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Utilizing assisted translocation to enhance forest growth and carbon stocks in European forests

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Klimatag 2022
22 April2022

Climate change and European Forests

Change in species composition

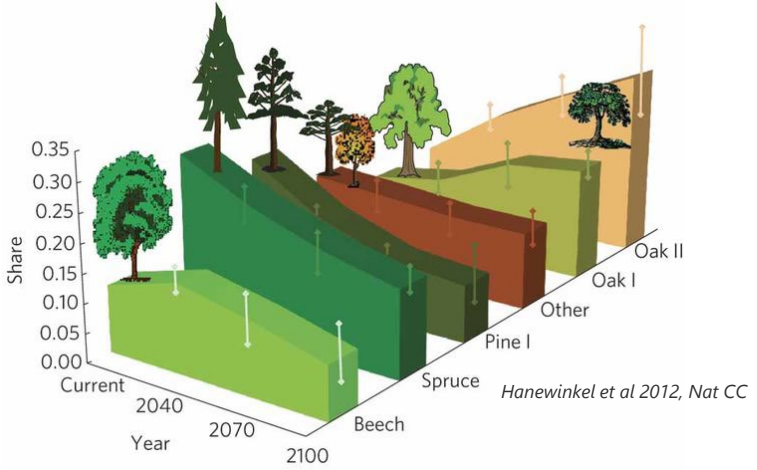
- Decrease in share of conifers such as Norway spruce
- Increase in share of broadleaved species such as oaks

Change in forest productivity

- Increase in productivity in north and boreal region
- Decrease or constant in Mediterranean an central Europe
- High uncertainty in predicted changes

Changes in disturbances

- Increase in wind disturbances
- Increase in fire risk
- Rise in favorable conditions in pests and pathogens



Hanewinkel et al 2012, Nat CC

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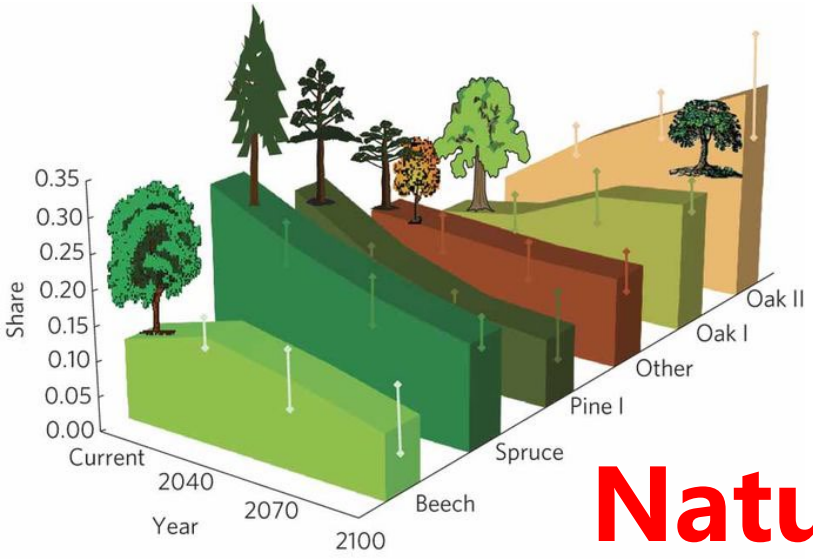
Climate change and European Forests



Hanewinkel et al 2012, Nat CC

- **Migration**
- **Adaptation**
- **Extinction**

Natural processes are too slow !!!

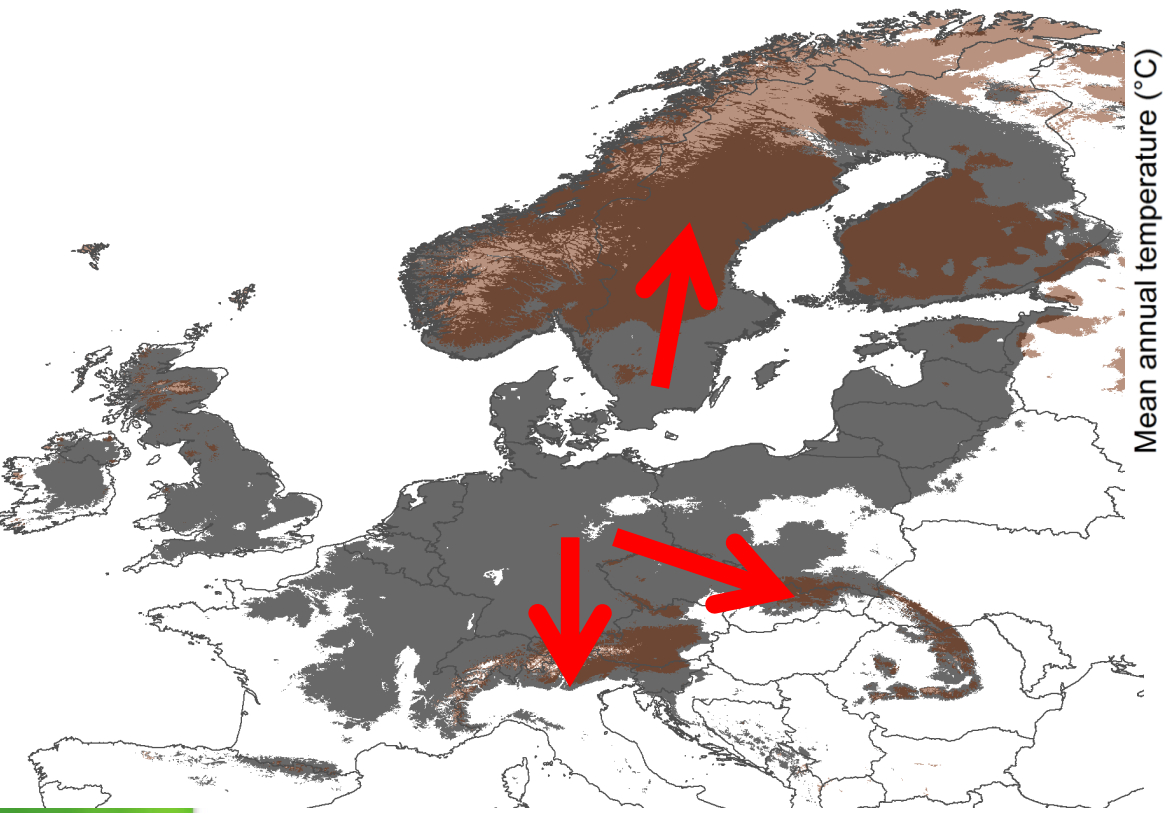
Climate change will alter link to local adaptation

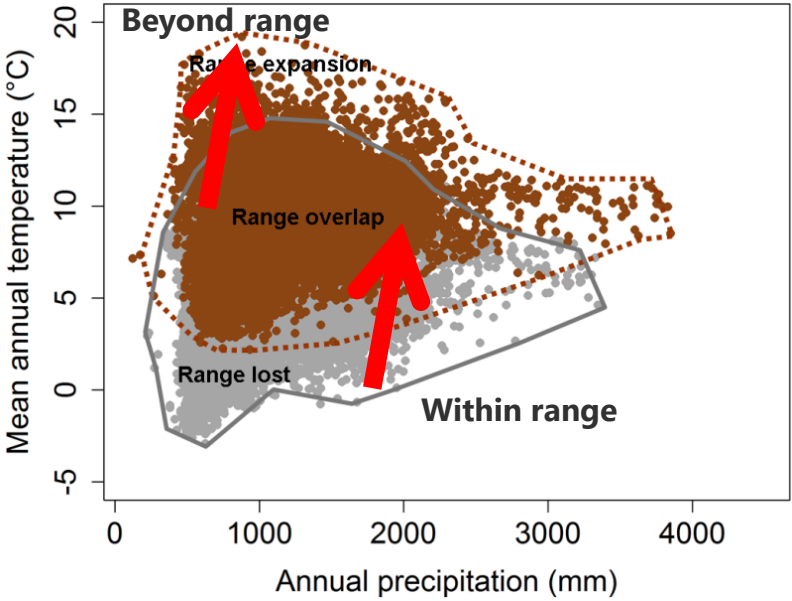
This will result in maladapted populations

Our Action plan

- Recent European policy initiatives such as the EU **Biodiversity Strategy**, the **3 billion tree pledge** calls for tremendous restoration efforts
- A large part will come from active plantation in addition to conserving existing forests.
- **On a practical scale two questions become important**
    - Which species to plant?
    - Where should I get adapted seeds and planting materials from?

Assisted migration

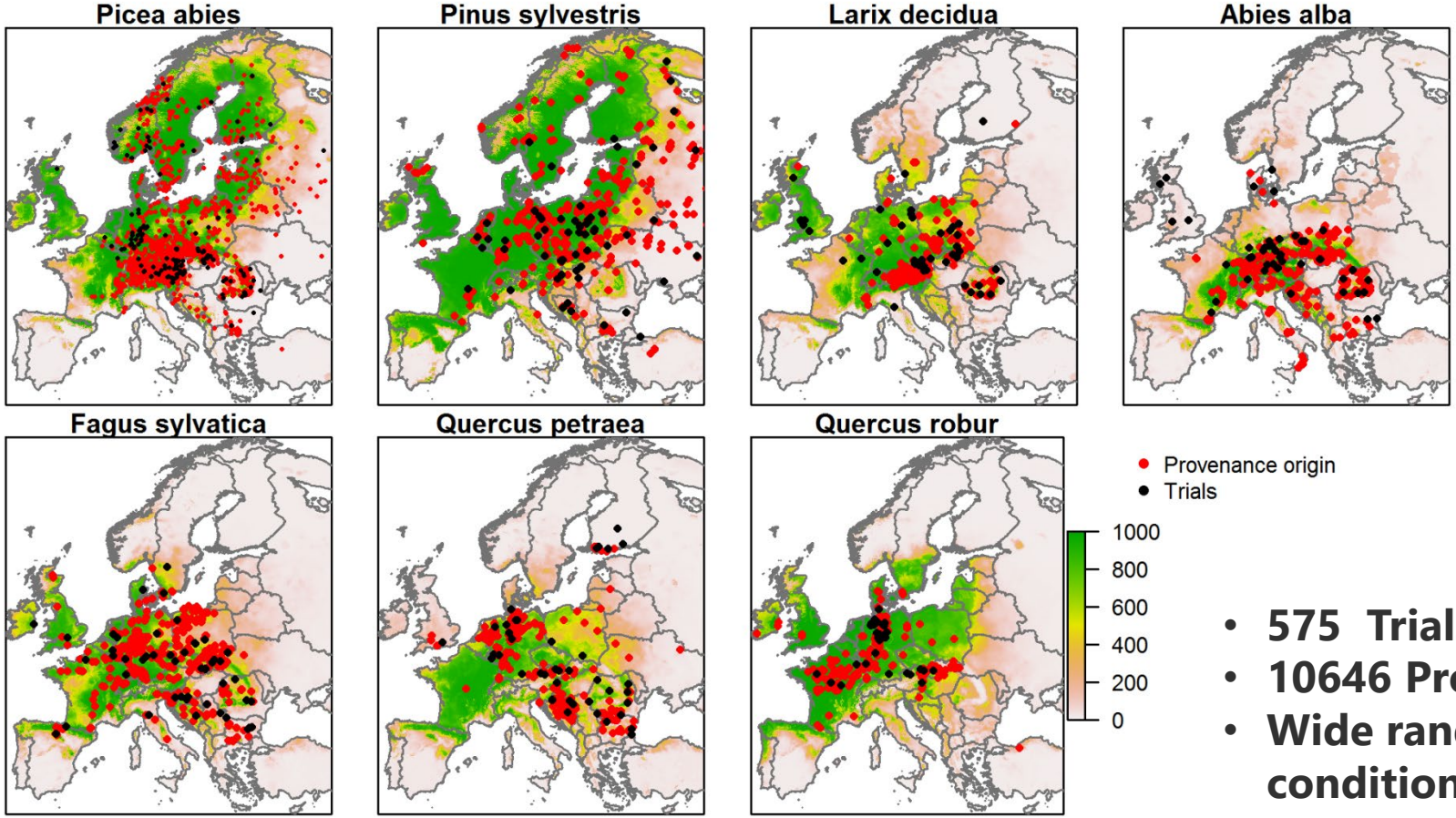




Provenance trials

HOT COLD

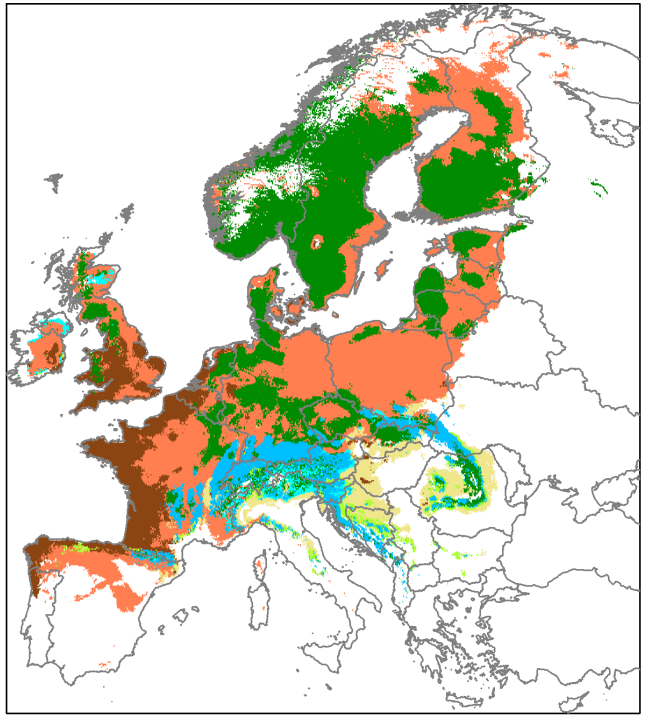
Harmonized provenance trial data (SUSTREE project)



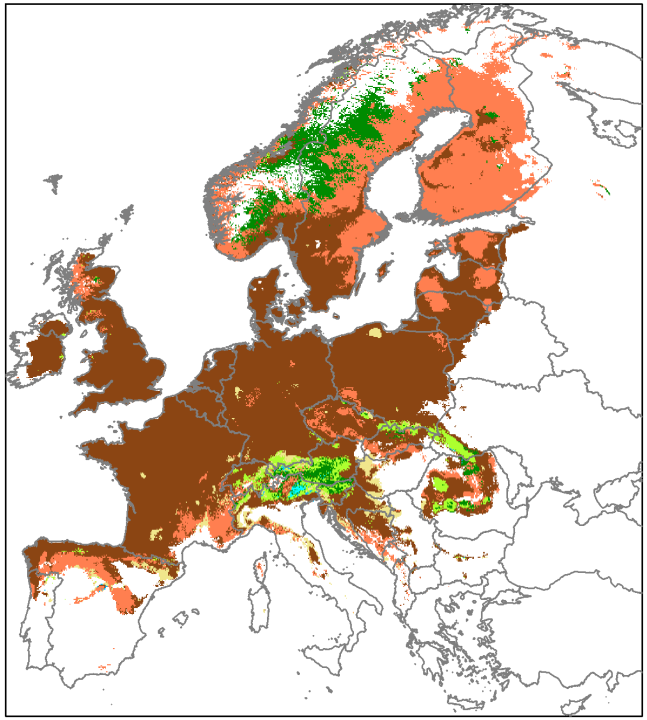
- 575 Trials
- 10646 Provenances
- Wide range of site conditions

Suitable Species

(A) Current

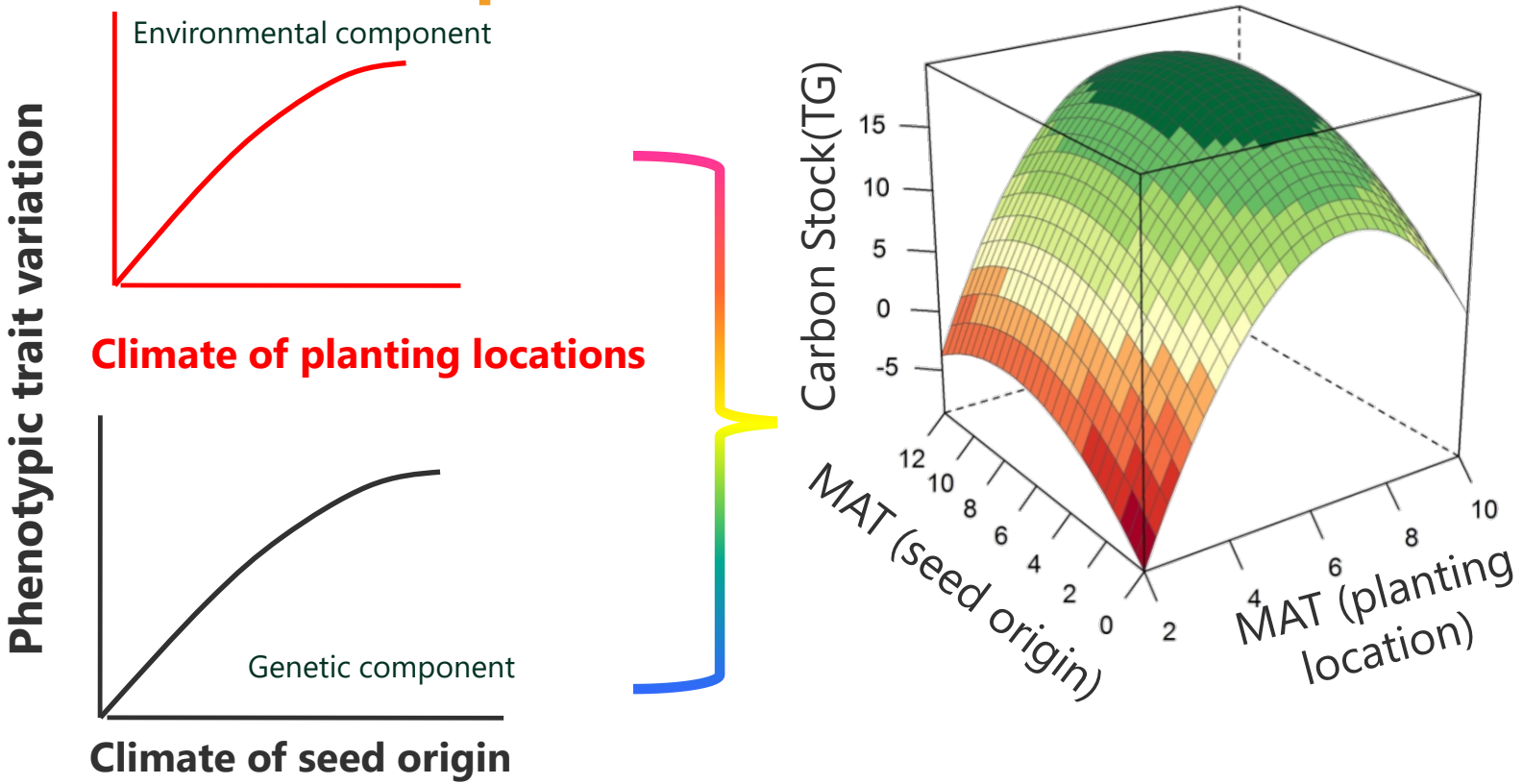


(B) RCP8.5 2061-2080



- A alba
- P abies
- P sylvestris
- L decidua
- F sylvatica
- Q petraea
- Q robur

Universal Response Function



Above Ground Carbon = *f*(climate of planting location + climate of seed origin)

Assisted migration scenario

Species choice

Species Today

Species Future

Seed source-choice

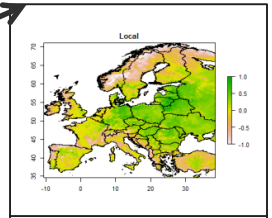
Local seeds

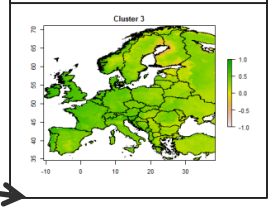
Future adapted

Local seeds

Future adapted

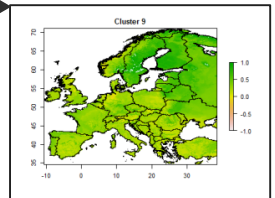
Carbon stocks

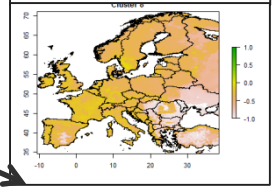




Local

Adapted





Local

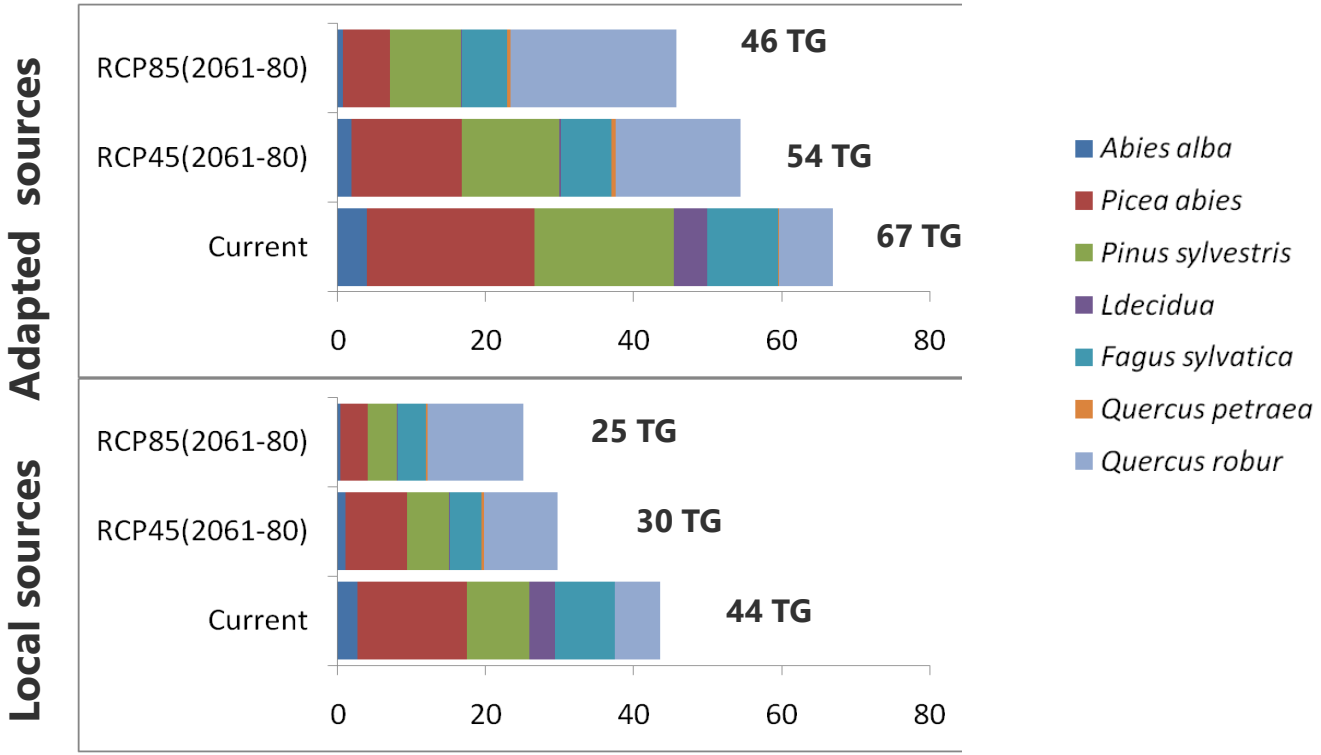
Adapted

Impact of forest adaptation strategies on carbon sequestration

Comparing:

Carbon sequestration under assisted migration

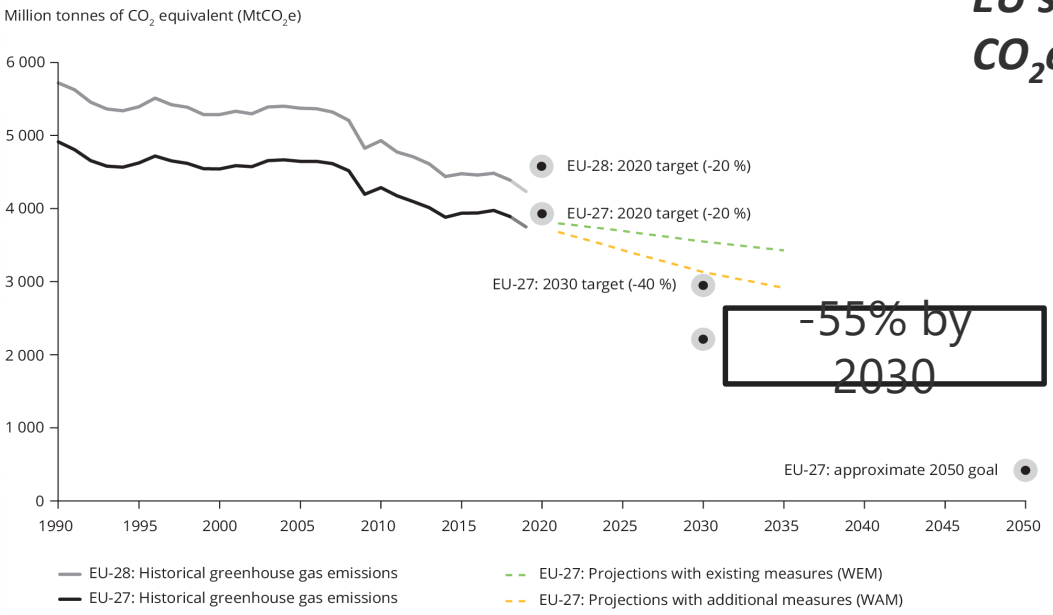
Carbon sequestration by local seed sources



AnnualCarbon Sequestration of reforested forest stands (up to age of 40) in Million Tonnes or Terragram in above ground living biomass

Relevance for Europe's emission targets

- *Average annual CO_2eq (1991-2010= 4294 Mt CO_2*
- ***Proposed a target to expand the EU's sink to absorb 310 million CO_2e per year by 2030***



-55% by 2030

Carbon neutral by 2050

Impact of forest adaptation strategies on carbon sequestration

Comparing:

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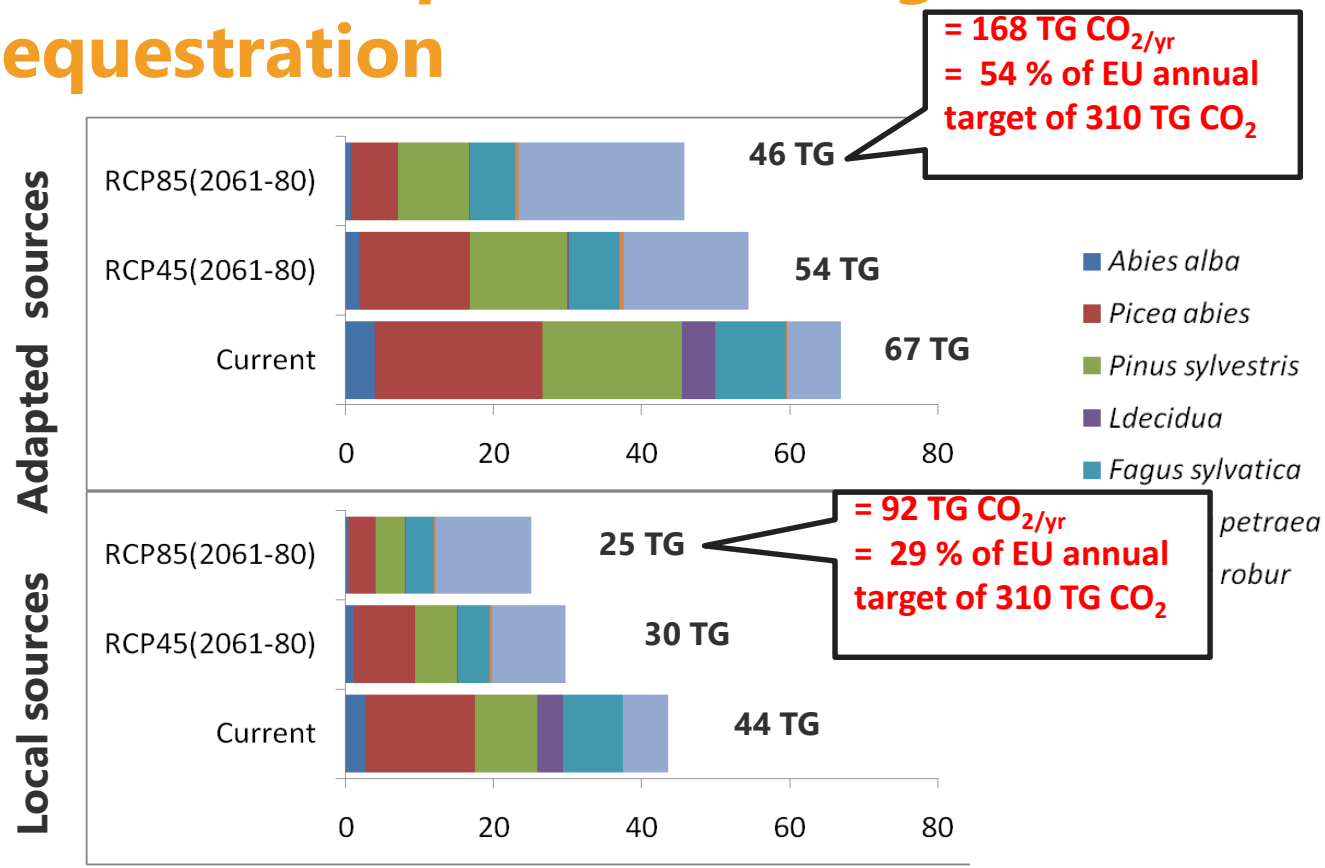
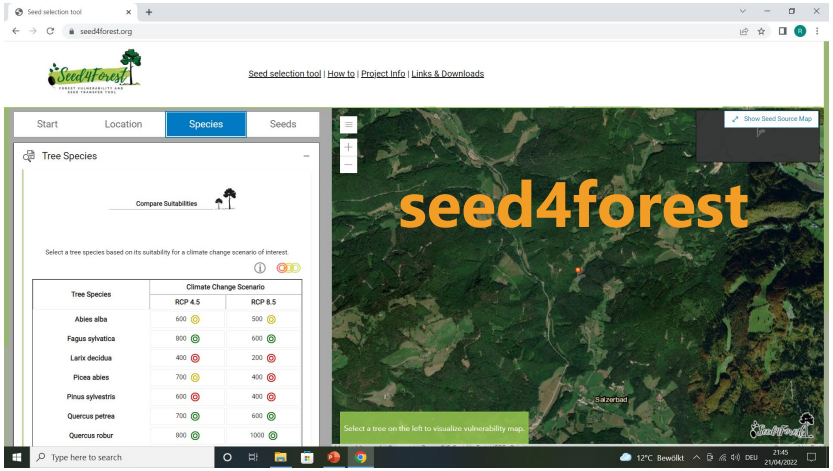


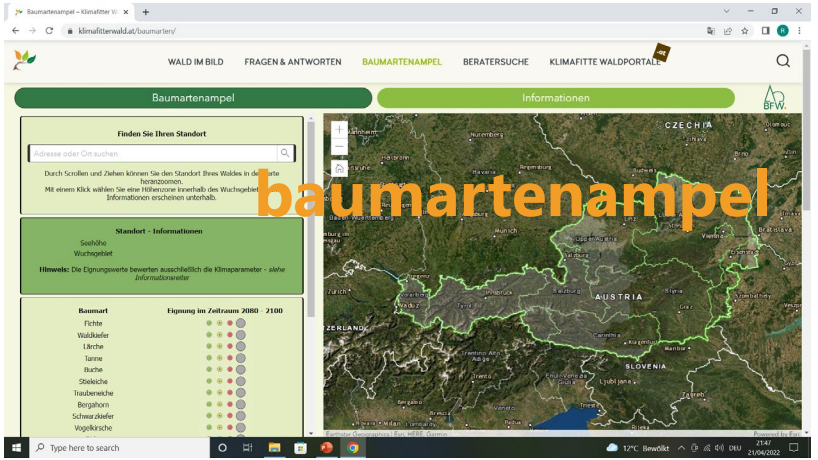
Annual Carbon Sequestration of reforested forest stands (up to age of 40) in Million Tonnes or Terragram in above ground living biomass

Conclusions

- Assisted migration/gene flow is able to sequester significantly more carbon even under strong warming (RCP8.5) and forest management for increasing resilience.
- Risks of Assisted migration such as invasiveness, hybridization, economic
- Tradeoffs between phenotypic traits
- Uncertainty in future

Our Tools





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D/ **High resolution climate data**

High-resolution gridded climate data for Europe based on bias-corrected EURO-CORDEX: The ECLIPS dataset

Debojyoti Chakraborty, Laura Dobor, Anita Zolles, Tomáš Hlásny, Silvio Schueler

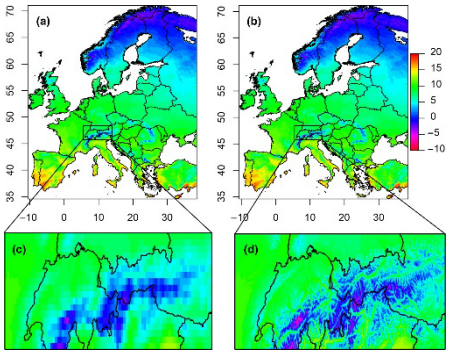

Foto | Filmstill aus „See Aural Woods" (Luma.Launisch & Takamovsky)

Thanks for your attention

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