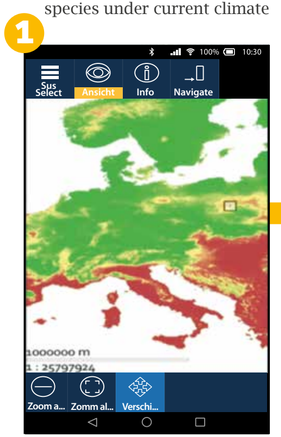
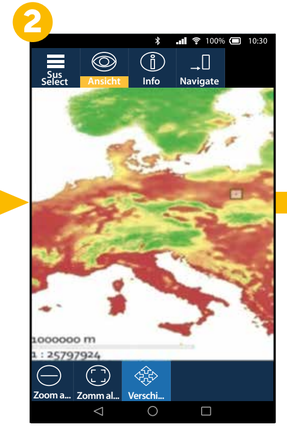
SusSelect - a decision tool to find optimal seed sources under climate change

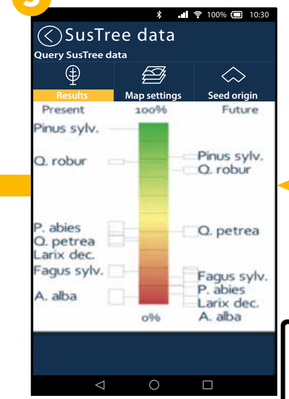
Map the vulnerability of tree species under current climate



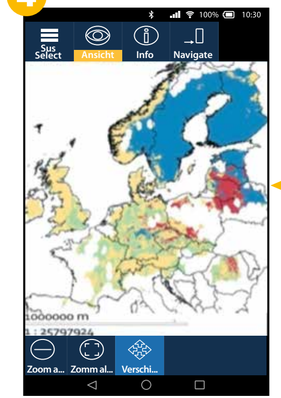
... under future change



Compare tree species vulnerability



Find best planting material



Box 2

SUSTREE Project

SUSTREE: “ *Conservation and sustainable utilization of forest tree diversity in climate change* ”

SUSTREE is a transnational project promoting climate change adaptation and genetic diversity of forest ecosystems in Central Europe. Funded by Interreg-CE, SUSTREE comprises of eight partner institutions from six countries (Austria, Germany, Czech-Republic, Hungary, Poland, Slovakia) of Central Europe sharing their expertise, to enable management of the forest genetic resources (Fig. 3).

Within this cooperation project:

- We develop transnational delineation models or decision support tools for forest seed transfer and genetic conservation based on species distribution models and available intra-specific climate–response function.
- These models are being connected to national registers of forest reproductive material in order to support nursery and forest managers for selecting the appropriate seed and planting material for future forest regeneration.
- Pilot applications in state forest enterprises will document the usability of the introduced tools for forest and natural resource managers as well as for policymakers and public bodies responsible for restoration and forest reforestation schemes.

Fig. 3: Countries cooperating in the SUSTREE project

Documentary film - BORDERLESS FORESTS

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http://www.interreg-central.eu/Content.Node/SUSTREE.html
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Interreg CENTRAL EUROPE
European Union European Regional Development Fund
SUSTREE

SUSTREE Policy Brief

Implementing assisted migration

KEY MESSAGES

1 The speed of climate change is faster than the natural pace of trees to adapt, calling for active management.

2 Assisted migration of forest seeds and seedlings enhances the resilience and reduces the vulnerability of European forests.

3 Seed transfer models based on Europe-wide experimental trials were developed to provide recommendations for assisted migration.

4 Stronger transnational coordination in seed management and tree breeding, as well as harmonization of national legislation, is required for Pan-European implementation of assisted migration.

Background

The unprecedented speed of climate change results in a drastic decline of major ecosystem services provided by European forest ecosystems. Climate change disrupts the link between climate and the local adaptation of forest tree populations requiring adaptive management measures.

Assisted migration is a generic term describing the facilitated movement of species and populations within and across their natural range to match the climatic conditions anticipated in the future (see Figure 1). The implementation of assisted migration as an adaptation strategy (box 1) in forestry is challenging due to the uncertainties of future climate, associated risks and the long life span of forest trees. Therefore, SUSTREE used Europe-wide long term experimental data to develop transfer models for forest seed and seedlings. These were integrated into a decision support system to guide assisted migration (see box 2).

At present, differences in national legislations hinder and even prohibit the implementation of assisted migration across national boundaries. To improve the situation, transnational coordination in seed management and tree breeding, as well as joint research activities need to be accomplished.

Harmonization of European and national legislation will be indispensable to enable the Pan-European facilitation of assisted migration and to establish climate-resilient forests ecosystems.

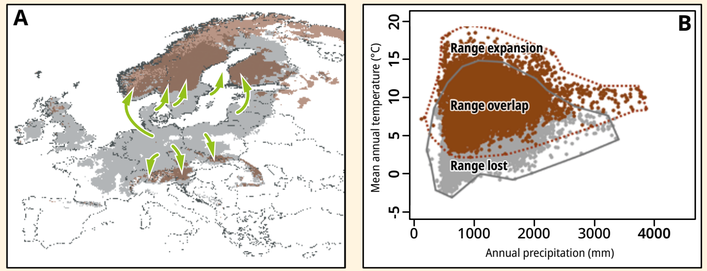


Figure 1:
(A) Requirements of assited migration due to shifts in climate suitability of Norway spruce in contemporary climate and a future climate scenario of RCP 8.5 in 2100. The shift in climatic suitability was predicted by species distribution models (SDMs) developed within the SUSTREE project. The gray regions represent current range predicted to be lost, dark brown represents current range to be retained under climate change and light brown represents range expansion. The arrows shows possible directions of transfer of seed materials to facilitated assisted migration.
(B) A simplified representation of such a SDM is depicted by a bioclimatic envelope space demarcated by mean annual temperature and annual precipitation showing range lost, range overlap and future range.

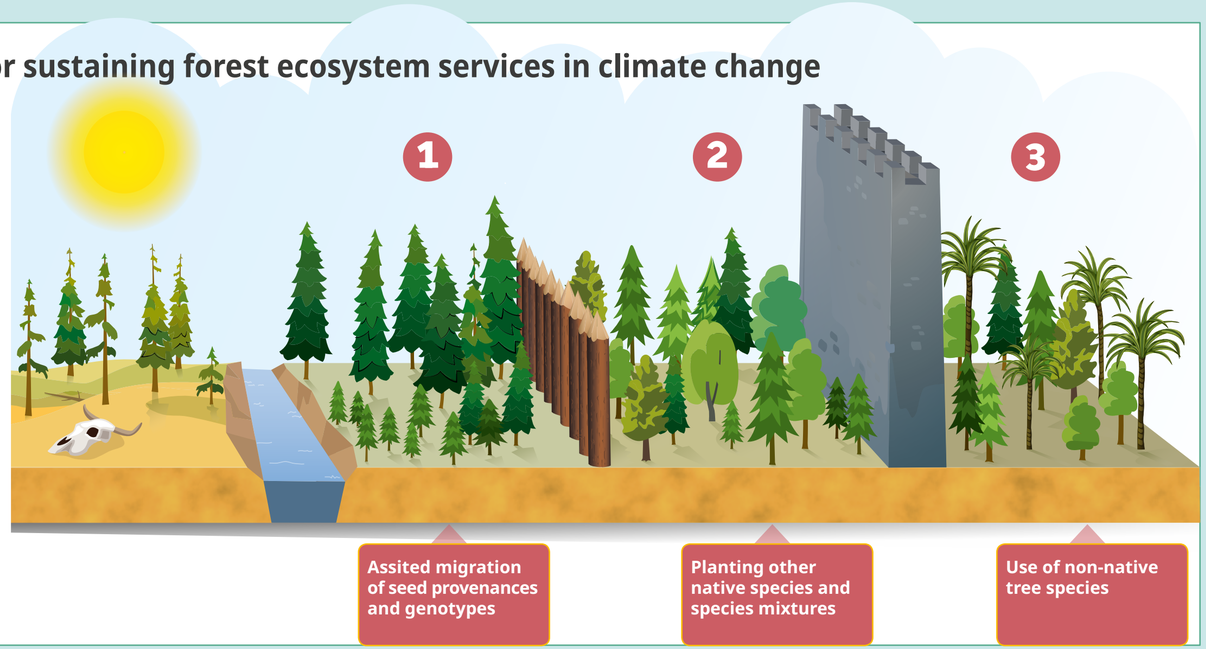
Three lines of defense for sustaining forest ecosystem services in climate change

To adapt forests to climate change, a three-step approach is proposed:

the first lines of defense utilizing new provenances and genotypes of the same species (assisted migration) and tree density reductions; the second line employes other native tree species and species mixtures better adapted to climate change.

If these defense lines fail, non-native tree species may be planted to sustain important ecosystem services such as carbon storage, biodiversity, wood production, etc.

The project SUSTREE mainly focused on the first two lines of defense.



Box 1

SUSTREE proposes solutions

SUSTREE offers practical solutions for assisted migration of seven important tree species of Central Europe. These species are European beech, Norway spruce, Scots pine, European larch, Silver fir, Pedunculate and Sessile oak.

Species distribution models were used to map their vulnerability under present and expected future climate conditions. Moreover, recommendations for transnational seed transfer were developed to identify the optimal seed source adapted to climate change (Figure 2).

These recommendations were found to enhance the resilience and reduce the vulnerability of European forest tree species. For example, using adapted seed sources would allow cultivating Norway spruce and European beech on a larger area than using local seed sources alone (Figure 2).

The species distribution models and seed transfer models were integrated into the decision support tool SusSelect, available as Smartphone App for forest and conservation practitioner (see box 2).

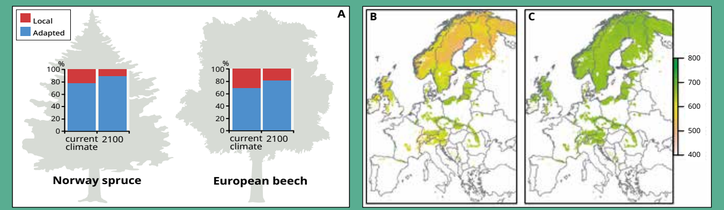


Figure 2
(A) Potential cultivation area for Norway spruce and European beech in current (1961-1990) and future climate in 2100 under the climate change scenario of RCP 8.5. Local refers to seed sources which are climatically and geographically similar to the planting location. Adapted refers to nonlocal seed sources that have the highest productivity in a given planting location in Europe as predicted by the delineation models developed in the SUSTREE project.
*Productivity in terms of the mean height in cm of Norway spruce at age 10 when planted with local seed sources **(B)** and adapted seed sources **(C)** in 2100 under the climate change scenario of RCP 8.5*