Using 3-D laser measurements for biomass estimation in semi-natural grasslands invaded by Lupinus polyphyllus

Dr. Frank Hensgen, Dr. Thomas Möckel, Damian Schulze Brüninghoff, Prof. Dr. Michael Wachendorf

Department of
Grassland Science and
Renewable Plant Resources

organicagriculturalsciences UNIKASSEL

UNIKASSEL VERSITÄT

Aims and Background

Invasive plant species such as *L.polyphyllus* lead to a decline in biodiversity

Invasion has to be detected early on and managed by choosing the right cutting dates and frequencies

In biosphere reserves, large areas have to be monitored in short time and with low disturbance → remote sensing?

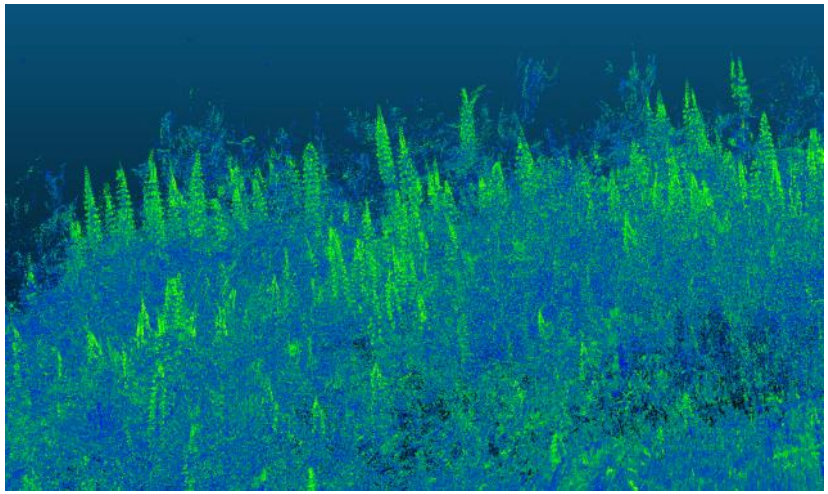
Is the terrestrial 3D laser as a tool to calculate biomass yield and identify invasive species biomass in large open grassland areas?

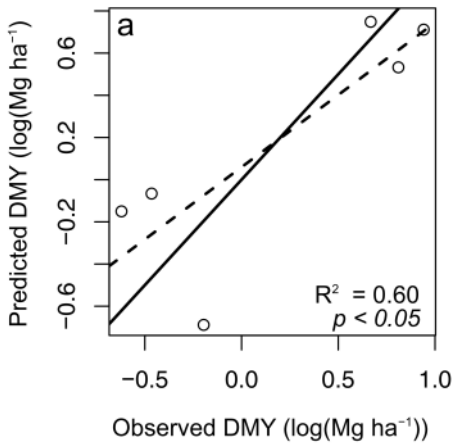
Methodology

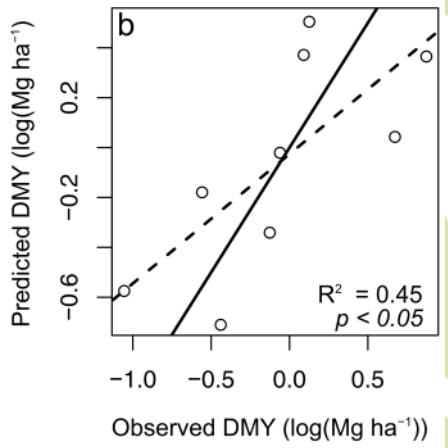
- Biosphere reserve “Rhön”: 6 plots, 8 x 8 m, 3 *Nardus*-, 3*Trisetum*- grasslands.
- Experiments: 25th May, 14th June, 12th September 2016.
- 64 x 1m² sub-plots.
- Lupine cover was estimated visually and the Biomass (Lupine / non Lupine) of 3 sub-plots harvested
- 4 Scans with 3-D laser Scanner (Leica Scan Station P30).
- Resolution of the sensor: 3mm (at a distance of 10m)
- The point cloud space was divided in a 3-D grid of small regular voxels.
- The resulting number of voxels was used as explanatory variable in a linear regression model to predict dry matter yield

Results

- Nearly all plots were invaded by the lupine, with estimated cover percentages up to 30 %.
- Lupine DM contribution was up to 39 %.
- Prediction of total biomass with the 3-D laser showed an accuracy of R^2_{adj} of 0.45 for Trisetum- and 0.60 for Nardus-grasslands. → higher R^2_{adj} of 0.71 for FM
- The number of voxels was negatively correlated with the estimated biomass, because denser biomass reduced the penetration depth of the laser impulse.







organicagriculturalsciences

Department of
Grassland Science and Renewable Plant Resources

UNIKASSEL VERSITÄT

Outlook

- Improve biomass estimation accuracy
- Identification of single species (Lupine) biomass
- Combine sensors (Laser + RGB, Laser+ Spectroscope)
- Test using airborne / satellite data