Geophysical Research Abstracts
Vol. 18, EGU2016-15071, 2016
EGU General Assembly 2016

Diverging drought resistance of Scots pine provenances revealed by infrared thermography and mortality

Hannes Seidel (1), Christian Schunk (1), Michael Matiu (1), Annette Menzel (1,2)

(1) Technische Universität München, Ecoclimatology, Dept. of Ecology and Ecosystem Management, Freising, Germany, (2) Technische Universität München, Institute for Advanced Study, Garching, Germany (amenzel@wzw.tum.de)

Climate warming and more frequent and severe drought events will alter the adaptedness and fitness of tree species. Especially, Scots pine forests have been affected above average by die-off events during the last decades. Assisted migration of adapted provenances might help alleviating impacts by recent climate change and successfully regenerating forests. However, the identification of suitable provenances based on established ecophysiological methods is time consuming, sometimes invasive, and data on provenance-specific mortality are lacking.

We studied the performance, stress and survival of potted Scots pine seedlings from 12 European provenances grown in a greenhouse experiment with multiple drought and warming treatments. In this paper, we will present results of drought stress impacts monitored with four different thermal indices derived from infrared thermography imaging as well as an ample mortality study. Percent soil water deficit (PSWD) was shown to be the main driver of drought stress response in all thermal indices. In spite of wet and dry reference surfaces, however, fluctuating environmental conditions, mainly in terms of air temperature and humidity, altered the measured stress response.

In linear mixed-effects models, besides PSWD and meteorological covariates, the factors provenance and provenance – PSWD interactions were included. The explanatory power of the models (R2) ranged between 0.51 to 0.83 and thus, provenance-specific responses to strong and moderate drought and subsequent recovery were revealed. However, obvious differences in the response magnitude of provenances to drought were difficult to explicitly link to general features such Mediterranean – continental type or climate at the provenances' origin. We conclude that seedlings' drought resistance may be linked to summer precipitation and their experienced stress levels are a.o. dependent on their above ground dimensions under given water supply. In respect to mortality, previous drought stress experience lowered the current risk and obvious provenance effects were largely related to different growth traits (dimensions).

Our experimental results suggest besides evidence for abiotic stress hardening provenance-specific variation in drought resilience. Thus, there is room for provenance-based assisted migration as tool for climate change adaptation in forestry.