FORBIO Climate

Adaptation potential of biodiverse forests in the face of climate change

DURATION
01/03/2014 – 28/02/2018

BUDGET
1 013 618 €

PROJECT DESCRIPTION

Climate change is expected to have a large impact on the distribution, composition and functioning of forest ecosystems worldwide due to the limited migration and adaptation potential of trees. Creating resistant and resilient forests is thus a key challenge for forest management. It has been suggested recently that epigenetic mechanisms may increase the capacity of trees to survive in a changing environment, but the extent and importance of these mechanisms in seedlings and saplings are still unknown. Research has also shown that more biodiverse ecosystems are better buffered against disturbances. Yet, these studies were predominantly performed in grasslands. More insight into the adaptive capacity of trees (in their consecutive life stages) and forests to climate change is thus badly needed.

FORBIO Climate wants to scrutinize the adaptive capacity of tree species and predict the future performance of tree species in Belgium under different scenarios of climate change. The project will focus on oak (*Quercus robur/petraea*) and beech (*Fagus sylvatica*), two tree species with high ecological and economic significance in Belgium (and Europe). FORBIO Climate will capitalize upon two unique research infrastructures available in Belgium, i.e. the FORBIO experimental sites and the Observational Biodiversity Platform, to test the following hypotheses: (1) epigenetic inheritance mechanisms can increase the adaptive capacity of trees to climate change during the reproduction stage; (2) across subsequent tree development stages, tree performance in more biodiverse forests is more resistant and resilient to climate change.

The project is structured in five work packages (WPs). WP1 will provide past climate data from selected weather stations that will be linked to the measurements on seedlings, saplings and mature trees in WP2-4 to assess the effects of climate variation on tree performance. WP1 will also provide high-resolution simulations of the future climate. The simulation results will be used in WP5 to make projections about future tree performance.

In this project, we merge approaches and methodologies typical of research on climate change with those of functional biodiversity research. By merging these so far separate worlds, we enable the two unique biodiversity functional research platforms in Belgium to become a climate change adaptation research platform.

Mixed stand of oak and beech

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We expect gap-filling results, which, fed into predictive models, will be able to give better predictions on the behaviour and performance of mixed forests under climate change scenarios. Hence, FORBIO Climate will produce innovative research results with impact in the international scientific community. Towards policy makers, FORBIO Climate will contribute to more realistic trend analyses on the sustainable supply of forest resources under climate change, at least for oak and beech in the climatic and environmental context of Belgium's regions. Towards forest managers, FORBIO Climate will produce recommendations for tree species choice and optimal tree species mixtures in order to reduce risk and increase resistance and resilience in adaptive forest management. Towards the large public, FORBIO Climate will provide more tangible information on how oak and beech forests, some of the most characteristic landscapes of Belgium's regions, will evolve in an unsure and changing future.

The future climate scenarios (WP1) will be used as inputs to predict the possible climate change effects on the growth and performance of oak and beech. The specific result of WP2 will be the quantification of the epigenetic effects of maternal temperature on the offspring seedling performance. WP3 will quantify the impact of tree species richness and composition on the overall performance of saplings and will distinguish between the biodiversity-mediated effects on nutrient availability and on the mitigation of drought stress and insect attacks. The output of WP4 will be a series of multilevel mixed models that quantify the contribution of tree diversity and soil resource availability (nutrients, water) in mitigating adverse climate effects on mature tree growth. The final output of FORBIO Climate will be an integrated risk and performance model for oak and beech in changing climate conditions (WP5), which will allow predictive mapping over Belgium as a help to forest policy and management. The submodels corresponding to each tree life stage will be elaborated using the results gained from the three empirical work packages (WP2-4) as well as from additional experimental and observational data coming from the literature. At least twelve scientific papers will be submitted to international scientific journals with peer review within the project lifetime and four PhDs will be completed. Next to the scientific output, FORBIO Climate will generate ample information and knowledge for non-scientific audiences as well.

Young FORBIO-site in Zedelgem

CONTACT INFORMATION

Coordinator

Kris Verheyen
Universiteit Gent (UGent)
Forest & Nature Lab, Department of
Forest and Water Management
kris.verheyen@ugent.be

Partners

Cédric Bertrand & Rafiq Hamdi
Royal Meteorological Institute of Belgium (RMI)
Weather Forecasting and Climatological Information
Meteorological and Climatological Research
cedric.bertrand@meteo.be,
rafiq.hamdi@meteo.be

Monique Carnol
Université de Liège (ULg)
Plant and Microbial Ecology
m.carnol@ulg.ac.be

Quentin Ponette
Université catholique de Louvain (UCL)
Earth and Life Institute
Environmental Sciences (ELI-e)
Forest Sciences
quentin.ponette@uclouvain.be

Bart Muys
Katholieke Universiteit Leuven (KULeuven)
Division Forest
Nature and Landscape
bart.muys@ees.kuleuven.be

Kristine Vander Mijnsbrugge
Instituut voor natuur- en bosonderzoek (INBO)
Kristine.vandermijnsbrugge@inbo.be

LINKS

http://forbio.biodiversity.be

BELGIAN SCIENCE POLICY OFFICE
Louizalaan 231 Avenue Louise • B-1050 Brussels
Tel. +32 (0)2 238 34 11
http://www.belspo.be/brain-be/ • Email : BRAIN-be@belspo.be

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