Growth and survival patterns across the REINFFORCE network reveal contrasting species responses to European climatic gradients

Species included in the REINFFORCE trials

Broadleaves species

ACPS - Acer pseudoplatanus
BEPE - Betula pendula
FASY - Fagus sylvatica
FAOR - Fagus orientalis
CASA - Castanea sativa
CESI - Ceratonia siliqua
LIST - Liquidambar styraciflua
ROPS - Robinia pseudoacacia
QUPE - Quercus petraea
QURO - Quercus robur
QURU - Quercus rubra
QUIL - Quercus ilex
QUSU - Quercus suber
QUSH - Quercus shumardii
EUGO - Eucalyptus globulus
EUNI - Eucalyptus nitens
EUGU - Eucalyptus gundal

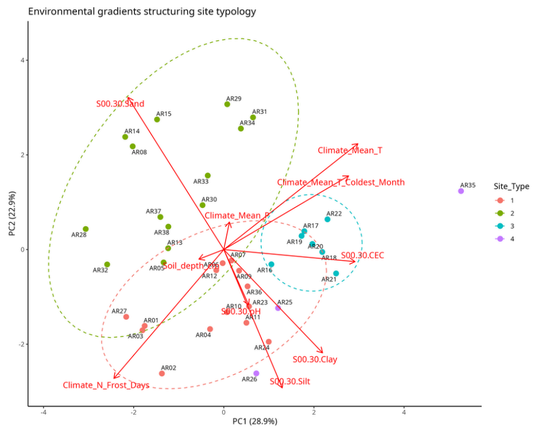
Conifers species

CEAT - Cedrus atlantica
CELI - Cedrus libani
CADE - Calocedrus decurrens
CULA - Cunninghamia lanceolata
LADE - Larix decidua
PINI - Pinus nigra
PIBU - Pinus brutia
PIPE - Pinus peuce
PIPT - Pinus pinaster
PISY - Pinus sylvestris
PIEL - Pinus elliottii
PITA - Pinus taeda
PIPO - Pinus ponderosa
PSME - Pseudotsuga menziesii
SESE - Sequoia sempervirens
THPL - Thuja plicata

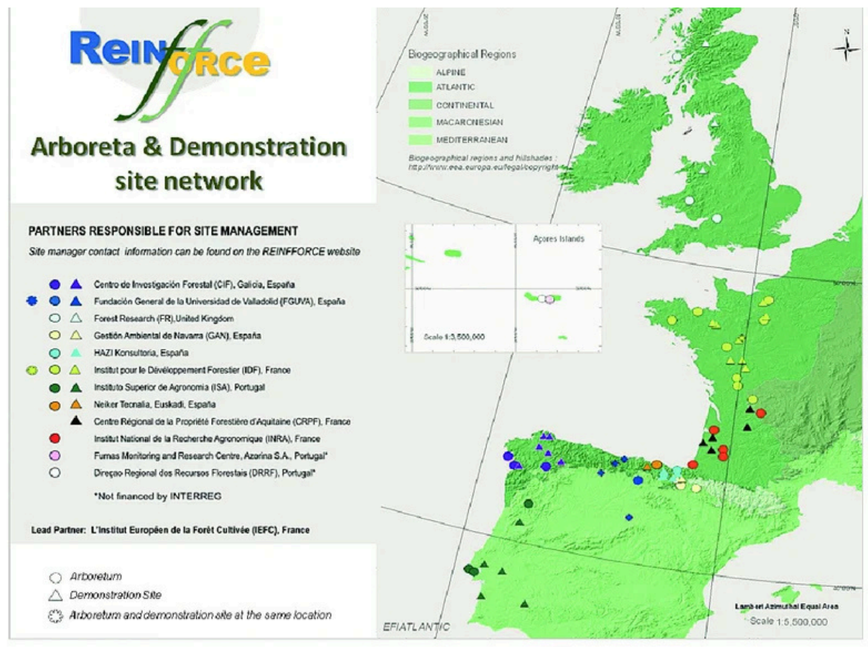
Species tested included European temperate species (Fagus sylvatica, Quercus petraea, Pinus sylvestris), Mediterranean taxa (Cedrus atlantica, Quercus suber, Pinus pinea), North American conifers (Pseudotsuga menziesii, Sequoia sempervirens, Thuja plicata), Australian Eucalyptus species, and endemic Macaronesian species from the Azores.

Background and objectives

- Climate change challenges forest resilience across Europe.
- REINFFORCE provides a unique trans-European network to evaluate species adaptation.
- We analysed survival and height growth across multiple sites, species and provenances.

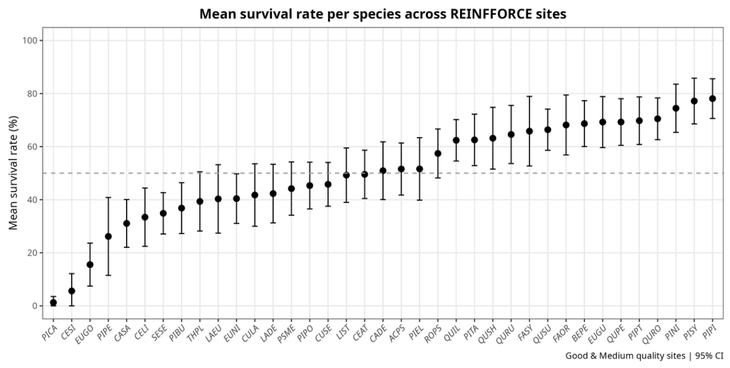


European environmental space occupied by REINFFORCE sites



The REINFFORCE experimental network Wide climatic gradient across Atlantic Europe

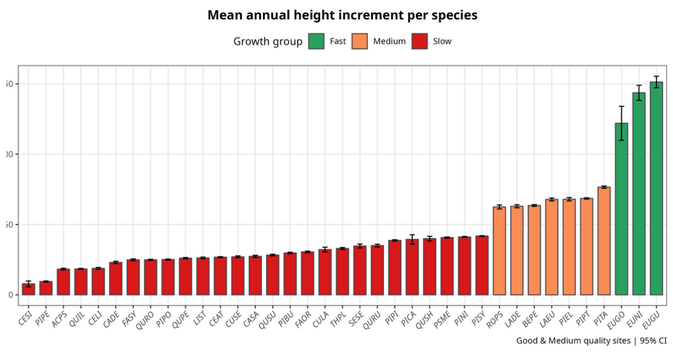
SURVIVAL ANALYSIS



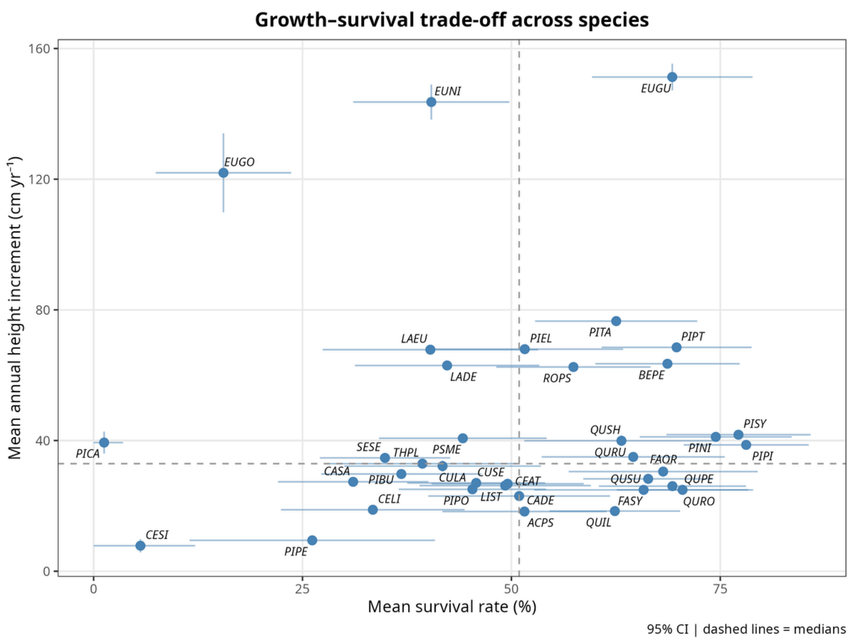


In most arboretums, the majority of oak species reach the critical threshold and show a relatively high survival rate. Pinus pinea (stone pine), Pinus sylvestris (Scots pine) and Pinus pinaster (maritime pine) are the three pine species with the highest survival rates. Certain well-known species, such as Betula pendula (birch) and Fagus sylvatica (purple beech), also survive well in most parts of the arboretum.

GROWTH ANALYSIS



Quercus ilex provenance effect



In most cases, Eucalyptus gundalii grows very quickly and survives well, followed by Pinus taeda (taeda pine), Pinus pinaster (maritime pine), Pinus elliottii (Elliott's pine), and a European-Japanese hybrid of Larix decidua (larch). Most oak species grow relatively slowly. In contrast, certain species, such as Ceratonia siliqua and Pinus peuce (swamp pine), grow very slowly and have a low survival rate.

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