Geophysical Research Abstracts
Vol. 21, EGU2019-5138, 2019
EGU General Assembly 2019

Mapping and understanding functional diversity through satellite remote sensing

Leon T. Hauser, Joris Timmermans, Nadejda A. Soudzilovskaia, and Peter M. van Bodegom

Leiden University, Institute of Environmental Sciences, Dept. of Conservation Biology, Netherlands (l.t.hauser@cml.leidenuniv.nl)

Introduction
Global biodiversity losses erode the functioning of our vital ecosystems. A growing body of research emphasizes the role of functional diversity as an important link between biodiversity and ecosystem functioning. Consistent information is however lacking on patterns of functional diversity at the spatial scales needed to monitor and track biodiversity. Our research demonstrates an approach to map plant functional diversity over large continuous terrestrial areas using currently available satellite remote sensing data. The merits of the presented approach are assessed by holding the functional diversity maps derived from satellite earth observation against land use information.

Methods
The study is conducted over the large scale region of Sabah, Malaysian Borneo, which can be characterized as highly biodiverse region under increasing threat of land use changes, particularly the expansion of industrial oil-palm plantations. We retrieved plant canopy traits over Sabah from Sentinel-2 multispectral imagery using a neural network trained on inverse radiative transfer modelling. We derived plant canopy Leaf Water Content, Chlorophyll a-b and Leaf Area Index as key traits based on which three multidimensional functional diversity metrics were calculated; functional richness, divergence and evenness. Spatial patterns of functional diversity were related to land use data derived from the CIFOR's 'Atlas of deforestation and industrial plantations in Borneo' and the ESA's Land Cover Climate Change Initiative.

Results
We detected significant differences in functional diversity across land use types, resonating with ecological expectations; intact forests feature consistently higher functional diversity compared to oil-palm plantations and croplands. Functional richness was found to exhibit larger within land-use variations as compared to functional divergence and evenness.

Conclusions
By linking the derived functional diversity metrics to land use information, the study showed the potential merits of this approach for studying continuous large-scale biodiversity patterns and furthering macro-ecological understanding. The findings propone satellite remote sensing derived functional diversity as a promising and feasible technique in global biodiversity monitoring, illustrating how functional diversity mapping from space can be informative to study the spatial distribution of biodiversity.