Geophysical Research Abstracts
Vol. 12, EGU2010-9690, 2010
EGU General Assembly 2010

Local adaptation to drought and warming in grass and tree species

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Climate change is characterized by a general warming trend, combined with an increase in the occurrence of extreme events such as drought. Plant species are known to differ in their responsiveness to these factors. Below the species level, however, intraspecific variability or ecotypes may differ considerably in their performance, especially in widely distributed species, with implications for modelling future species distributions and adaptation to climate change.
Here, we selected five provenances for each of four grass (Holcus lanatus, Arrhenatherum elatius, Alopecurus pratensis and Festuca pratensis) and one tree species (Pinus nigra) on the basis that climate of the origin was similar to future local projections for our site. Target areas were located from Spain in the southwest to Hungary in the southeast. The selected provenances were compared to local provenances in a pot experiment under warming (+1.5°C) and a single, severe drought (1000-year recurrence) in a fully factorial design. Survival, biomass production and phenology were measured as response variables. This study is part of the EVENT-experiments in Bayreuth.
The results imply that local adaptation occurs mainly with respect to drought. The mean performance of at least some of the selected provenances generally surpassed the mean performance of the local provenance in each species.
It seems therefore possible to select pre-adapted ecotypes as an adaptation strategy in the face of climate change. Furthermore, climate envelope models may considerably over-estimate the plasticity of species.