Contributions of Tree Breeding to Create Forests for the Future

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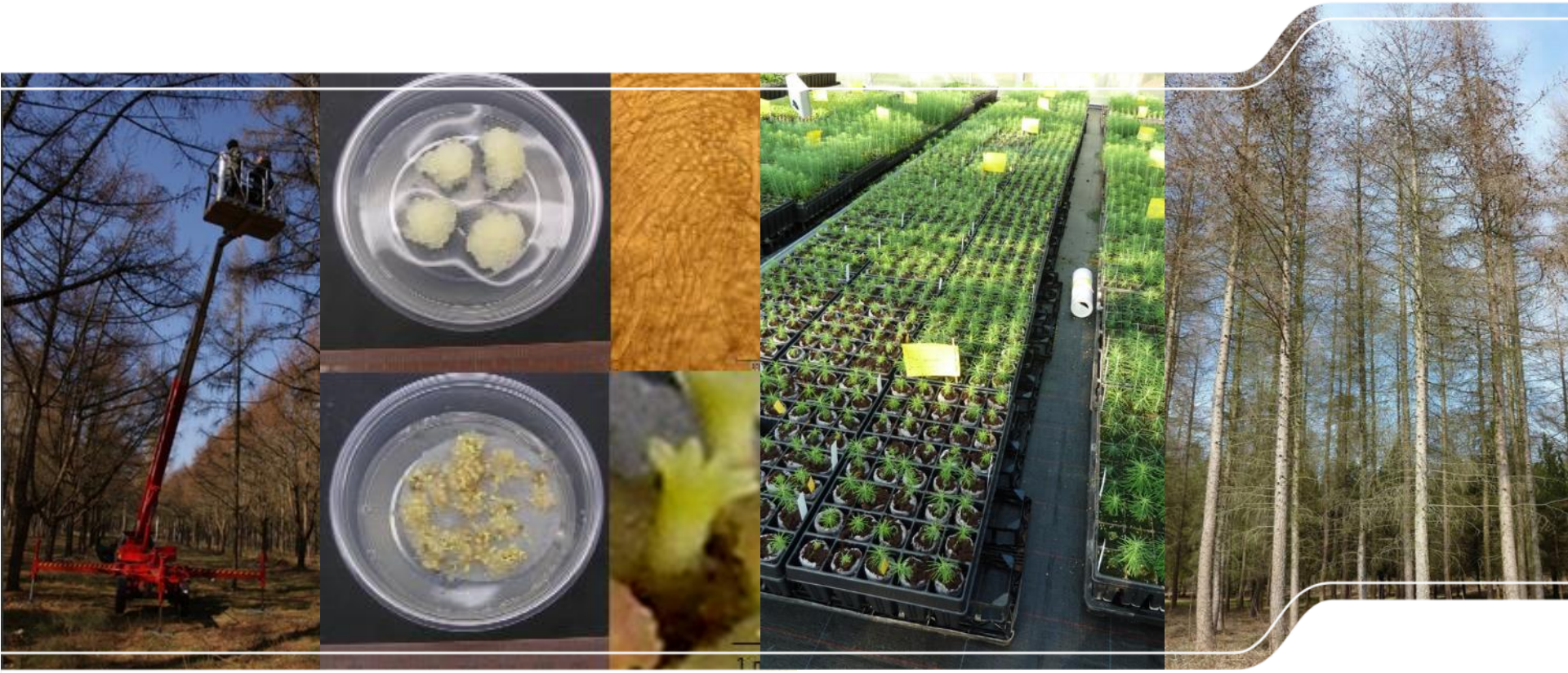

Sachsenforst
Wald braucht Zukunft

Agenda

- Challenge
- Catalogue of methods and contributions
- Conclusions and open questions

Forest tree breeding in Saxony

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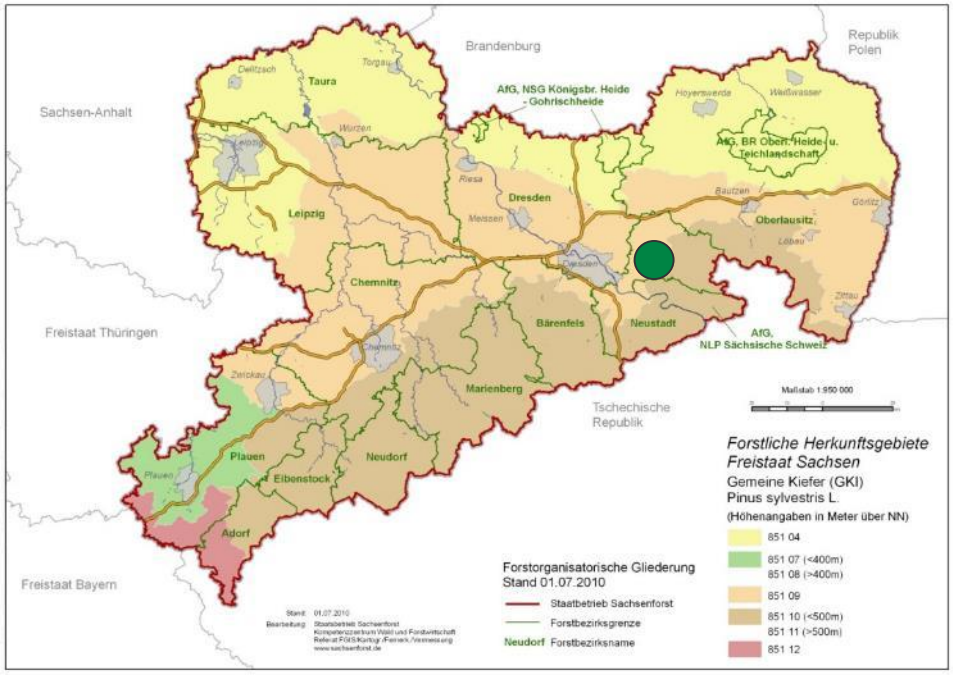
- Established 1946 in Tharandt near Dresden
- Since 1951 in Graupa, Pirna
- Today, one of the four major tree breeding institutions in DE



The challenge

- Current bark beetle infestation
  - Singular event due to unfavourable combination of several impacts on forests?
  - Unambiguous symptom for rapidly changing environmental conditions due to global anthropogenic impacts on climate and natural resources?
- Whatever the answer is - another question:
  - To reforest and to create the forests for the future, which range of species is and which genetic resources of these species are available?

The challenge

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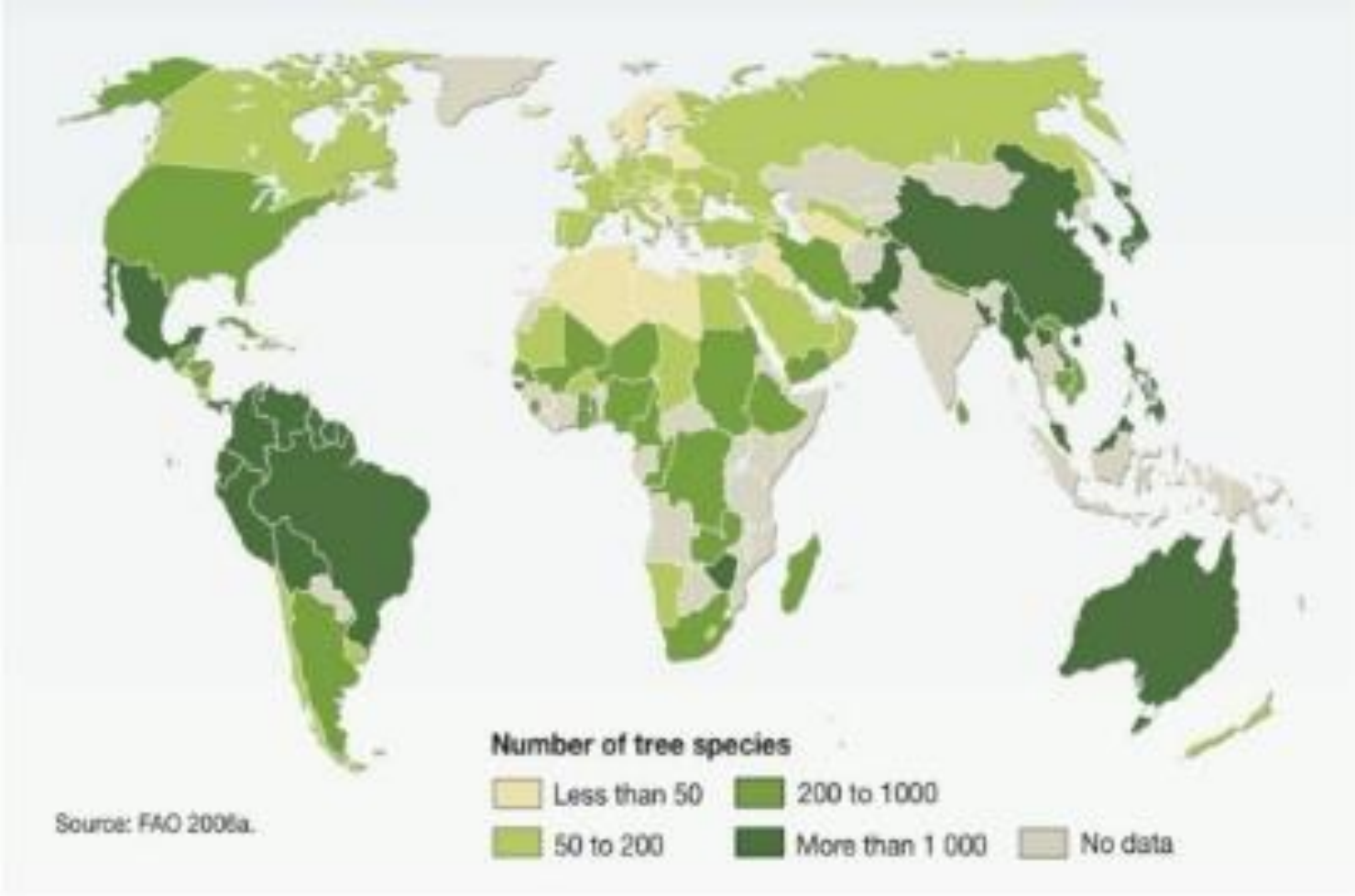

(Rekacewicz et al. 2009; Number of Tree Species per Country in the World; https://www.grida.no/resources/11216)

The challenge

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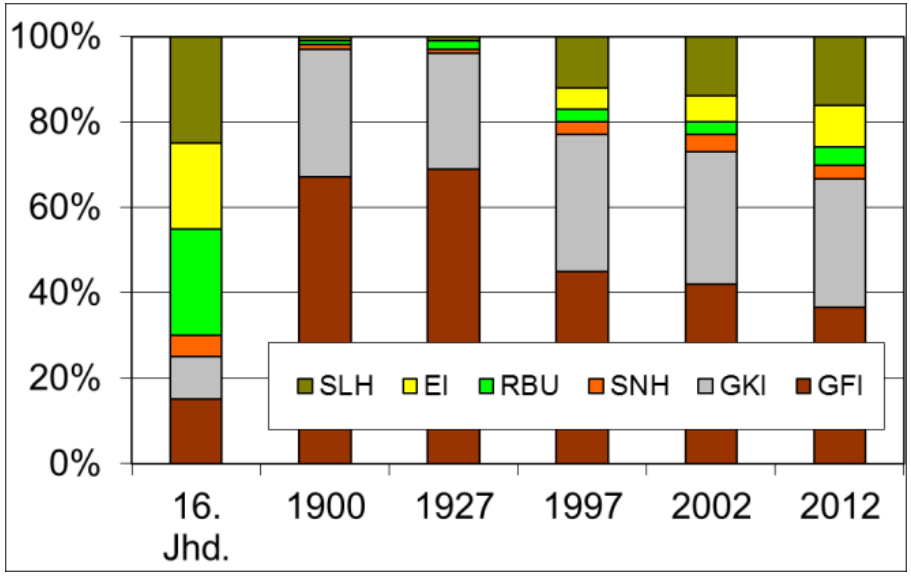
Range of species (for example Saxony)

- Native tree and shrub species
  - 128 woody species (among them 31 tree sp.) (Schmidt & Klausnitzer 2002)
  - 30 % of tree species (11 sp.) already endangered to different degree (Schulz 2013)

- Further endangering through pests and diseases (e. g. Ash, Maple)
- Loss and shift of area (e. g. Spruce, Pine, Beech)
- Next impact?



Catalogue of methods

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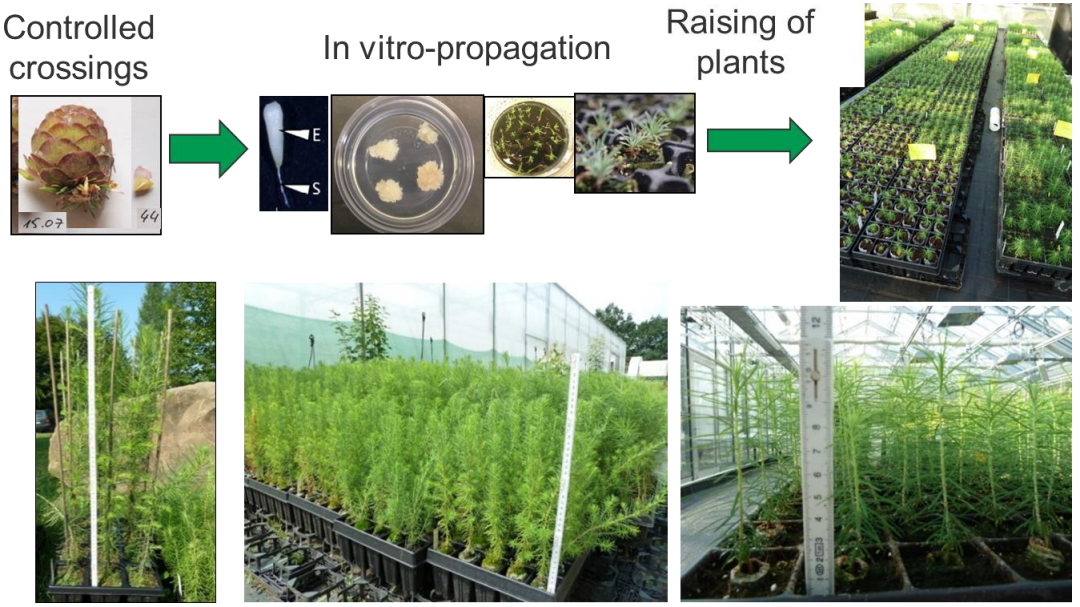
- Conservation and promotion of forest genetic resources
- Selection of plus trees, progenies and provenances
- Phenotypic and genetic characterization
- Procurement of forest reproductive material
- Transfer of knowledge



Catalogue of methods

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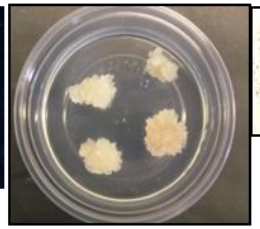
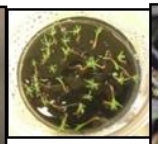
Controlled crossings

In vitro-propagation

Raising of plants





What we are looking for?

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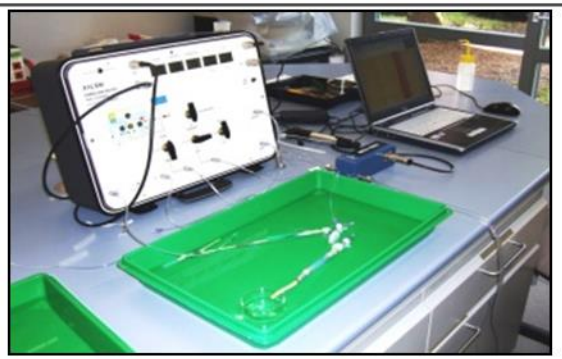
Trial plots	Green house	Laboratory
		

Response of tree species, their provenances and individuals to climatic factors

- Immediate, mid and long term response to frost or drought of plants
  - with different genetic background on one and the same site
  - with one and the same genetic background on different sites

➔ Evaluation of the response as such

➔ Relations between immediate and long term response

Contributions – Native species

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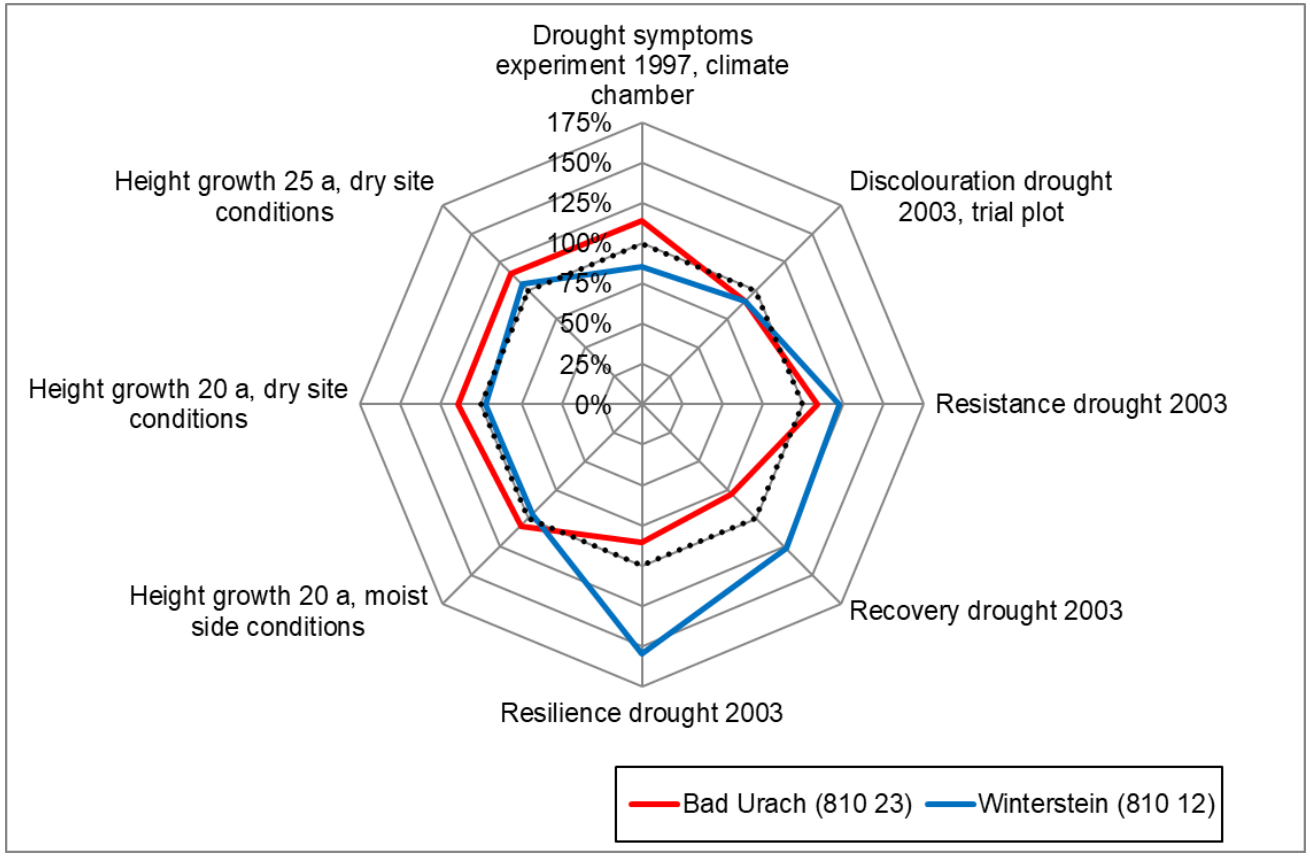
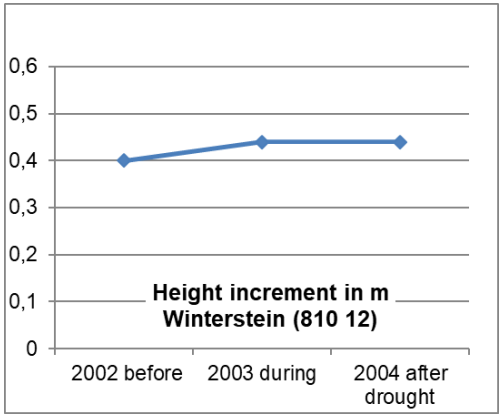
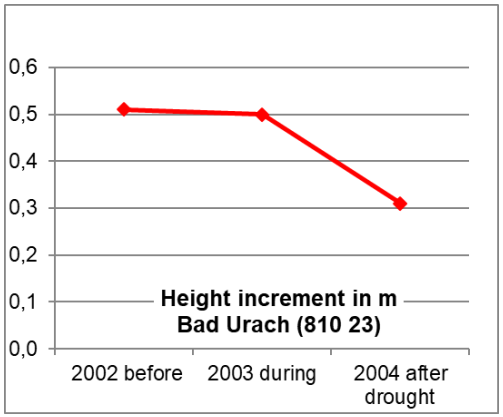
Response of provenances of European beech from the south-western and the eastern part of Germany to climatic impacts







Contributions – alternative tree species

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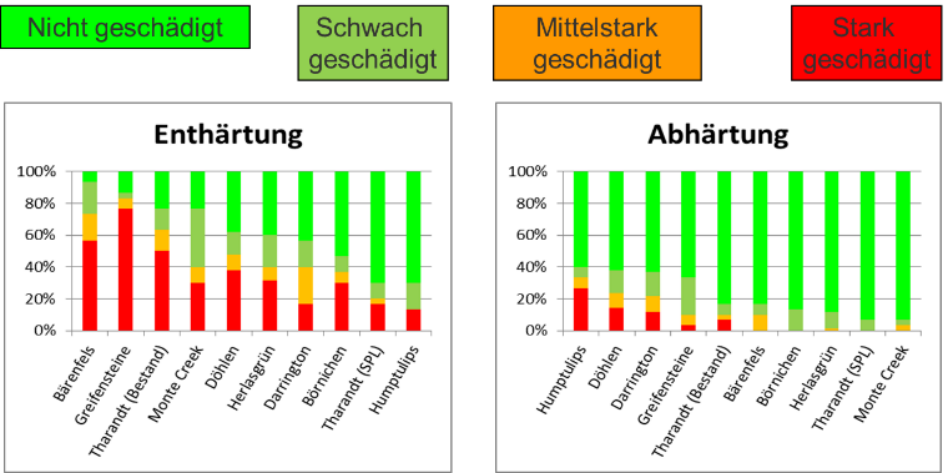
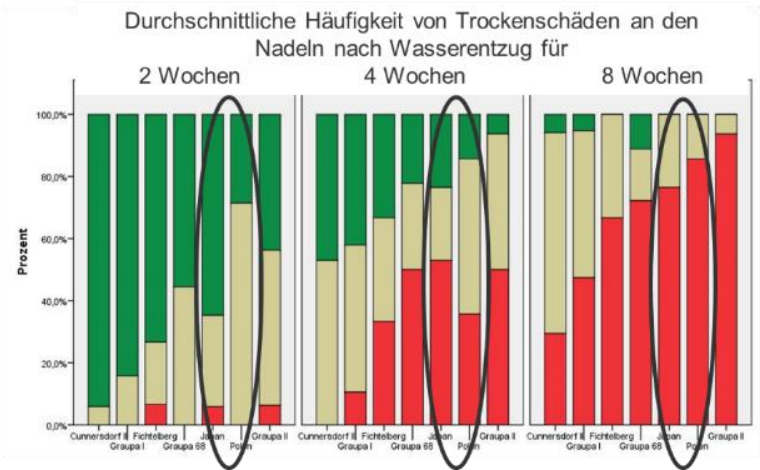
Knowledge already available, immediate use possible

- Alternative species: Grand fir, Douglas fir, Northern Red oak, Locust as well as Japanese larch
- Shelter wood: Aspen, Silver birch, Hybrid-poplar and Hybrid-larch

Douglasie: Herkunftsspezifische Unterschiede (Frostschäden bei –18° C (HKG 823 06))



Hybridlärche: Unterschiede zwischen Nachkommenschaften nach 2, 4 und 8 Wochen Trockenheit



Contributions - Tree species under intensive research

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Fast WOOD

4 fit clim

4 adapt clim


Douglasie


Gem. Fichte


Wald-Kiefer


Europ. und Jap. Lärche


Stiel- und Trauben-Eiche


Berg-Ahorn

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Contributions - Tree species under intensive research

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- Comprehensive and interstate evaluation of existing experimental trial plots
  - ➔ Special consideration of site conditions
  - ➔ Selection and propagation of plus trees
- Establishment of clone collections as base for the establishment of seed orchards
- Evaluation of adaptability (e. g. genetic variability, response to drought and frost)

Contributions - Species for future use

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- Recommendations of Federal-State-Working Group „Forest Genetic Resources and Legal Regulations“ (BLAG-FGR)
  - Category „Rare native tree species“ (e. g. European lime, Hornbeam)
  - Category „European tree species“ (e. g. Oriental beech, Nordmann fir)
  - Category „Non-European tree species“ (e. g. Cedar)
- Interstate concept for the establishment of combined species and provenance trials by BLAG-FGR
- Elaboration of project proposal by Section Silviculture of the German Association of Forest Research Institutes (DVFFA)
- Selection and conservation of plus trees of species already well established (clone collections, seed orchards)

Conclusions and open questions

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- Wide selection of methods and procedures in tree breeding ➔ lot of possibilities
- Erosion of knowledge on the way in state as well as private institutions
- Project approach and legal constraints versus long term task
- Transfer, implementation, application
  - Con: Chancing and keeping of strategies
  - Pro: Promotion of breeding material
  - Pro: Examples for successful use
  - Pro: Balancing volatile supply and demand

Conclusions and open questions

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- 2018 to 2020 – begin of the end or end of the beginning?
- Air pollution mostly reversible – climate change?
- Abiotic impacts big challenge – biotic impacts a challenge too big?
- Limits of adaptability?
- Self healing powers of nature – myth or reality?
- Role of forestry in a CO_2-neutral economy and society?

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Thank you very much for your attention