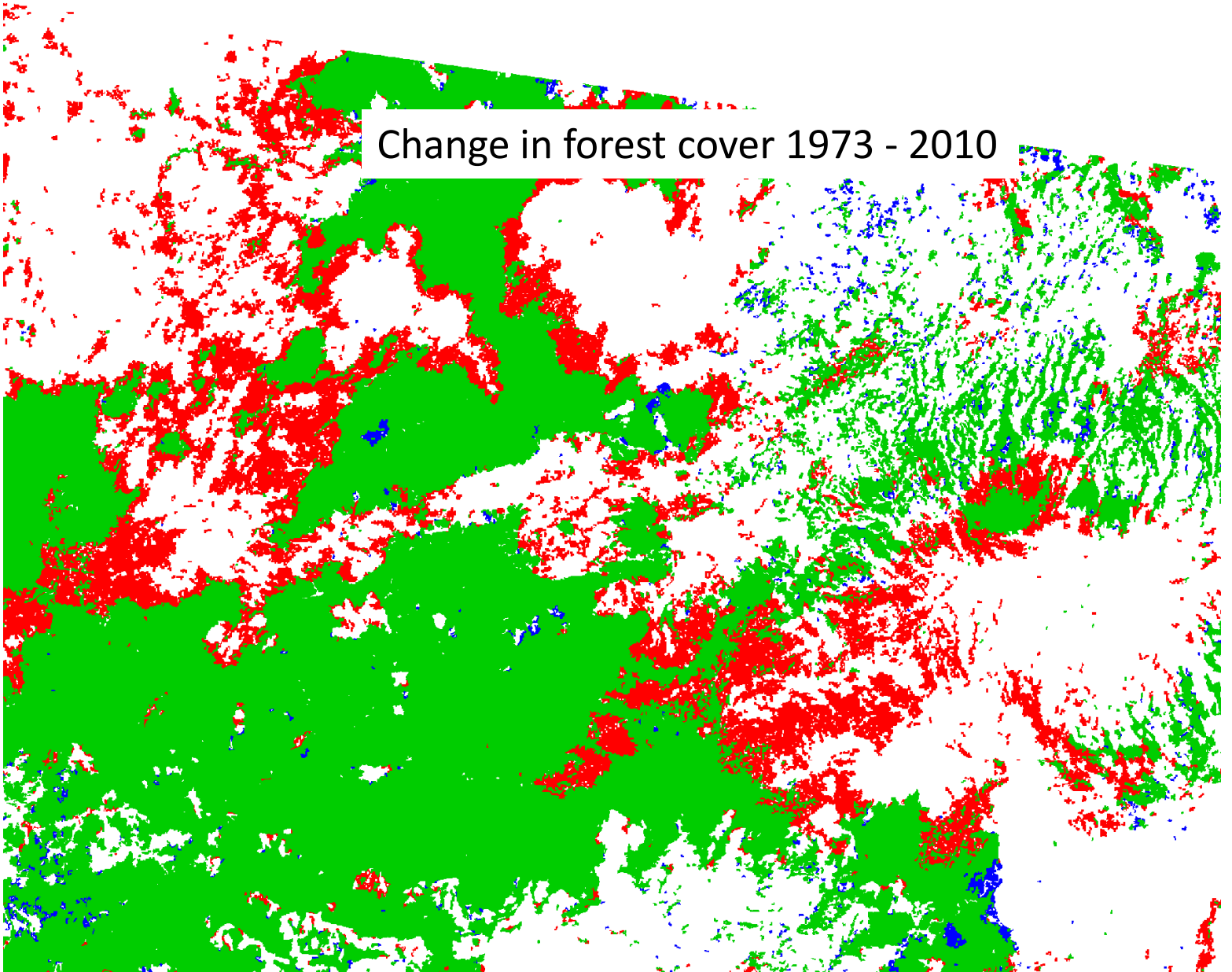






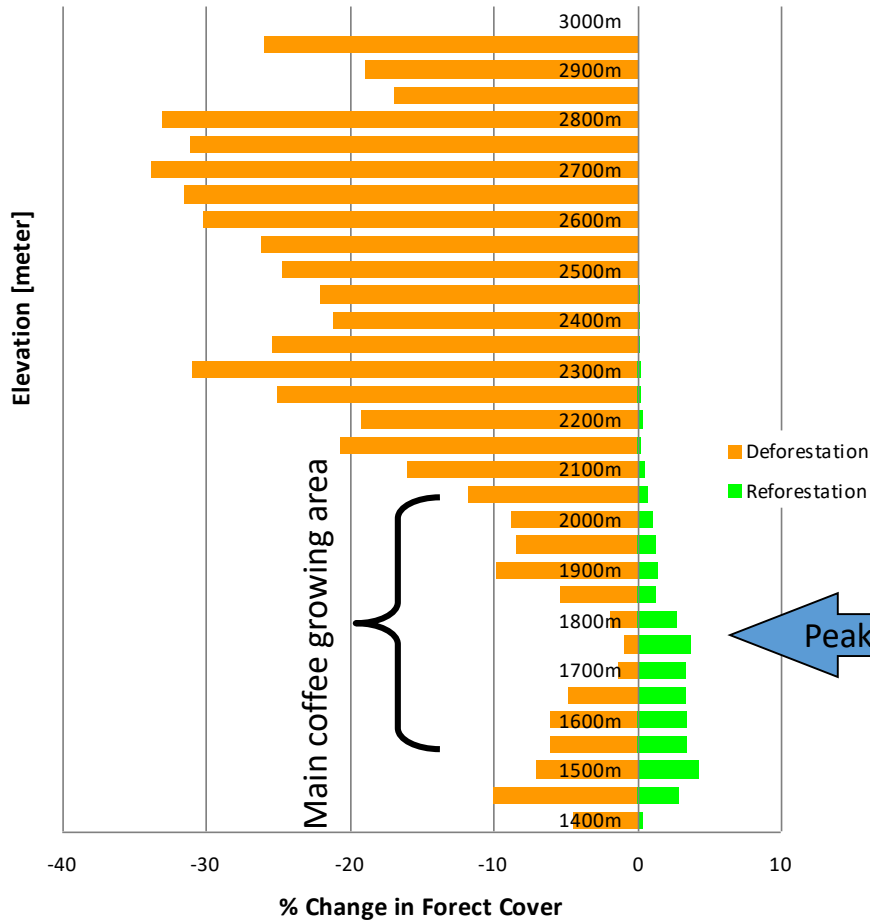
*Microcoelia globulosa*

## Change in forest cover 1973 - 2010



# Forest Cover Change 1973-2010

Gera-region

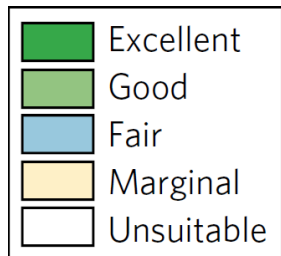
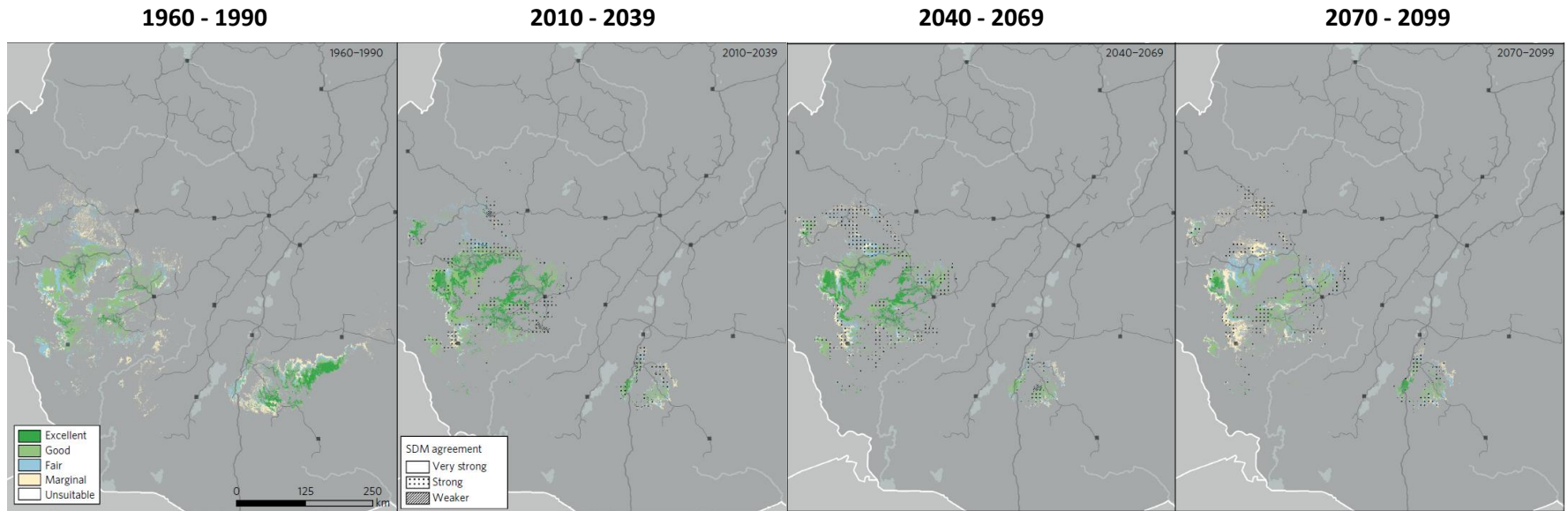


Peak coffee abundance



# How will climate change affect coffee cultivation?

PREDICTIONS FOR COFFEE CULTIVATION UNDER A NO-MIGRATION SCENARIO



**Coffee cultivation is very sensitive to climate change**  
We have little idea about the impacts on coffee diseases  
and smallholder farmers....

# New project: The relationship between climate, pathogens, and coffee yield: optimizing management for smallholder farmers



**Burik Nurihun**  
(PhD student)



**Erik Kjellström**  
SMHI

How will the micro- and macroclimate change in SW Ethiopia?



**Lowe Börjeson**  
Human Geography  
SU

How will climate change and disease affect the management decisions of the smallholder farmers?



**Girma Adugna**  
Plant pathology  
Jimma University

What is the impact of predicted climate change on coffee fungal diseases?



**Kristoffer Hylander**  
DEEP  
SU

What management strategies are most effective to optimize the microclimate?

# Placing out hundreds of dataloggers to measure the microclimate



PhD student Biruk Nurihun

# Interviews with farmers January 2020 about climate change and adaptation actions



# Summary

- Microclimate is important for species
- Trees drive important variation in microclimate
- Forestry can affect species distributions and responses to climate change indirectly by regulating the microclimate. (RA7-type of response!)
  
- Microclimate is important for coffee
- Coffee always grows with trees and thus regulate biodiversity
- With current climate trees are cut down at high altitudes – perhaps they will be replanted when climate get warmer...
- Climate and land-use interactions regulate biodiversity. (RA7-type of response!)