Investigating the history and consequences of secondary contact between divergent populations of *Trichaptum abietinum* in Europe

Dabao Lu 11 April 2024

Norwegian Biodiversity & Genomics Conference 2024

Aknowledgements

PhD Advisors:

- Inger Skrede
- Håvard Kauserud
- David Peris
- Sundy Maurice
- Jørn Henrik Sønstebø
- Mark Ravinet
- Glenn-Peter Sætre

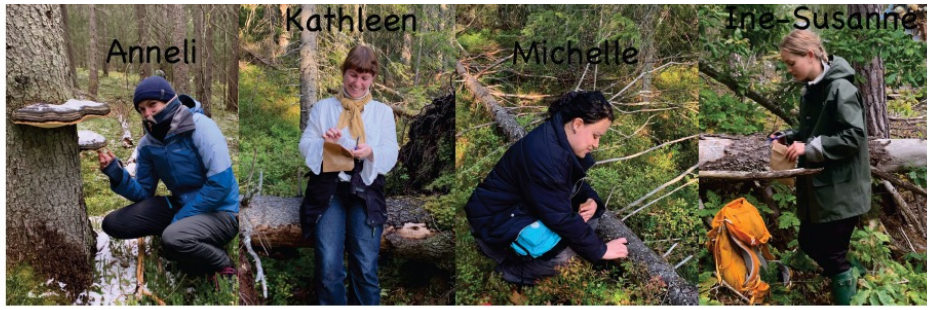
The Research Council of Norway

Genomics of speciation: dissecting mechanisms of reproductive barriers in fungi

UiO:Life Science Internationalization support

The Trichaptum Alliance:

- Anneli Andersen
- Kathleen Helleland
- Michelle Vera
- Ine-Susanne Methlie



Bærekraftprosjekt:
The genetic legacy of global change

Kingdom Fungi

biodiversity:
150,000 described species, several millions estimated

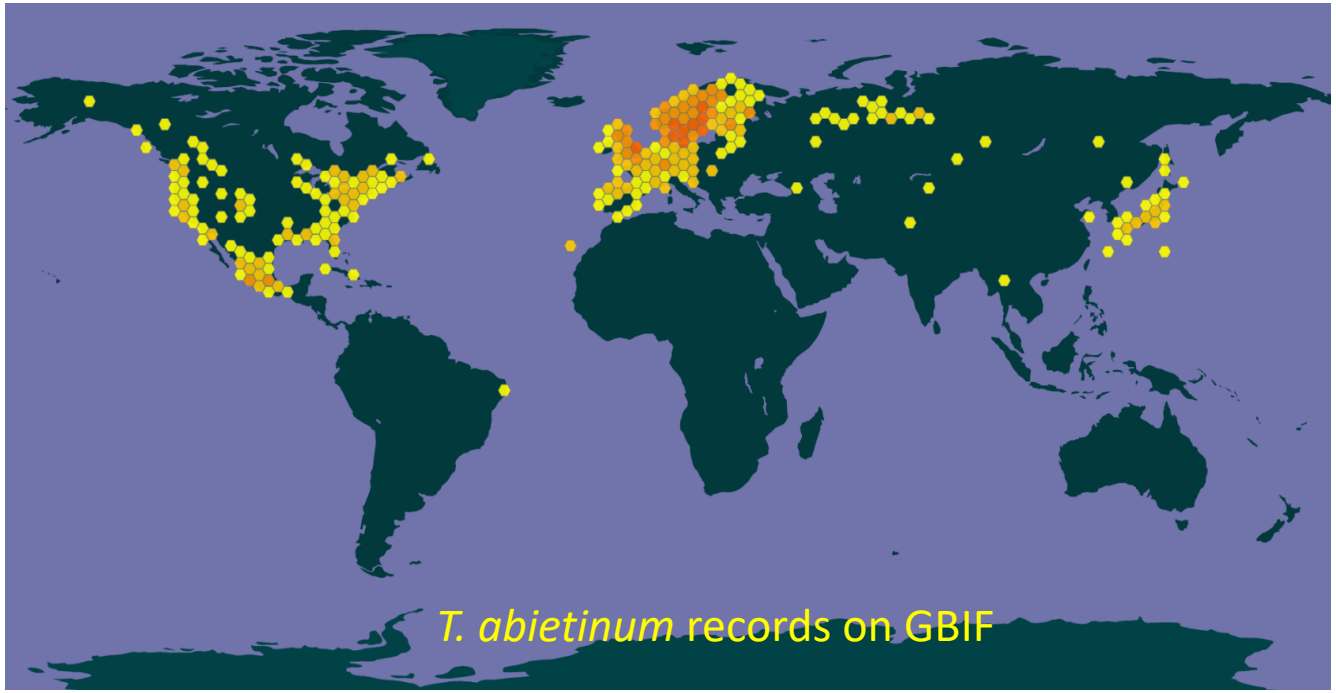
ecological diversity:
decomposers, various mutualisms and parasites
(on animals, plants and other fungi)

morphological diversity:
unicellular (yeasts) or multicellular

Trichaptum abietinum: a widespread species complex

Common white rot on Pinaceae

Widespread: circumtemperate/boreal distribution



- **Easy to culture and cross in the lab**
- **Small genome:** 50 Mb PacBio reference genome

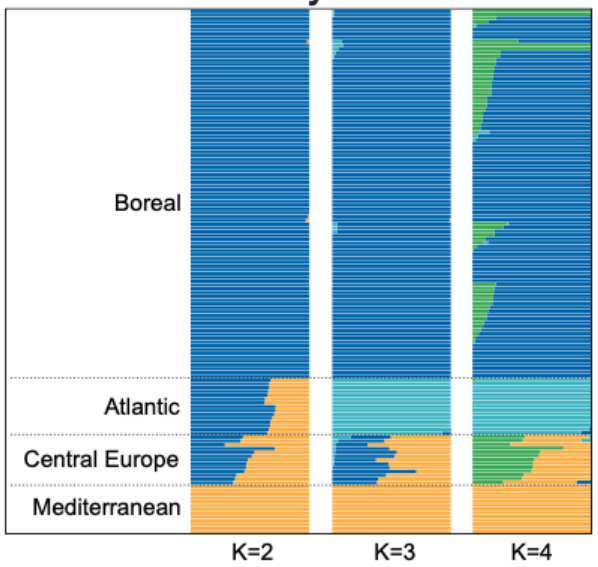
Peris et al. (2022): Large-scale fungal strain sequencing unravels the molecular diversity in mating loci maintained by long-term balancing selection

Population structure of 138 European *T. abietinum* genomes

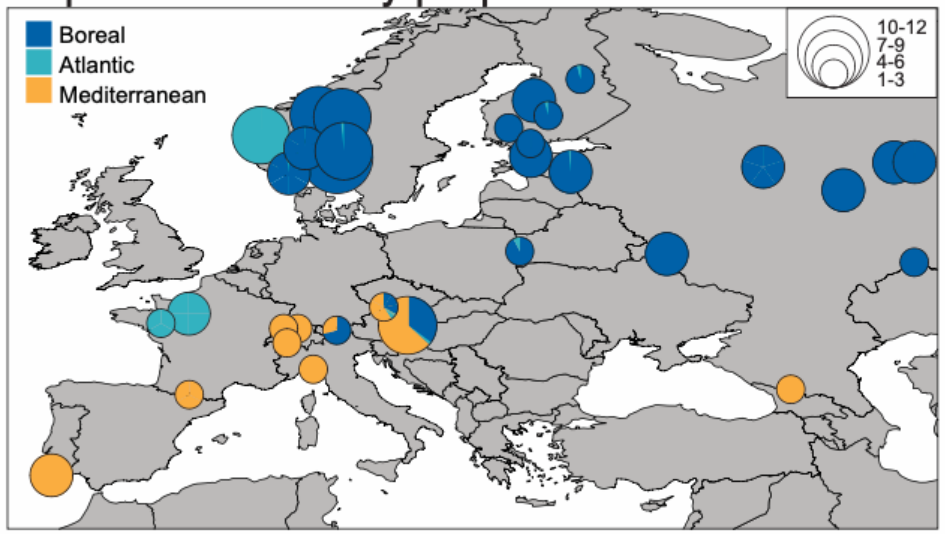
Ine-Susanne Methlie

"The distribution of biodiversity across the world is largely measured as species diversity – their numbers, proportions and distinctness. But within a species there are often several geographic subspecies, and genetic studies have added greatly to knowledge of subspecific diversity, with some regions possessing more lineages and older divergence."
Hewitt (2004): The structure of biodiversity – insights from molecular phylogeography

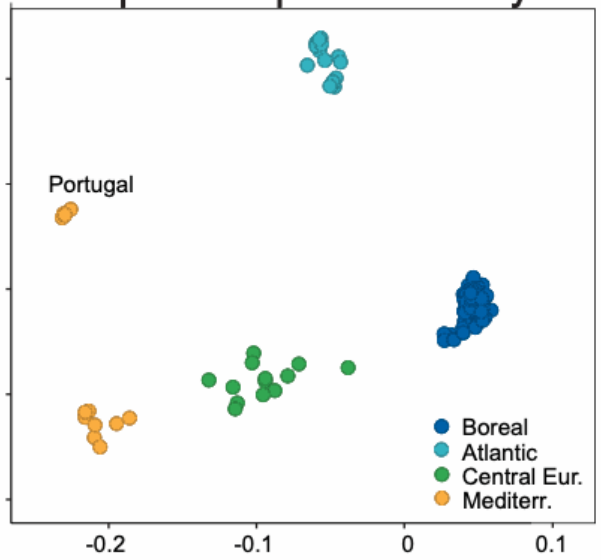
Admixture analysis



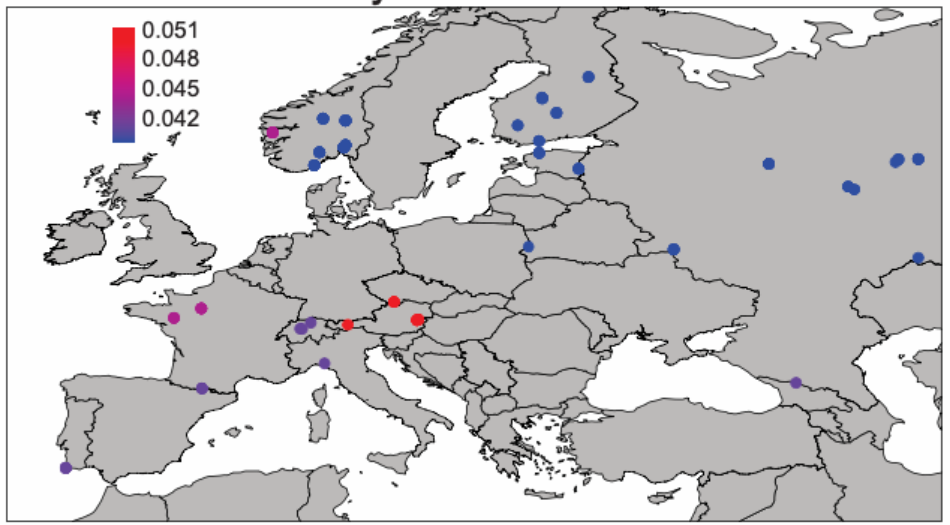
Population ancestry porportions k=3

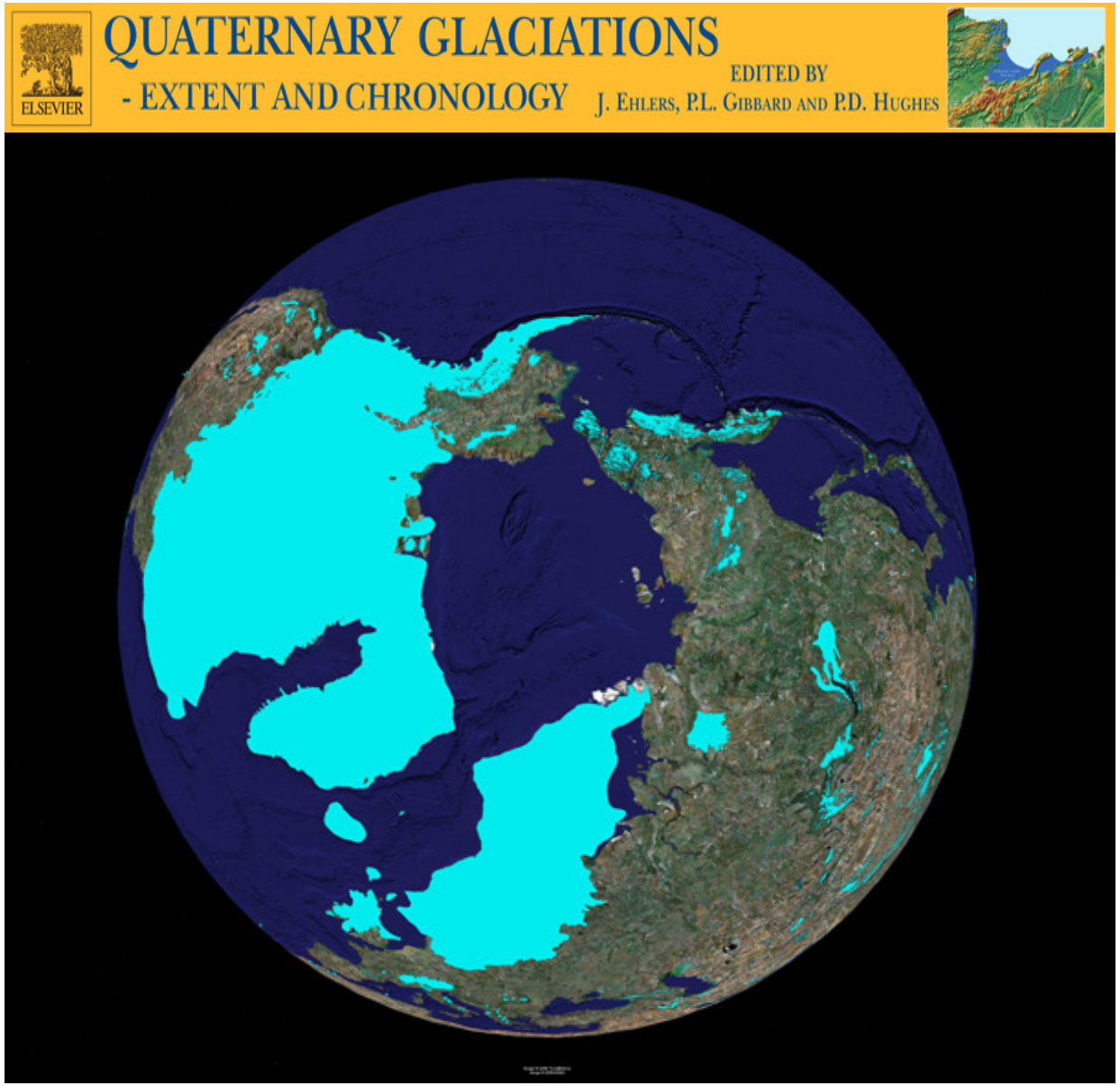


Principal component analysis



Nucleotide diversity





- Alternating series of glacial and interglacial periods the last 2.58 million years

Comparative phylogeography and postglacial colonization routes in Europe

PIERRE TABERLET,* LUCA FUMAGALLI,† ANNE-GABRIELLE WUST-SAUCY,‡ JEAN-FRANÇOIS COSSON§

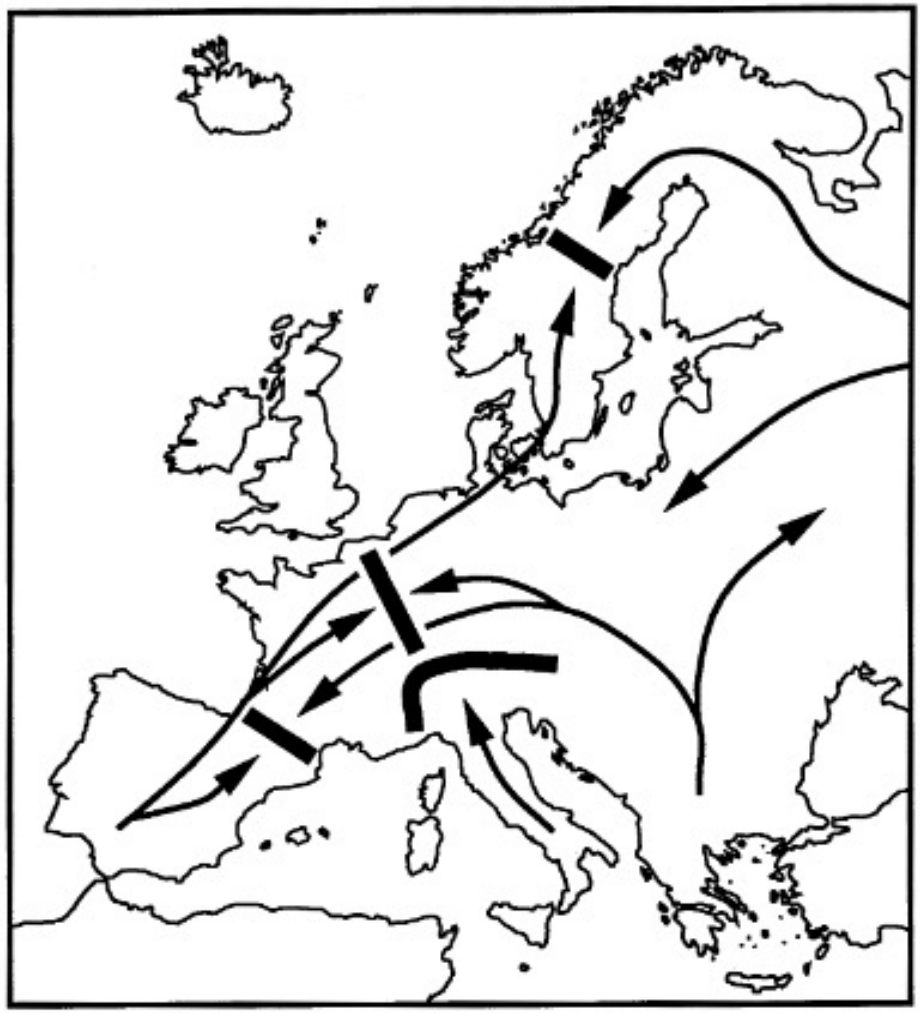


Fig. 6 Main postglacial colonization routes and subsequent suture zones in Europe.

Inferring postglacial recolonization routes

Summary of 4 **plant** and 6 **animal** taxa

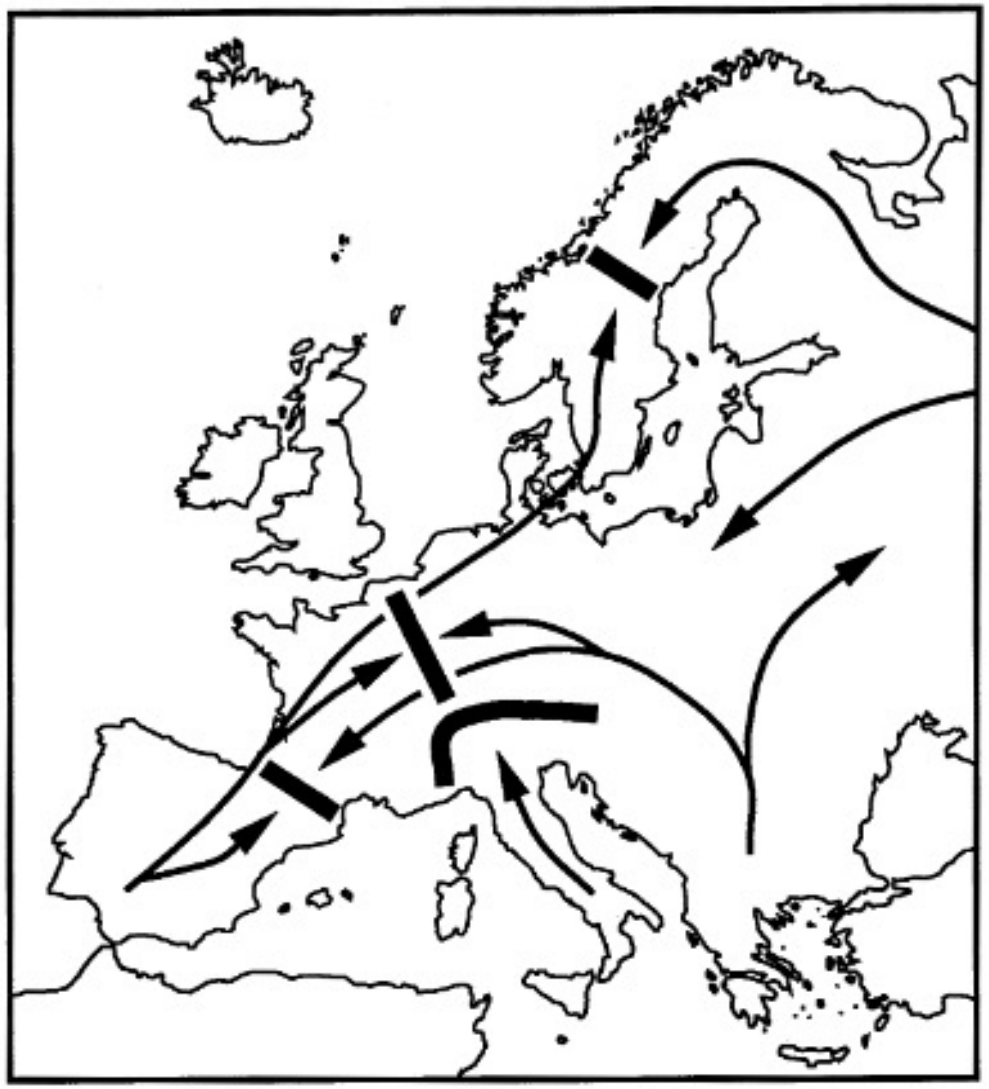
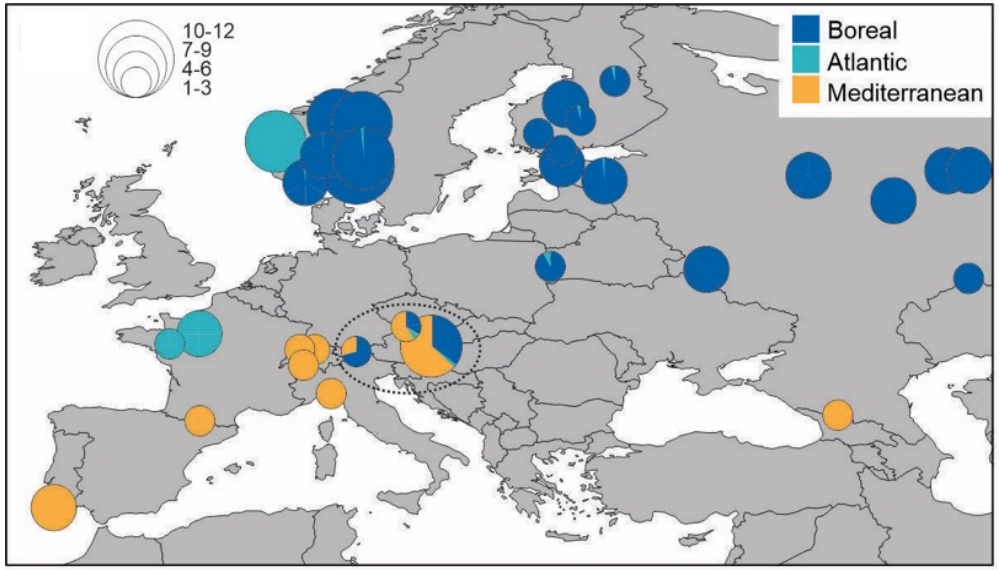
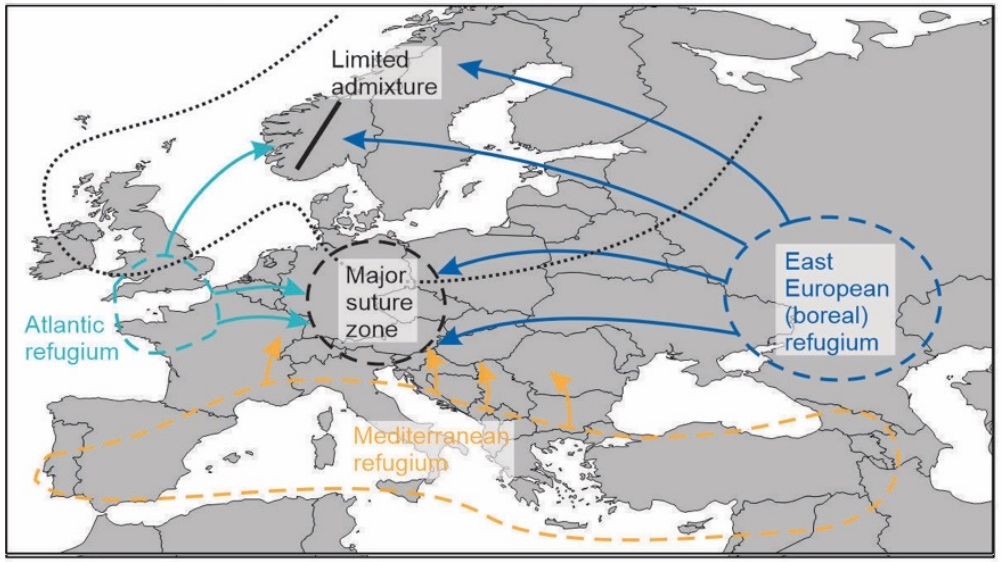


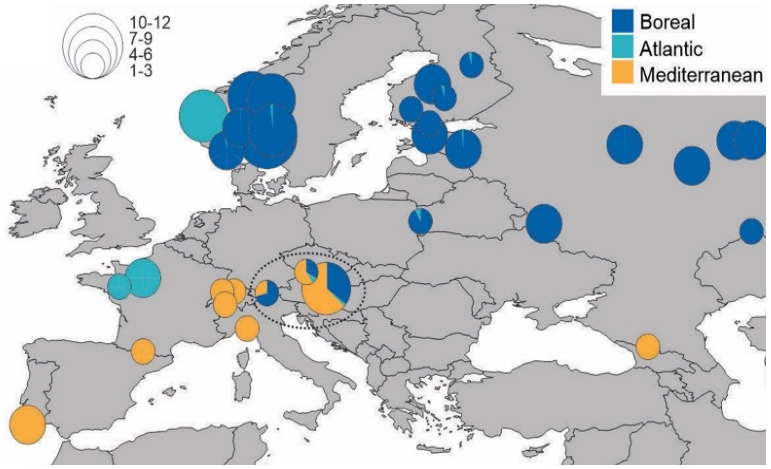
Fig. 6 Main postglacial colonization routes and subsequent suture zones in Europe.

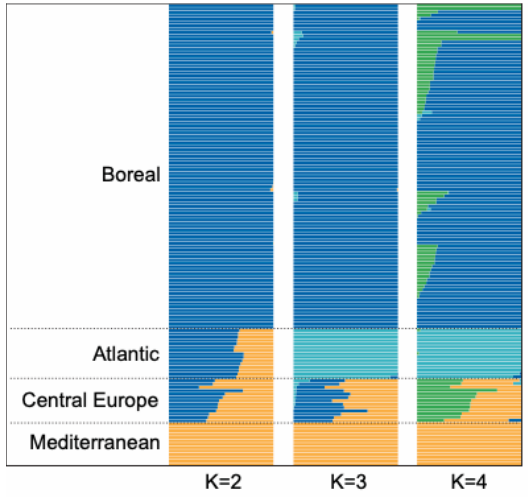
The wood decay **fungus** *Trichaptum abietinum*





Investigating the history of secondary contact

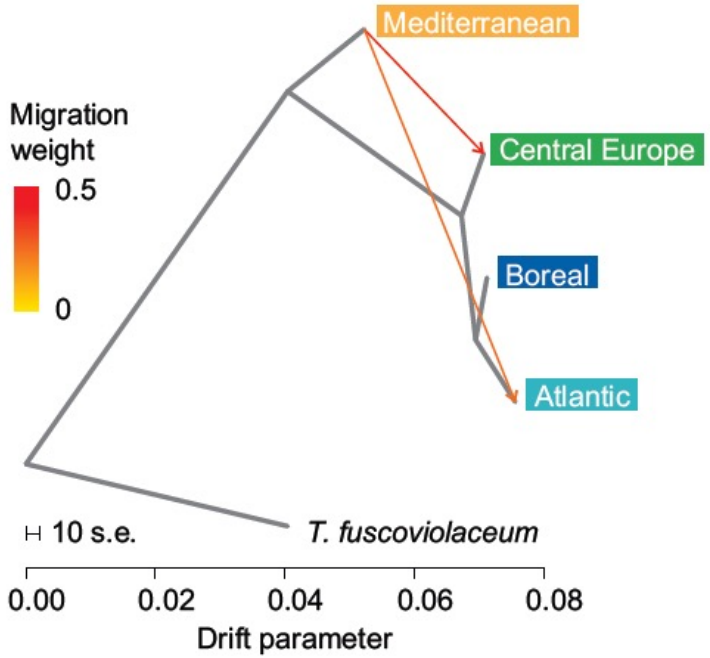




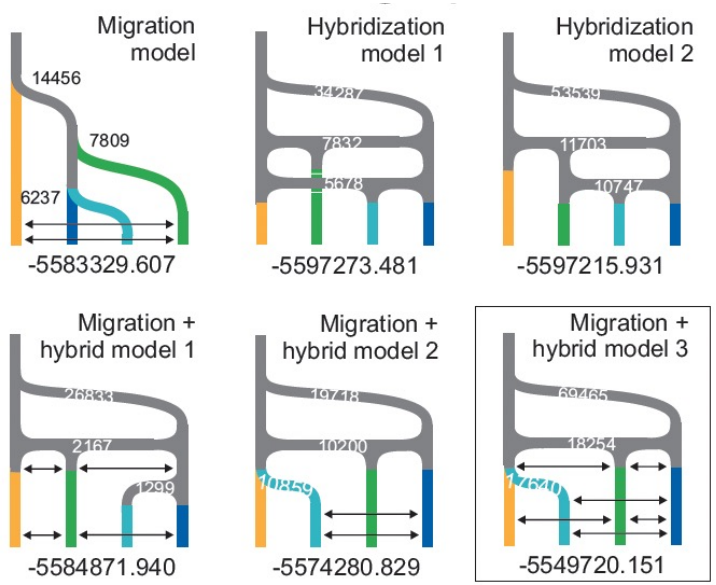
Admixture dating with Ancestry HMM:

-one main admixture pulse 600 generations ago giving rise to admixed Central European population

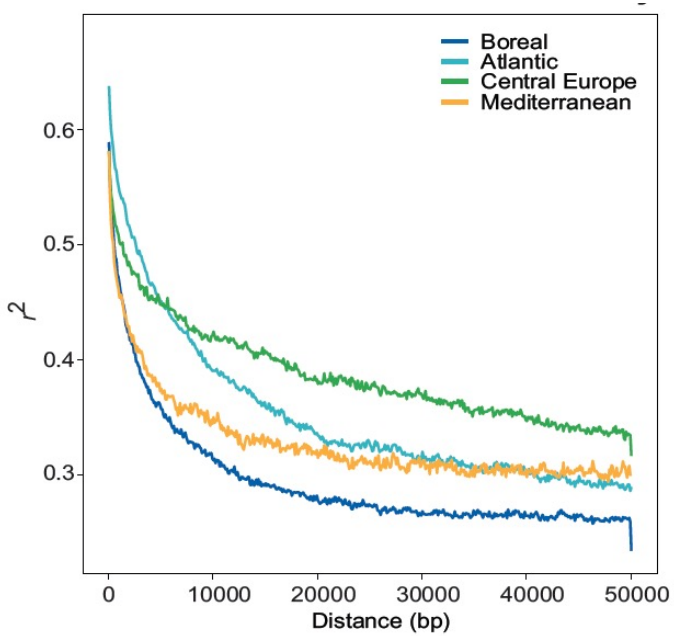
Treemix Phylogenetic network



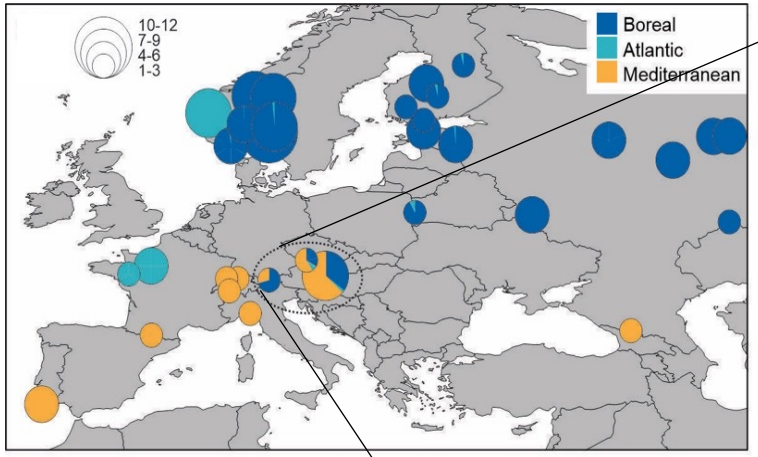
Fastsimcoal2 Demographic modelling



Genome wide LD decay

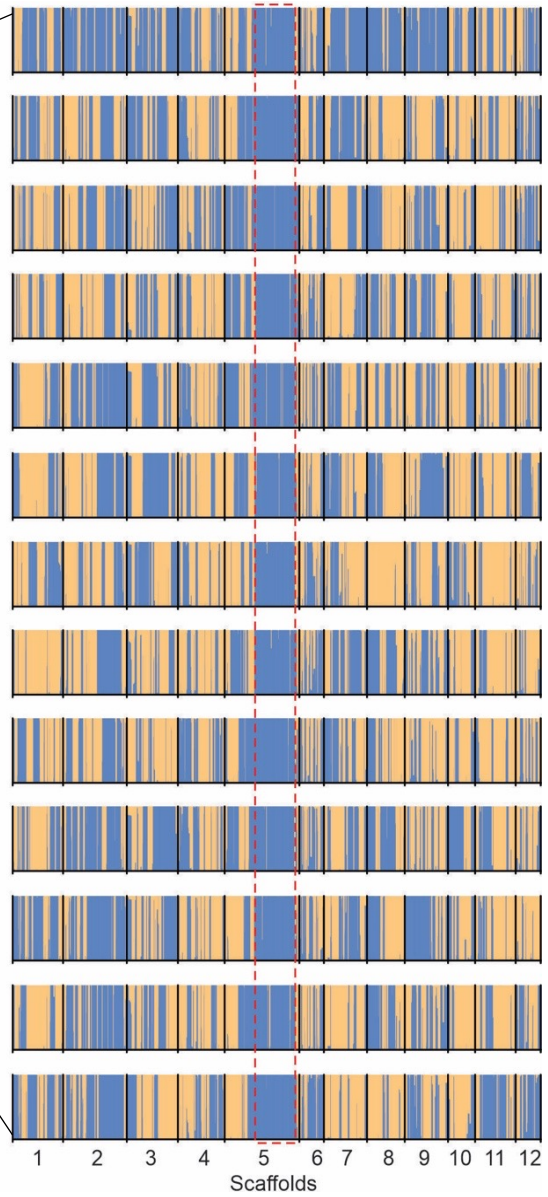


Investigating concequences of secondary contact

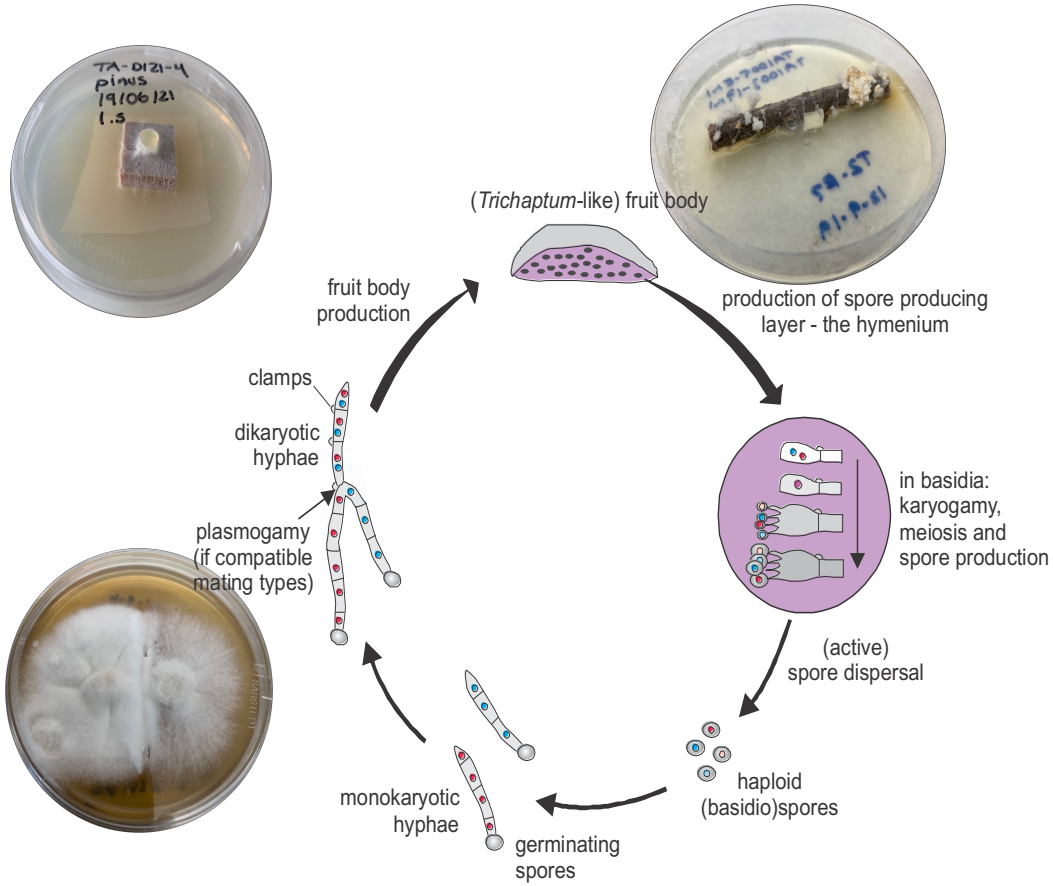


Michelle Vera Castellanos

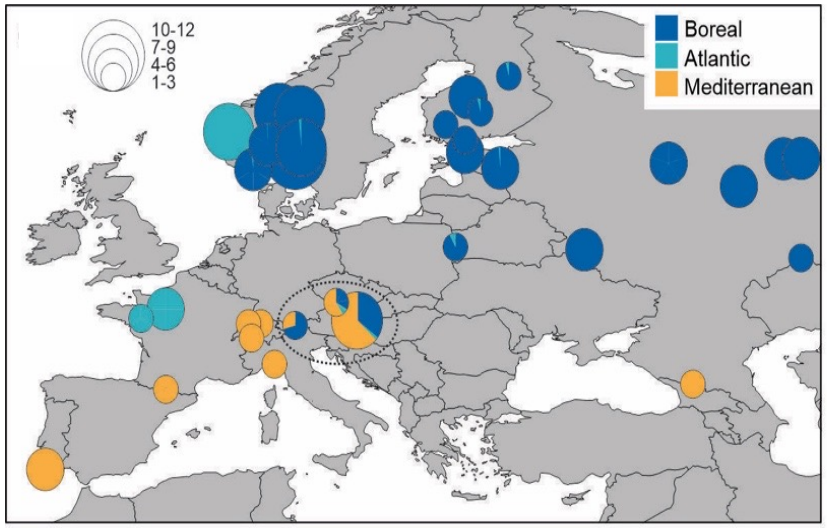
Local Ancestry Inference (PCAdmix)

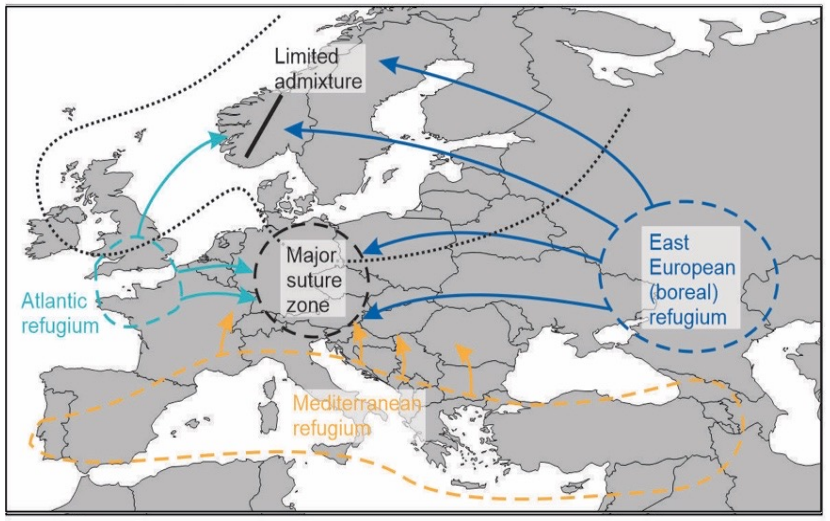


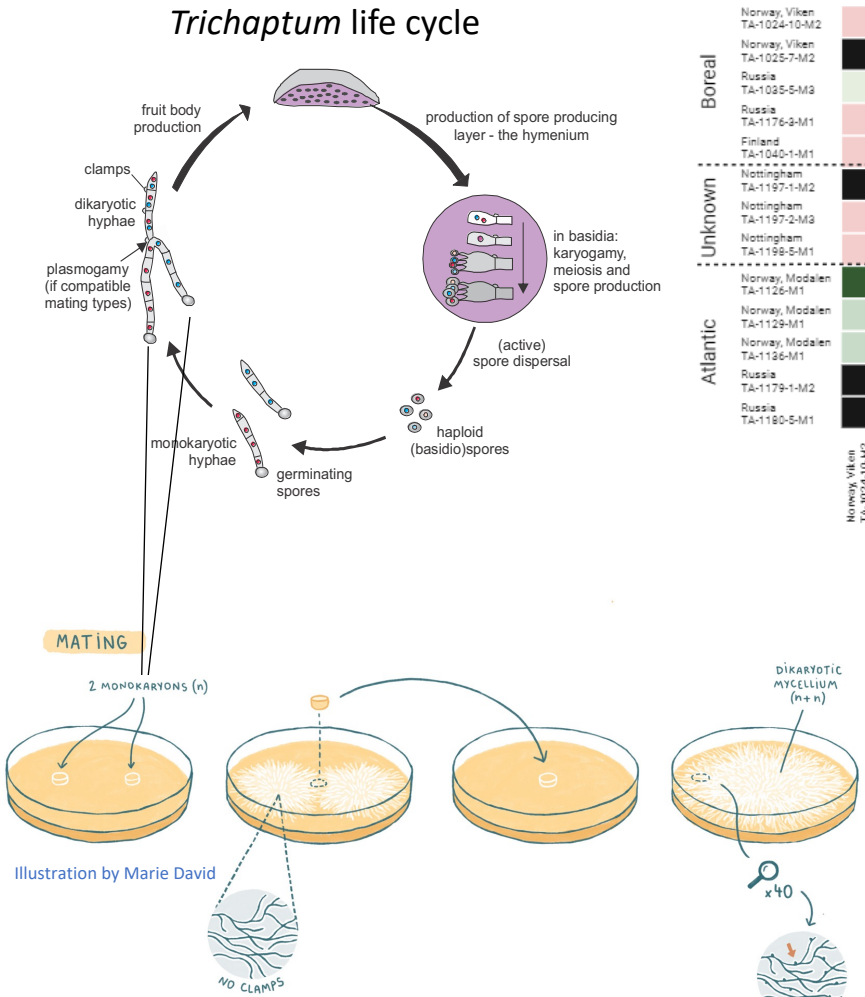
Assessing reproductive barriers in the *Trichaptum* life cycle

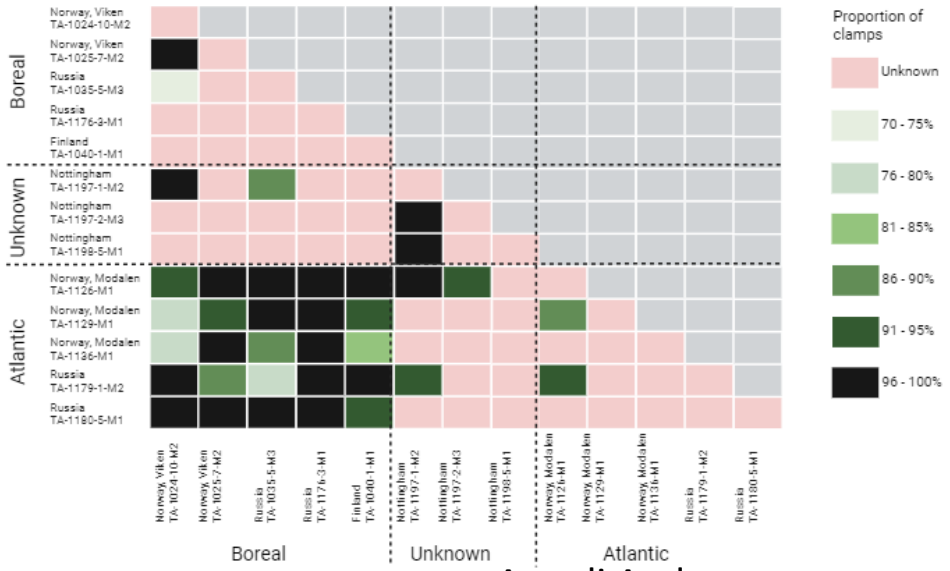


Determining mate compatibility with crosses





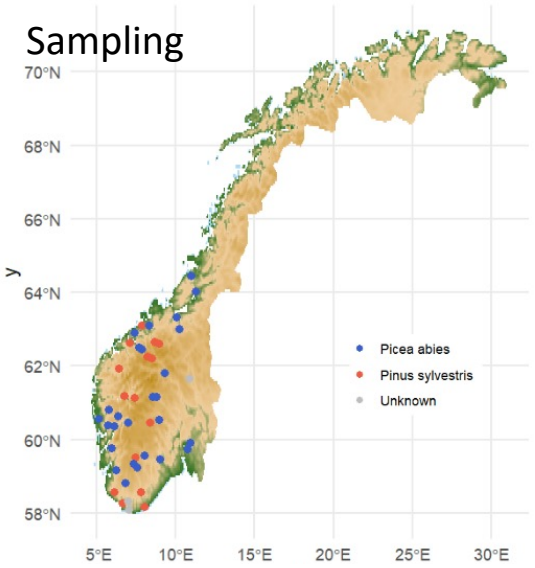




Anneli Andersen

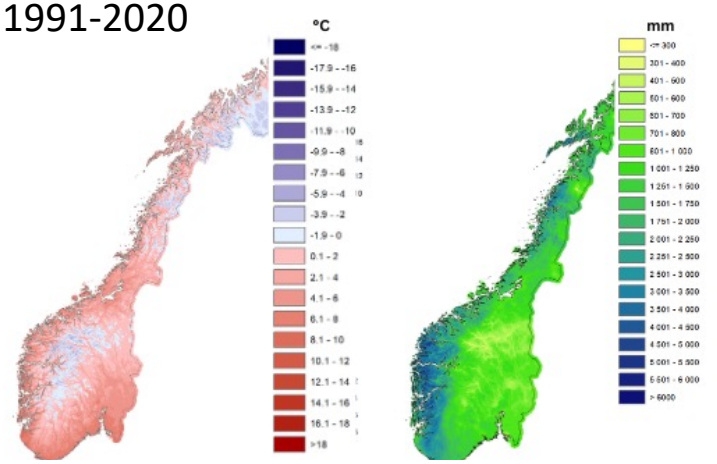
Assessing local adaptation with common garden experiments

Sampling



Kathleen Helleland

Mean annual temperature and precipitation 1991-2020



Growth at different temperatures and water potentials

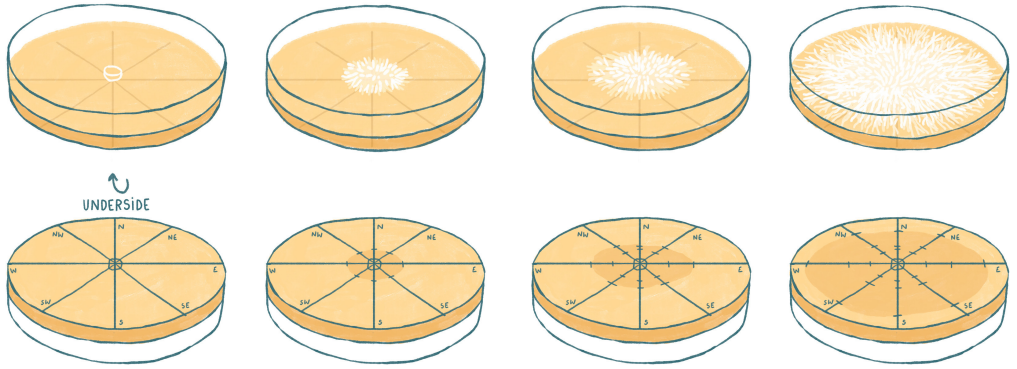
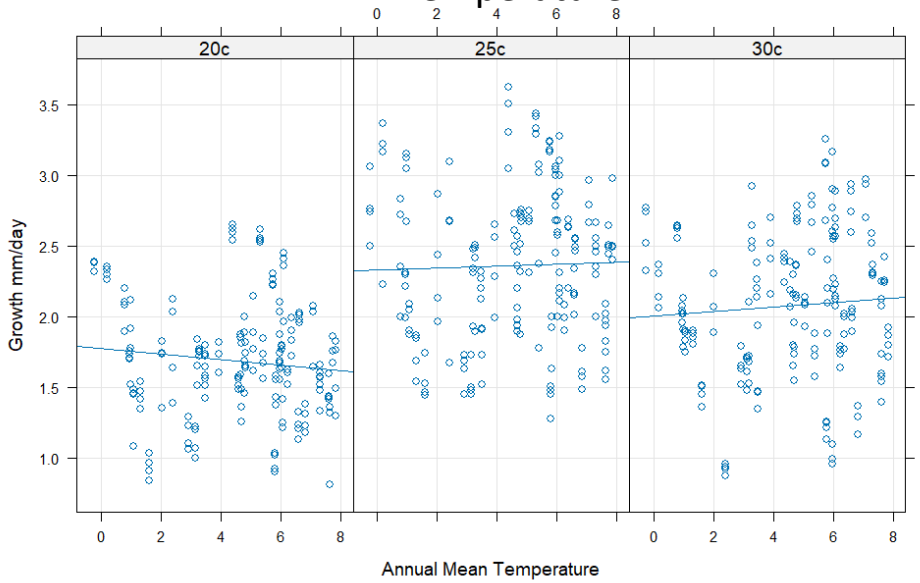
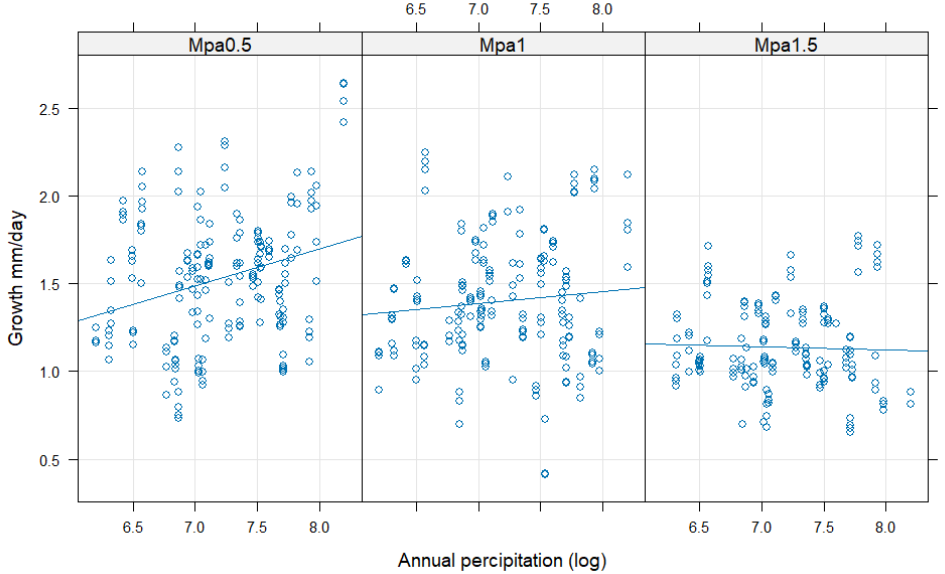


Illustration by Marie David

Temperature



Water potential (Drought)



Thank you for your attention!

Orbital Consequences

The sun and the earth describe orbital changes
which drive climate cycles and modify ranges.
The shape of the land forms a number of places
that allow the survival of different races.
When enclaves advance with the ice in retreat
some form hybrid zones where two ranges meet.
Such regions are common and not very wide
so the mixing of genes affects neither side.
They divide up the range in a patchwork of pieces
with echoes and glimpses on the nature of species.
A brief rendez-vous and the ice comes again.

When the glaciers melt so that ranges expand
some plants will spread quickly where there's suitable land.
Those insects which eat them will follow this lead
some flying, some walking to establish their breed.
Those that try later meet a resident band,
they must somehow be better to make their own stand.
But the mixture will change as more types arrive
and warming conditions allow new species to thrive.
Some will move on to fresh places ahead,
those that remain must adapt, or are dead.
And then the tide turns and the ice comes again.

Each refuge could foster a deviant form,
new neighbours, chance changes and drift from the norm.
When the warm breakout comes, those few in the van
disperse from the edge and breed where they can.
Pioneer pockets grow to large populations,
a very good place to strike new variations.
Some may not work well with their parental kind
so stopping the spread of those from behind.
Continental theatres provide plenty of chances
to establish new morphs in both retreats and advances.
New species may form when the ice comes again.

So what will you do when the ice comes again?
It could be quite quick, if the ice cores speak plain.
The great ocean currents that warm our green spring
may stop in a season should the salt balance swing.
Great civilizations in north temperate lands
must migrate south to the sun and the sands.
But past pollen and dust tell us these will be drier,
wet forests will shrink and population grow higher.
Our forebears hung on near a sea or a cave.
They fished and they painted, they dreamed, they were brave.
So like Noah and Eric, we must adapt and survive.

G. M. Hewitt

Thomas Fearnley, *Grindelwaldgletscheren*