Assessment of plant population and soil parameters

HELMHOLTZ Centre for Environmental Research

Background:

Digitisation has found its way into the agricultural sector. Numerous technologies have emerged under the heading of "precision farming" that enable the monitoring and optimisation of agricultural sub-areas with the aim of protecting the soil and the environment, increasing yields and using less fertiliser and pesticides.

Challenge:

Machine-assisted, non-destructive plant detection is currently carried out using opto-electronic, radar or ultrasound-based methods. However, these have the disadvantage that signals from plant debris, shadows or soil are also detected. Remote sensing offers the chance to generate large amounts of data on plant physiological parameters such as the leaf area index LAI, but calibration with *in-situ* data requires a lot of time, money and personnel.

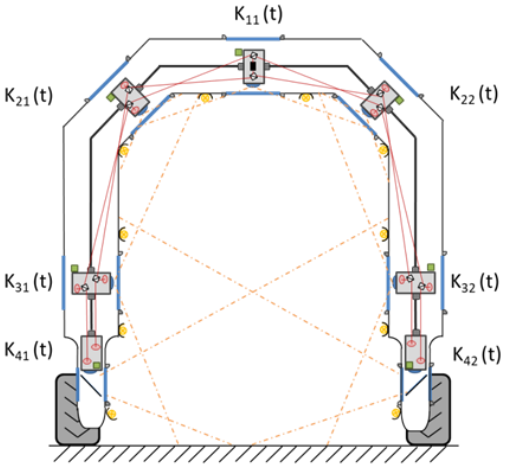

Fig.: Tomography imaging of vegetation

UFZ know-how:

- Wireless ad-hoc sensor networks
- Remote sensing
- Precision Farming

UFZ expert:

Hannes Mollenhauer, Department of Monitoring and Exploration Technologies

Other partners:

German Aerospace Center, Friedrich Schiller University Jena, University of Rostock

IP Status:

European patent application: "Arrangement and method for characterising vegetation" (EP2172776.3, filed 05/2021)

Innovation:

A technical concept was developed to record image data of the plants with the help of a remote-controlled or autonomous vehicle and using plenoptic cameras. From this, a 3D structure of the vegetation is reconstructed with software to finally determine remotely sensed parameters (e.g. LAI, biomass, leaf area, cover). These *in-situ* data are supplemented by simultaneous direct sampling of soil and plant parts, e.g. to determine the dry matter, so that a comprehensive documentation of the status and development of plant population and soil conditions can be made.

Advantages of tomographic imaging:

- ✓ Simple and resource-efficient 3D documentation of plant population
- ✓ Determination of leaf area index, biomass, coverage, dry matter, soil parameters,...
- ✓ Objective *in-situ* data throughout the vegetation phase
- ✓ Distinction between green vegetation and dry components/soil

Fields of application:

- **Agriculture:** Fertilisation of partial areas of a field according to need
- **Forestry**: characterisation of the tree population for efficient tree removal
- **Road safety:** Cost-effective monitoring of roads and railway lines
- **Geoinformation technology:** Calibration or validation of remote sensing data

We are looking for:

Industrial partners from geoinformation technology, field measurement technology or agriculture to test our concept and jointly develop a prototype

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