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Cool forests at risk?

The Critical Role of Boreal and Mountain Ecosystems for People, Bioeconomy, and Climate

 # #IBFRA18

17-20 September 2018

IIASA, Laxenburg, Austria

Focus of Research

Wind disturbance and carbon stock in a boreal forest;

Carbon stocks that can be reduced by salvage logging after wind disturbance are critical to mitigate global warming.

Key Challenges

Salvage logging after wind disturbance

Suggestion to Address these Challenges

Change the conventional forest management

A large vegetation-plot database for research and conservation of boreal forest diversity in Europe

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Abstract

Detailed knowledge of habitats, particularly of their species composition, is a precondition for effective nature conservation. However, very little vegetation-plot data from zonal boreal forests of Europe are currently available for assessing e.g. species distribution and diversity, or habitat mapping. We have established a vegetation-plot database of boreal and hemiboreal forests of Europe, aiming to cover the following countries and regions: Iceland, Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Belarus, Scotland and north of the 52nd parallel in Poland and in European Russia, west from the Ural Mountains. Vegetation-plot records of all types of forest communities occurring within these zones are collected. For the first time, this database will enable detailed investigation of vegetation patterns of boreal and hemiboreal forests on the European scale.

To assess the data availability, we requested data from the European Vegetation Archive (EVA), which is the largest vegetation-plot data repository in Europe. Only Lithuania, Poland and Scotland were sufficiently covered there. To fill in the gaps, we started a cooperation within an international team of vegetation scientists (now 24 members) to compile the European Boreal Forest Vegetation Database. Currently, we have managed to obtain over 11 000 plots from Belarus, Estonia, Finland, Latvia, Norway and large areas in Russia. We are still looking for potential collaborators, from all of the countries within the study area, to contribute with vegetation-plot data and local expertise. Our ambition is to digitize already published vegetation-plot records from literature, and to encourage complementary field surveys to cover the most apparent gaps.

The European Boreal Forest Vegetation Database can serve a wide range of purposes in vegetation science. One of the intended aims is to create a unified classification system of boreal forest types in accordance with both the EuroVegChecklist (hierarchical floristic classification system of the European Vegetation Survey) and the European Nature Information System (EUNIS) habitat classification. These typologies serve as the basis for the conservation actions of the European Environmental Agency (EEA). Moreover, the database can be used for gradient analyses of species-environment relationships and for studies of species-richness patterns. The database can potentially be useful in addressing biogeographical questions such as sharpening the definition of the border between the hemiboreal and boreal vegetation zones. Once established, the database will enhance the use of these data by a wide range of researchers. In the near future, the whole database, or a subset of it, can be requested via the EVA.

Focus of Research

The focus of the reseach is in compiling and bringing high-quality data accessible for wide range of researches and projects, and to use this database to investigae the species diversity patterns and enhance the conservation of boreal and hemiboreal forest diversity.

Key Challenges

Not yet, it describes a database, which will, in the near future, be used to assess the distribution and conservation status of boreal and hemiboreal forest communities. First, we need to unify the classification system across the study are to identify the conservation needs.

Suggestion to Address these Challenges

The project is in an early stage, and we have yet no suggestions to address the challenges, which we did not yet investigate.

Novel peatland management practices - key for sustainable bioeconomy and climate change mitigation

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Abstract

Peat soil of croplands and forests is currently the largest emission source in the LULUCF sector and climate-smart peatland management has large potential to mitigate emissions. We aim to develop ecologically and economically sustainable climate change mitigation options for forest and cropland management. The emissions from managed peat soils may be mitigated by limiting depth of actively decomposing peat layer by raising the soil water table closer to soil surface. In managed peatland forests we test continuous cover forestry with elevated water table as an alternative to rotation forestry with clear-cuting and ditch network maintenance. On croplands, other potential means to mitigate emissions are no-till, catch crops and addition of biochar. We will measure GHG exchange on experimental study sites and develop dynamic models for predicting GHG exchange for different management practices. The data will feed economic analyses, i.e., static gross margin and profitability calculations. Microeconomic dynamic models with optimization will be used to quantify the required incentives for a farmer to choose climate-smart management options. For forest sites, cost-efficiency of mitigation options is assessed by comparing net present value - GHG ratios of the management alternatives. We will compile GHG emission scenarios needed for evaluation of the climate policy options in Finland. Our results will have an important impact on the economic optimization of climate change mitigation in the agriculture and LULUCF sectors and they help to meet the agreed emission reduction targets.

Focus of Research

Climate change mitigation

Key Challenges

Emission reduction on managed peatland forests and croplands

Suggestion to Address these Challenges

paludiculture and CCF without ditch network maintenance i.e. elevated ground water table to reduce aerobic decomposition

Development of explanatory model for bark beetle infestations based on a 10-years long outbreak in the High Tatra Mts.

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Abstract

Bark beetle outbreaks are one of the main disturbance agents in mountainous forests of Central Europe, affecting ecosystem functions and local economies. The number and intensity of future outbreaks is in question. In recent decades, Norway spruce forests (Picea abies Karst.) of the High Tatra Mts. in the Carpathian have been subject to unprecedented tree mortality caused by infestations of the Eurasian spruce bark beetle (Ips typographus L.). Bark beetle infestations start with infestations of individual trees, than proceed to infestations spots (group of tree is attacked) and at the end, several local or regional outbreaks can affect mountain forest ecosystems on a landscape scale. Therefore, analysis of the spatiotemporal pattern of bark beetle outbreaks across landscape in several consecutive years can reveal new insights into the population dynamics of tree-killing bark-beetles. Bark beetle outbreaks are usually indicted by natural disturbances (wind, drought) and they are affected by forest management, climate (temperature, solar radiation, rainfall), stand characteristics (forest age, diameter of trees) and other environmental variables (altitude, slope etc.).

We analysed a more than 10-years long bark beetle outbreak on the southern slopes of the High Tatra Mts., which occurred after a storm damaging more that 10,000 ha of forests in 2004. To develop an explanatory model for bark beetle outbreak in the High Tatra Mts., we have derived a 10-year long data of forest mortality caused by bark beetles, wind, fires and logging from Landsat satellite images. Climate variables and other environmental variables were acquired for the 10-year long period from forestry databases, digital elevation model and from meteorological data. To explain the spatio-temporal pattern of infestations and to identify main drivers of bark beetle infestations, all above mentioned variables were modelled on a landscape surface (raster analysis). Our results indicate that infested spots (group of trees infested by bark beetles) occurred on sites with higher temperature sums during the seasons as non-infested trees and they have received higher solar radiation loads. Thus, temperature and potential solar radiation can act as a surrogate for identifying future bark beetle infestations

Focus of Research

Focus of our research is on bark beetle outbreaks, which can affect ecosystem functions as well as forest economy and management. They act as one of the main disturbance agents in mountainous and boreal forests and they can be affected in the future by global changes.