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Book of abstracts

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

PN3: Remote sensing and mapping of Cool Forests

Time: Monday, 17/Sep/2018: 4:00pm - 5:50pm · *Location:* Laxenburg Conference Center, Marschallzimmer 2
Session Chair: Christiane Cornelia Schmullius
Session Co-Chair: Susan G. Conard

4:00pm - 4:15pm

The use of satellite information (MODIS/Aqua) for phenological and classification analysis of plant communities

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Abstract

Classification of vegetation cover by satellite data (MODIS/Aqua) allows to automate the process of constructing vegetation maps and minimize the inclusion of ground data in this process. The use of satellite information makes it possible to describe the phenological development of plant communities and to find their differences. The object of the study were plant communities of meadows, steppes of Khakassia and forest communities of the Krasnoyarsk Territory, Russia.

For the analysis of phenological dynamics in plant communities we have used the value of NDVI (Normalized Difference Vegetation Index). With the help of the original computer program, a nonlinear regression analysis of the NDVI (t) time series was carried out from 2003 to 2017. The penology indicators (the beginning and end of the growing season, the absolute value of the maximum of photosynthetic activity, etc.) during the season were calculated from the values of the coefficients of the regression equations .Analysis of the relationships between the values of the parameters of regression equations in different years has shown that the "clouds" of values in the parametric space for different plant communities (forest, meadow, steppe) differ significantly from one another, which makes it possible to classify plant communities. Thus, using multi-year NDVI data and weather data, it is possible to classify plant communities and divide forest, steppe and meadow communities.

The reported study was funded by RFBR and Russian Geographical Society according to the research project № 17-05-41012.

Focus of Research

The focus of our research is using multi-year NDVI data and weather data to classify plant communities and divide forest, steppe and meadow communities.

Key Challenges

Classification of vegetation cover by satellite data allows to automate the process of constructing vegetation maps.The use of satellite information makes it possible to describe the phenological development of plant communities and to find their differences.

Suggestion to Address these Challenges

Our research allows to monitor the boundaries of plant communities by satellite data.

4:15pm - 4:30pm

Global harmonised in-situ data repository for forest biomass datasets validation

Dmitry Schepaschenko[1], Christoph Perger[1], Christopher Dresel[1], Liudmila Mukhortova[2], Natalia Lukina[3], Elena Tikhonova[3], Olga Trefilova[2], Leonid Krivobokov[2], Dilshad Danilina[2], Maria Konovalova[2], Andrey Osipov[4], Kapitolina Bobkova[4], Viktor Karminov[5], Olga Martynenko[5], Petr Ontikov[5], Alexey Aleynikov[3], Tatyana Braslavskaya[3], Nikolay Shevchenko[3], Anatoly Shvidenko[1], Florian Kraxner[1]

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Abstract

Forest monitoring is high on the scientific and political agenda. Global measurements of forest height, biomass and how they change with time are urgently needed as essential climate and ecosystem variables. The Forest Observation System – FOS (http://forest-observation-system.net/) is an international cooperation to establish a global in-situ forest biomass database to support earth observation and to encourage investment in relevant field-based observations and science. FOS aims to link the Remote Sensing (RS) community with ecologists who measure forest biomass and estimating biodiversity in the field for a common benefit. The benefit of FOS for the RS community is the partnering of the most established teams and networks that manage permanent forest plots globally; to overcome data sharing issues and introduce a standard biomass data flow from tree level measurement to the plot level aggregation served in the most suitable form for the RS community. Ecologists benefit from the FOS with improved access to global biomass information, data standards, gap identification and potential improved funding opportunities to address the known gaps and deficiencies in the data. In the Boreal region FOS closely collaborates with the V.N. Sukachev Institute of Forest, Institute of Biology

of the Komi Scientific Center, Forestry faculty of the Bauman Moscow State Technical University, Center of Forest Ecology and Productivity of the Russian Academy of Sciences and the International Institute for Applied Systems Analysis. FOS is an open initiative with other networks and teams most welcome to join. The online database provides open access for both metadata (e.g. who conducted the measurements, where and which parameters) and actual data for a subset of plots where the authors have granted access. A minimum set of database values include: principal investigator and institution, plot coordinates, number of trees, forest type and tree species composition, wood density, canopy height and above ground biomass of trees. Plot size is 0.25 ha or large. The database will be essential for validating and calibrating satellite observations and various models. Comparison of plot biomass data with available global and regional maps (incl. IIASA global biomass map by Kindermann et al., 2013; Boreal and temperate forest by Thurner et al., 2013; WHRC global biomass map by Baccini et al., 2018; IB-CAS global map by Hu et al., 2016; GlobBiomass map, 2018) shows wide range of uncertainties associated with biomass estimation.

Focus of Research

Validation of global and regional forest biomass dataset

Key Challenges

Sharing in situ measurements

Suggestion to Address these Challenges

Provide recognition and benefits for the scientists who open access to the sample plot data

4:30pm - 4:45pm

Biogeophysical climate impacts of forest management in Europe inferred from satellite remote sensing observations

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Abstract

Forest management influences climate by altering the concentration of CO_2 or other atmospheric compounds (biogeochemical effects) and through its impact on albedo, evapotranspiration and surface roughness (biogeophysical effects). Forest management measures aiming at reducing or counteracting climate change need to account for both biogeochemical and biogeophysical effects. However, the biogeophysical climate effect of forest management is still poorly constrained and decision-makers lack scientific evidence when designing sustainable forest management strategies.

To bridge this gap, we used hourly, high resolution (5km), land surface temperature (LST) over Europe derived from satellite remote sensing observations (EUMETSAT, Land Surface Analysis) and performed several types of regression-based analysis to assess the link between LST and spatial patterns of forest structure and forest type. As an indicator for forest structure and forest type we included data on tree cover density and broadleaved tree fraction (Copernicus High Resolution Layers). As potential confounding factors (i.e. variables that coincide with the spatial distribution of broadleaf tree fraction and tree cover density) we included additional variables like elevation and exposition.

Our results show that a higher fraction of broadleaved trees as well as a higher tree cover density provide cooling during the day in summer. Analyzing the mean diurnal cycle in June, July and August we found that an increase of 50% in tree cover density causes the highest reduction of temperatures (~ 1.5-4.5°C) at 12:00 UTC. An increase of 50% in broadleaved tree fraction provides a cooling that is highest at around 16:00 UTC (~ 0.5 to 2°C). The effect of an increased tree cover density at around 15:00-16:00 UTC is similar to the effect of an increased broadleaved tree fraction, which means that both strategies may be important when trying to reduce daily maximum temperatures in summer. In high latitudes and high altitudes an increase in tree cover fraction and broadleaved tree fraction cause warming during day and night in winter. However, during the day in summer there is a cooling effect of a higher broadleaved tree fraction and a slight cooling effect of a higher tree cover density. For boreal and alpine forests, an increase in tree cover density and broadleaved tree fraction could therefore lead to an increase in yearly mean temperatures while reducing maximum temperatures in summer and potentially during heatwaves.

Focus of Research

The focus of our research is on the biogeophysical climate effects of forest management. It is important for decision-makers that are seeking to mitigate climate change.

Key Challenges

Our research shows that maximum temperatures occuring in boreal and mountain ecosystems may be reduced if forests are adequately managed.

Suggestion to Address these Challenges

Changes in forest structure (i.e. an increase in tree cover density) and in forest composition (i.e. increasing the amount of broadleaved trees) could be two strategies to reduce extreme temperatures in summer.

4:45pm - 5:00pm