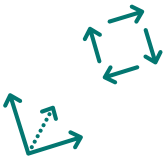
A VIEW FROM ABOVE: WATCHING BIODIVERSITY AT WORK

GUNNAR LISCHEID, PHILIPP RAUNEKER, MICHAEL SOMMER

Drone and PhD student at work

Numerous studies have investigated the effects of biodiversity, e.g., of vascular plants, on ecosystem functions. It has often been found that enhanced biodiversity increases the stability of ecosystems and increases the resource-use efficiency. It is commonly assumed that complementary use of niches plays a pivotal role: Species differ with respect to nutrient and water uptake mechanisms, rooting depth, or seasonal timing, thus enabling the sustained use of scarce resources that are not available for other species. The PETCHY project aims at testing this hypothesis with respect to plant water use.



The often observed beneficial effects of biodiversity on resource use efficiency and ecosystem stability have been ascribed to the fact that different species use different niches in time and space for water and nutrient uptake. It is therefore advisable to confirm if higher biodiversity actually results in larger within-site spatial and temporal variability of functional patterns, such as plant water uptake. Here »temporal variability« refers to changes of spatial patterns of water uptake and evapotranspiration in time, depending on hydrological boundary conditions that favour or discriminate against single species or functional groups.

The PETCHY project aims at determining and comparing mean evapotranspiration of the experimental grassland plots of the Biodiversity Exploratories, the spatial patterns and spatial heterogeneity within the experimental plots, as well as the temporal stability of these patterns. To this end, two innovative techniques are combined. UAV-borne remote sensing using thermal and multispectral sensors allows determining the spatial patterns of the actual evapotranspiration at very high spatial resolution with low effort. Recently published approaches for analysing large sets of hydrological time series data have been very successful in disentangling the interplay of different effects on the observed dynamics. By merging these two approaches, the spatial and temporal aspects can be integrated in order to better understand the effect of biodiversity on plant water use.

The project approaches the topic from different angles:

1) The within-plot spatial heterogeneity of evapotranspiration is determined by means of high-resolution UAV-borne remote sensing. We expect that a higher spatial variability is associated with a higher resilience to drought stress.

2) The effects of plant species diversity on spatial patterns of evapotranspiration will be distinguished from the effects of small-scale soil heterogeneity with respect to nutrient availability, water holding capacity, and soil moisture. We expect mutual dependencies between plants and soil, but an additional effect of plant diversity on evapotranspiration in addition to the effects of soil.

3) Multi-temporal UAV surveys are used to check the observed spatial patterns of evapotranspiration for temporal stability. We expect that temporal (seasonal) stability of spatial patterns of evapotranspiration within single plots will decrease with increasing biodiversity.

Project: Patterns of Evapotranspiration changing throughout the Year (PETCHY) **Term:** 2017–2020 **Sponsor:** DFG
Lead at ZALF: G. Lischeid (lischeid@zalf.de)
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