FOURCAST

FOrest cold and URban heat island effects on Climate Adaptation of biodiversity

DURATION
1/02/2023 – 1/05/2027

BUDGET
999 431 €

PROJECT DESCRIPTION

Significant climate change over the past decades has already resulted in marked effects on biodiversity, such as shifts in phenology and species' distribution and changes in community composition. Climate change accelerates species extinction and alters species interactions. Studies projecting future distributions of European plants, based on climate envelope models, suggest that between 8 and 30 % of the plant species may become extinct and that without mitigation, 57 % of plants are likely to lose ≥ 50% of their current climatic range by the 2080s. Similarly profound impacts of climate change have been observed for insects and other ground dwelling arthropods. However, a recent study has shown the critical role of topographic variation in creating microrefugia, which can substantially reduce extinction risk from climate change. Local factors such as urbanization and green areas (e.g., forests, parks) affect the locally observed warming trends.

In this project proposal, we study past and contemporary effects of climate change on biodiversity in Belgium, a strongly urbanized country, while paying special attention to the buffering effects caused by forests. Studying the relation between changes in fauna and flora and climate change necessitates the use of reliable, long-term climatological and environmental data. In this project, local climate data of unprecedented detail will be used to link changes in biodiversity to climate. The climate data will account for forest microclimate and urban environments, which can interactively affect the local climate trends and functional traits and thermophilization of fauna and flora. Long-term environmental data of study sites will help in disentangling climate change effects from effects caused by environmental change directly impacting habitat quality. This project combines the study of climate change effects at three different temporal and spatial scales. On a first scale (150 years), historical specimens from collections of RBINS and Meise BG collected in Belgium will be analysed to detect shifts in the phenology of flowering plants and arthropods, as well as changes in plant functional traits. On a second scale (25 years), > 50 forest plots distributed across Flanders and Brussels will be re-characterized and re-inventorized for arthropods and plants 25 years after a first detailed inventory. This will allow drawing solid conclusions about effects of recent climate change on stand characteristics and thermophilization. Finally, a mesocosm experiment and local weather stations will be set-up along an Urban Heat Island (UHI) gradient in the Brussels region to analyse contemporary interactive effects of an urban environment and forest buffering.

This project has a high scientific, political and societal relevance both in Belgium, Europe and beyond. The expected results on how urbanization vs trees impact local climate can inform city planning because of the important effects of heat extremes on human health. It will provide very relevant input and background knowledge to global and European biodiversity strategies/initiatives (such as the CBD, EU Biodiversity Strategy 2030) and climate strategies (such as the EU Adaptation Strategy), as well as their national counterparts.

FOURCAST

The project will provide useful input to the National Climate Adaptation Strategy and the National Adaptation Plan. The development and further refinement of coherent climate scenarios, serve in Belgium as a reference for the impact and vulnerability analyses in the different sectors, such as public health and biodiversity conservation. The project will provide an opportunity to further unlock the valuable federal natural history collections of Meise BG (www.botanicalcollections.be) and the RBINS (https://virtualcollections.naturalsciences.be/). Considerable efforts are still required to digitize data associated with these specimens. Researchers involved in the project as well as citizen scientists will contribute significantly to speeding up the process of such actions for selected taxa, because standardized data are required for statistical analyses.

Scientifically, this research is state-of-the-art for both climate science and global change biology. An output of ten to twelve scientific papers in high impact journals is expected, which will be published open access as much as possible. The project partners also aim to maximize efforts to make the data gathered during the project open to all by publishing plant and animal records, as well as data associated with natural history collections and herbaria on GBIF and in open access data papers. Climate data will be made available via already established platforms. Scientific publications in local non-peer review scientific journals will be encouraged. Publications in local journals appeal to the non-expert audience and bridge the gap between highly specific scientific publications and general media outlets. The FOURCAST project is expected to provide us with essential new insights in the response of the Belgian fauna and flora to climate change. Specific efforts will be made to translate the results into recommendations for policy decisions and practice at the different administrative levels, ranging from local decision makers over regional and national administrations to European and global levels and to communicate them to the relevant stakeholders (Urban planning services, Forest and Nature administrations and NGO's).

CONTACT INFORMATION

Coordinator

Filip Vandelook
Meise Botanic Garden
Research department
filip.vandelook@plantentuinmeise.be

Partners

Steven Caluwaerts
Royal Meteorological Institute of Belgium (RMI)
Department Meteorological and Climatological Research
Climate modelling and impact studies
steven.caluwaerts@ugent.be

Pieter De Frenne
Universiteit Gent (UGent)
Department of Environment Forest & Nature Lab
Pieter.DeFrenne@ugent.be

Bruno De Vos
Research Institute for Nature and Forest (INBO)
Environment and Climate Unit
bruno.devos@inbo.be

Frederik Hendrickx
Royal Belgian Institute of Natural Sciences (RBINS)
fhendrickx@naturalsciences.be

LINKS

www.projectfourcast.be