DIGITAL TECHNOLOGIES TO OPTIMIZE NITROGEN TRADEOFFS IN FUTURE AGRICULTURAL LANDSCAPES

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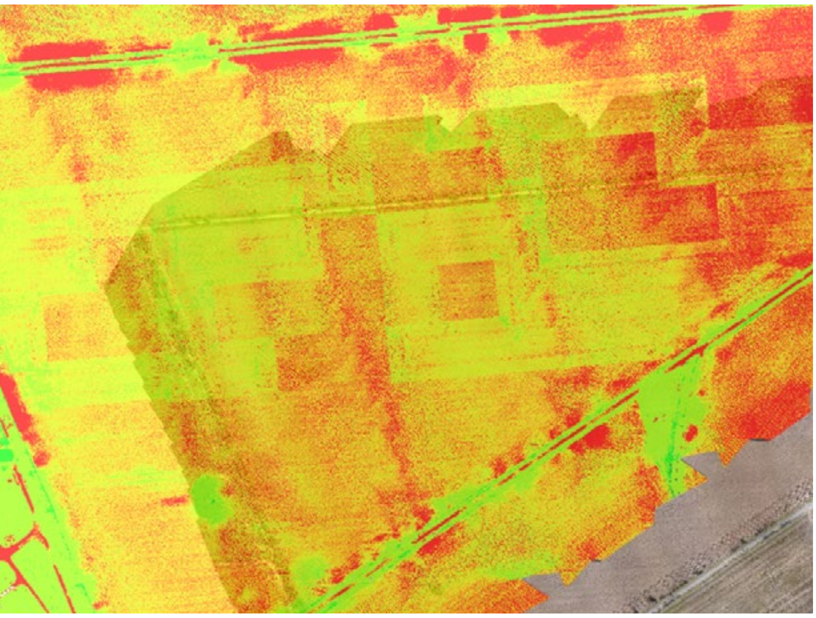

NDVI measurements at the patchCROP landscape laboratory © Maire Holz | ZALF.

The project provides an improved knowledge basis for forecasting tools that enable site-specific nitrogen management in field cultivation. To this end, a holistic process understanding of N transformation is abstracted into an integrated crop-soil model, along with proximal and remotely sensed data. Whether more spatio-temporally diverse cropping systems will improve nitrogen use efficiency at the field scale in the future is also being explored.

Nitrogen (N) is the nutrient that most often limits crop productivity. Simultaneously, excess N leads to environmentally harmful nitrous oxide and nitrate emissions. To ensure yields while minimizing N losses, we need innovative cropping systems which consider the high spatial variability of N transformations in the fields. These variabilities are caused by soil heterogeneity and weather conditions. In this project we therefore aim to develop predictive tools to support site-specific crop N management. This also promotes optimal provision of ecosystem services related to N.

In particular, we are investigating risk-based assessment frameworks to support the design and spatial allocation of crop rotations, as well as the next generation of digital knowledge needed to optimize in-season nitrogen management.

The experimental setup is located in the landscape laboratory patchCROP in Tempelberg. It considers the effect of patch size, crop rotation as well as small scale heterogeneity of soil properties. To reflect small-scale soil heterogeneity within patches, measurements of numerous N related physical, chemical and biological soil parameters are being conducted along gradients of yield potential. Thus, we identify the factors that control the spatial variability of soil N transformation and N availability and subsequent crop performance.

The ZALF working groups involved in this project have extensive experience in process understanding of N cycling, N management and remote sensing and crop and soil modeling. Through the interdisciplinary and close cooperation, the existing approaches will be combined and further improved leading to an integrated toolbox at the plot, field and landscape scale.

This will allow us to develop a risk-based assessment framework which supports targeted N management in the design of sustainable agricultural landscapes of the future.

Project: Optimal N for future agricultural landscapes: digital technologies to optimize tradeoffs **Term:** 2021–2023
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