

Remote sensing data fusion and feature selection for biomass prediction in extensive grasslands invaded by *Lupinus polyphyllus*

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Background

- Heterogenous, extensive grasslands are at risk by the spread of invasive plant species
- Remote sensing-based (RS) yield estimation is challenging for heterogeneous invaded grasslands
- Estimations from single sensor data is often insufficient
- Feature selection can increase interpretability and performance

Material and Methods

Study site:

- 2 *Trisetum flaccescens* TF/TFL_(invaded)
- 2 *Nardus stricta* NS/NSL_(invaded)

Sensors (Fig. 1):

- Terrestrial laser scanner
- UAV-based hyperspectral sensor

Reference parameters:

- FMY and DMY

Sensor-based parameters (Fig. 2):

- a) Normalised spectral wavelength
- b) Sum of Voxels
- c) Canopy Surface structure
- d) Mean canopy Height

Machine learning:

- Random Forest Regression (RFR)

Feature selection:

- VSURF

Criteria for best method:

- 100-times split (training/test)

Impact of Lupine (Fig. 3):

- Normalised deviation of pred. vs obs.

Results

Best was Sensor fusion:

- FMY: R² 0.80, nRMSE 12.0 %
- DMY: R² 0.81, nRMSE 12.1 %

Lupine contribution:

- Lowest Normalised deviation between 20 and 40 % Lupine cover

Feature selection:

- From 307 to 16 (FMY) and 29 (DMY) features

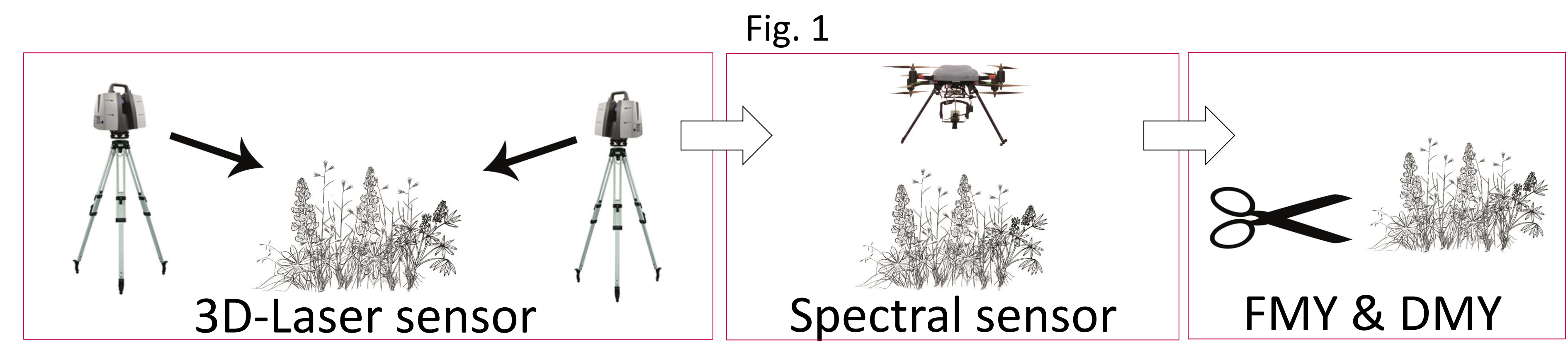
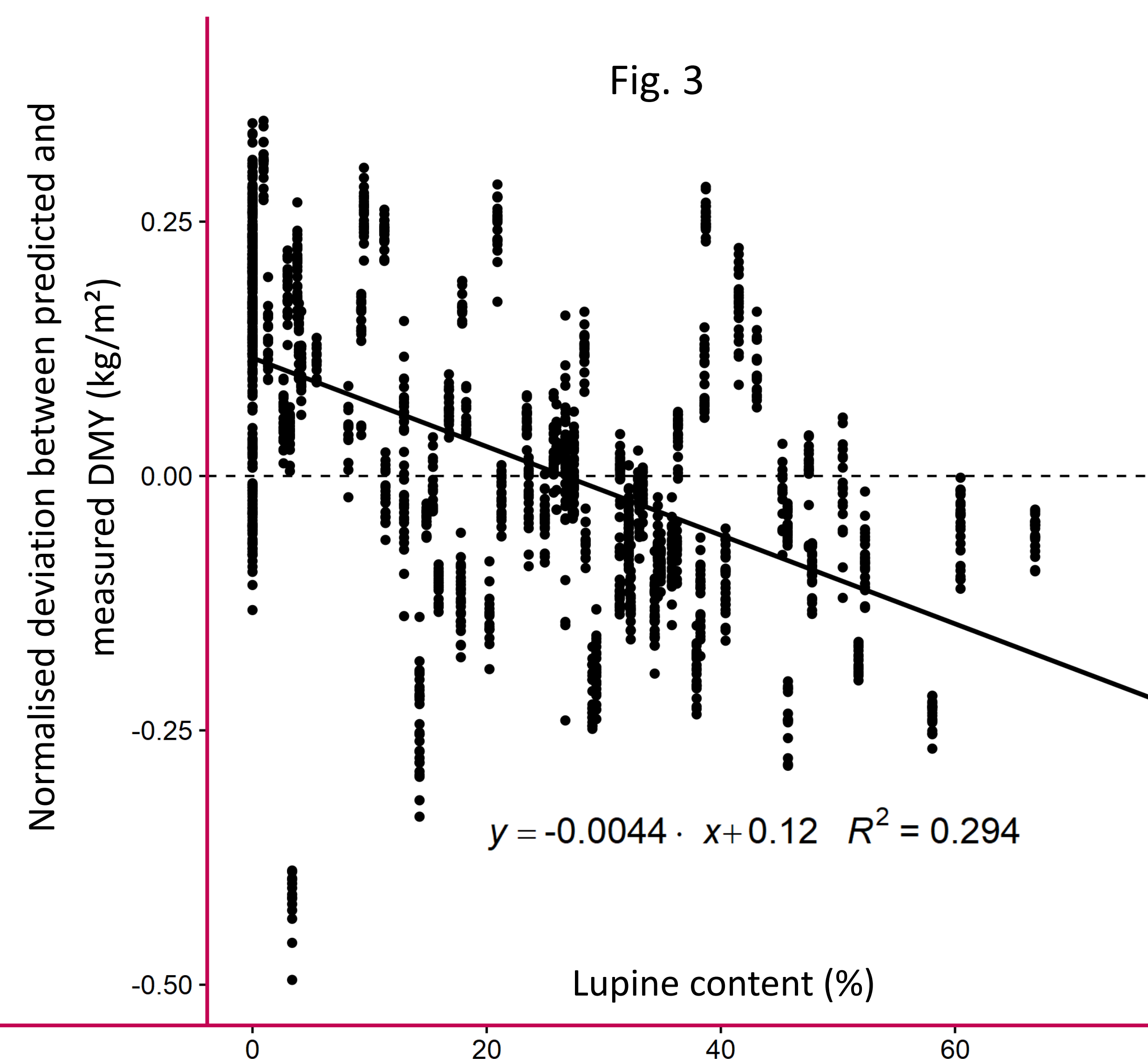


Fig. 1

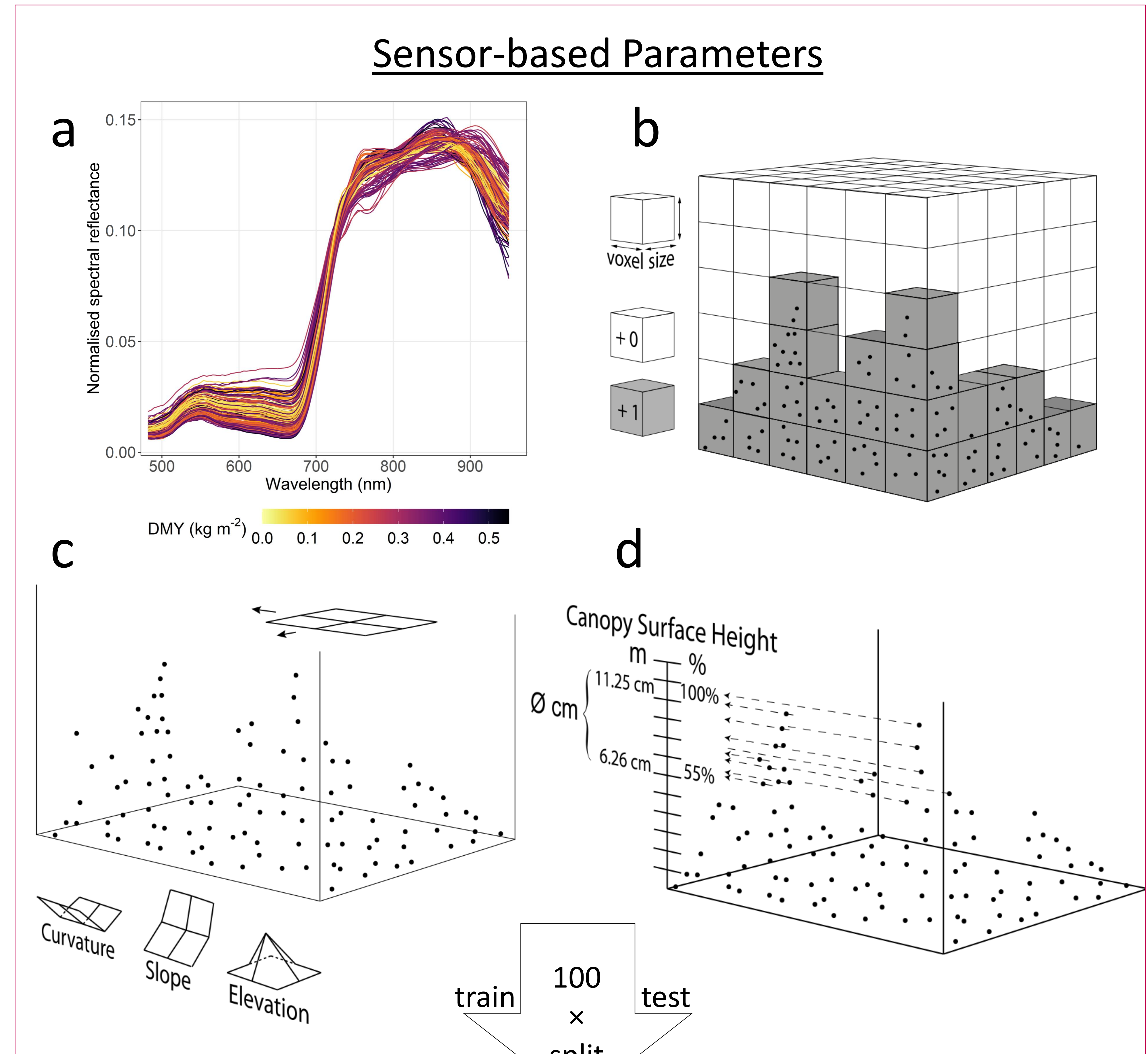


Fig. 2

train 100 × split test

Conclusion

Prediction quality of RS-based FMY and DMY prediction in grasslands:

- Complementary sensor systems increase the performance
- Features can be reduced without decrease of performance
- Impact by abundance of invasive species depend on its contribution