Geophysical Research Abstracts
Vol. 17, EGU2015-7145-1, 2015
EGU General Assembly 2015

A spatially explicit multi-isotope approach to map influence regions of plant-plant interactions after exotic plant invasion

Christine Hellmann (1,2), Jens Oldeland (3), and Christiane Werner (2)

(1) Experimental and Systems Ecology, University of Bielefeld, Bielefeld, Germany (christine.hellmann@uni-bielefeld.de), (2) AgroEcosystem Research, BAYCEER, University of Bayreuth, Bayreuth, Germany, (3) Biodiversity, Evolution and Ecology of Plants, Biocentre Klein Flottbek and Botanical Garden, University of Hamburg, Hamburg, Germany

Exotic plant invasions impose profound alterations to native ecosystems, including changes of water, carbon and nutrient cycles. However, explicitly quantifying these impacts remains a challenge. Stable isotopes, by providing natural tracers of biogeochemical processes, can help to identify and measure such alterations in space and time. Recently, δ^{15}N isoscapes, i.e. spatially continuous representations of isotopic values, derived from native plant foliage, enabled to accurately trace nitrogen introduced by the N_2-fixing invasive Acacia longifolia into a native Portuguese dune system. It could be shown that the area of the system which was altered by the invasive species exceeded the area which was covered by the invader by far. But still, definition of clear regions of influence is to some extent ambiguous. Here, we present an approach using multiple isoscapes derived from measured foliar δ^{13}C and δ^{15}N values of a native, non-fixing species, Corema album. By clustering isotopic information, we obtained an objective classification of the study area. Properties and spatial position of clusters could be interpreted to distinguish areas that were or were not influenced by A. longifolia. Spatial clusters at locations where A. longifolia was present had δ^{15}N values that were enriched, i.e. close to the atmospheric signal of 0 ‰ compared to the depleted values of the uninvaded system (ca. -11 ‰). Furthermore, C. album individuals in these clusters were characterized by higher foliar N content and enriched δ^{13}C. These results indicate that the N_2-fixing A. longifolia added nitrogen to the system which originated from the atmosphere and was used by the native C. album, inducing functional changes, i.e. an increase in WUE. Additionally, clusters were identified that were presumably determined by inherent properties of the native system.
Thus, combining isotope ecology with geostatistical methods is a promising approach for mapping regions of influence in multi-isotope isoscapes which may be relevant not only to detect ecological boundaries within the context of exotic plant invasion but for plant-plant-interactions and small-scale variability of biotic and abiotic conditions in general.