Life Terra

Data gathering and decision making in Life Terra

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Aims

- Develop a **framework** and a **database** for **species selection** and distribution for successful, efficient and scalable forest landscape restoration (FLR)
- Develop a **land suitability model** that allows assessing the **suitability of species** for a given area, accounting for climate change scenarios
- Develop efficient **large-scale monitoring technologies** to estimate **carbon storage** through time in planted forests

Framework for species selection and spatial planning

Stakeholders' involvement: goals & purposes (what & why)

Characterise the site

- Ownership, land uses
- Physical environment layers
- Climate projections
- Current vegetation and soil condition
- Maps of habitats & natural vegetation

Integrate site & species information for species selection

Assess natural vegetation suitability given the current state of the physical environment and climate change scenario projections. Include climate-resilient species.

Account for landscape heterogeneity (slope, aspect, ridge, valley).

Assess stakeholders' species suggestions, prioritizing ecosystem services, climate-resilient species and biodiversity.

List of selected species.

Adjust the species selection & planting event schedule to species availability in nurseries and seasonal planting windows.

Distribute the species

Set restoration units (RU) and map them through map algebra.

Get the numbers

Choose species shares and planting densities for each RU.

Order the seedlings

What do we need?

Tree and shrub species database

Many sources of information about flora exist, but we have identified a **need for integration and synthesis** focusing on key aspects for FLR.

We are building an integrated database that includes:

Basic traits, chorology & autecology of the species

- Basic description (broadleaf/conifer, habit, leaf phenology)
- Growth rate and growth rate changes
- Native range or non-native range if introduced
- Subspecies, varieties, or hybrid species and their distributions
- Environmental requirements (climate, soil, underground water, light availability, habitat structure)

Ecological and societal relevance

- Ecosystem functions and services
- Uses (potential direct benefits for the local economy)

Relevant information for selection & spatial planning

- Co-occurrence with other tree species
- Relative abundance (density, pure/mixed stands/secondary)
- Threats (pests, diseases, abiotic stressors)
- Potential effects of climate change

Gathering specific biomass equations to estimate carbon storage by young trees and shrubs

Monitoring survival and growth is essential to FLR. Scalability demands **efficient monitoring and assessment methodologies**.

Currently, satellite imagery lacks enough precision to assess tree growth over the first years after planting.

We searched for **allometric equations for young trees** but found **scarce literature**. Different methodologies across studies hinder comparison and integration.

We have selected 1 for genus and 28 species specific equations.

Genus: *Pinus* (5), *Quercus* (5), *Cistus* (2), *Prunus* (2), *Abies*, *Acer*, *Betula*, *Carpinus*, *Erica*, *Fagus*, *Fraxinus*, *Juniperus*, *Picea*, *Pseudotsuga*, *Rosmarinus*, *Salix* (generic), *Sorbus*, *Tilia*, *Ulex*.

What is next?

- **Apply the framework** for species selection across climatic and geographic gradients in Europe; **learn from experience & monitoring**
- **Expand the species database** & **refine** it with LT and Restor data
- **Collaborate with Restor in SDM**, considering climate change scenarios
- **Expand & integrate knowledge about allometries** in young trees

Tools for integration

We joined Restor, an online platform for the global restoration movement that is developing a **worldwide land suitability model.**

Restor (restor.eco)

- **Lists suitable species** for any given area through **species distribution models** (SDM)
- Opportunity to **learn from monitoring & assessing** different projects and generate knowledge for the species database
- SDM accuracy is yet to be improved, and it can **benefit from the input of projects like Life Terra** (LT)

Bibliography

Database (main sources):

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Biomass equations:

P. Annighöfer et al., *European Journal of Forest Research*, 2016, 135(2), 313-329; A. Çömez, *Fresenius Environmental Bulletin*, 2017, 26(3), 2368-2379; O. E. Sakici et al., *Environmental Monitoring and Assessment*, 2018, 190(5), 1-10; A. Valdecantos & D. Fuentes, *Land Degradation & Development*, 2018, 29(5), 1442-1452; L. Deltell, V. M. Santana & J. Baeza, from UA (before submission).

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