JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

AMIES II - Midterm Meeting

Giessen, Rauischholzhausen in May 2016

VolkswagenStiftung

Scenario Development for Sustainable Land Use in the Greater Caucasus, Georgia

- Project unit C
- Analysing and Modelling Relations between Phytodiversity and Productivity

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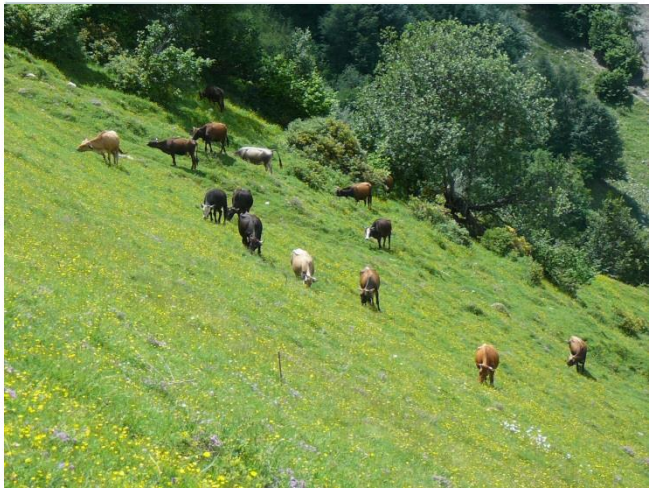
Content

- Introduction
- Method of remote Sensing
- Modelling
  - Productivity
  - Grassland degradation

Agricultural system

Biodiversity Hotspot

Land Use Change



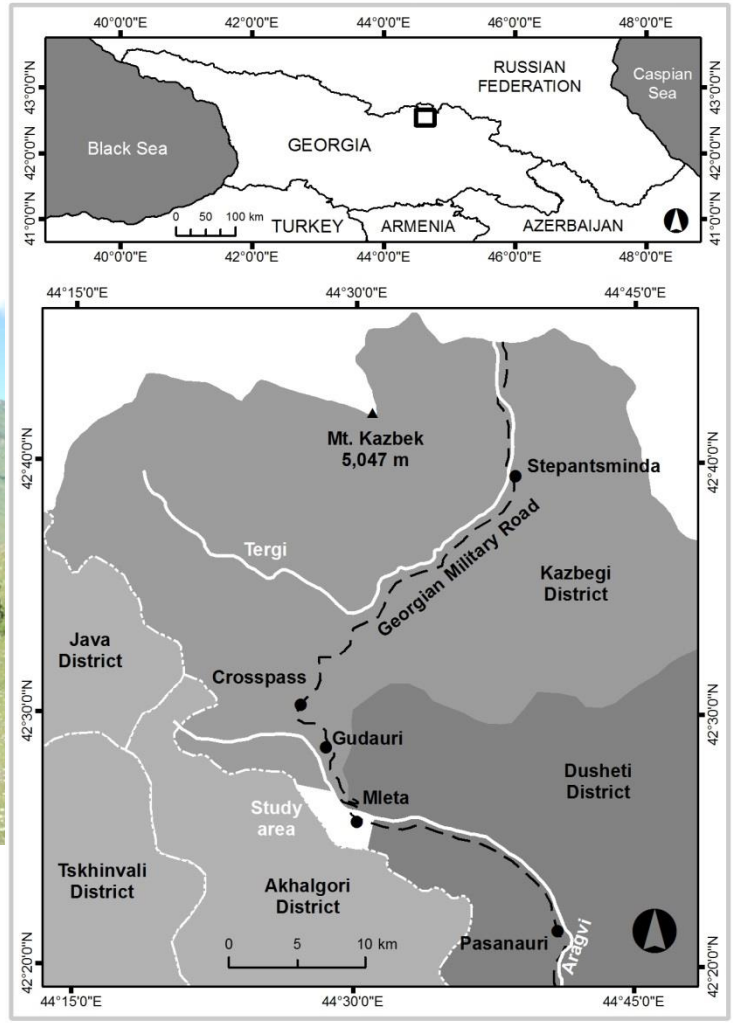
Grassland degradation

Overall Objectives

Development of site specific remote sensing methods to:

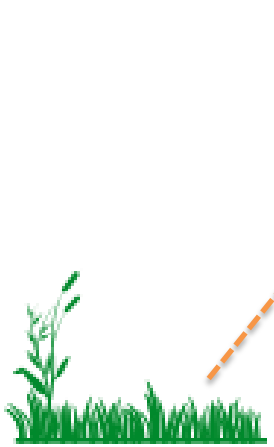
- **Estimate the grassland productivity of the Kazbegi region**
- **Assess the grassland degradation in the Upper Aragvi valley**

Study region



Remote Sensing

Sensor

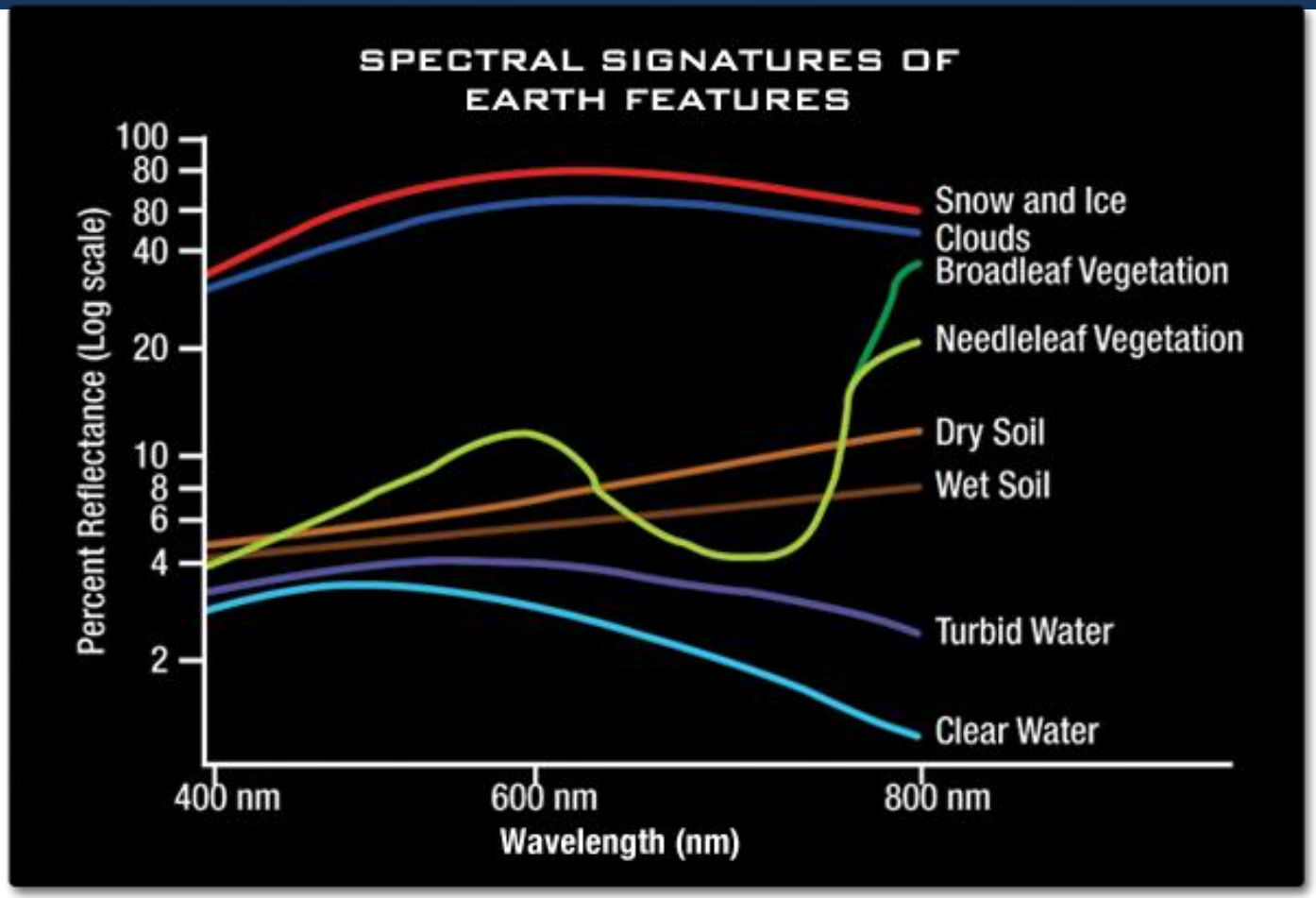


WorldView-2 Satellite (1,84 m)

RapidEye Satellite (5 m)

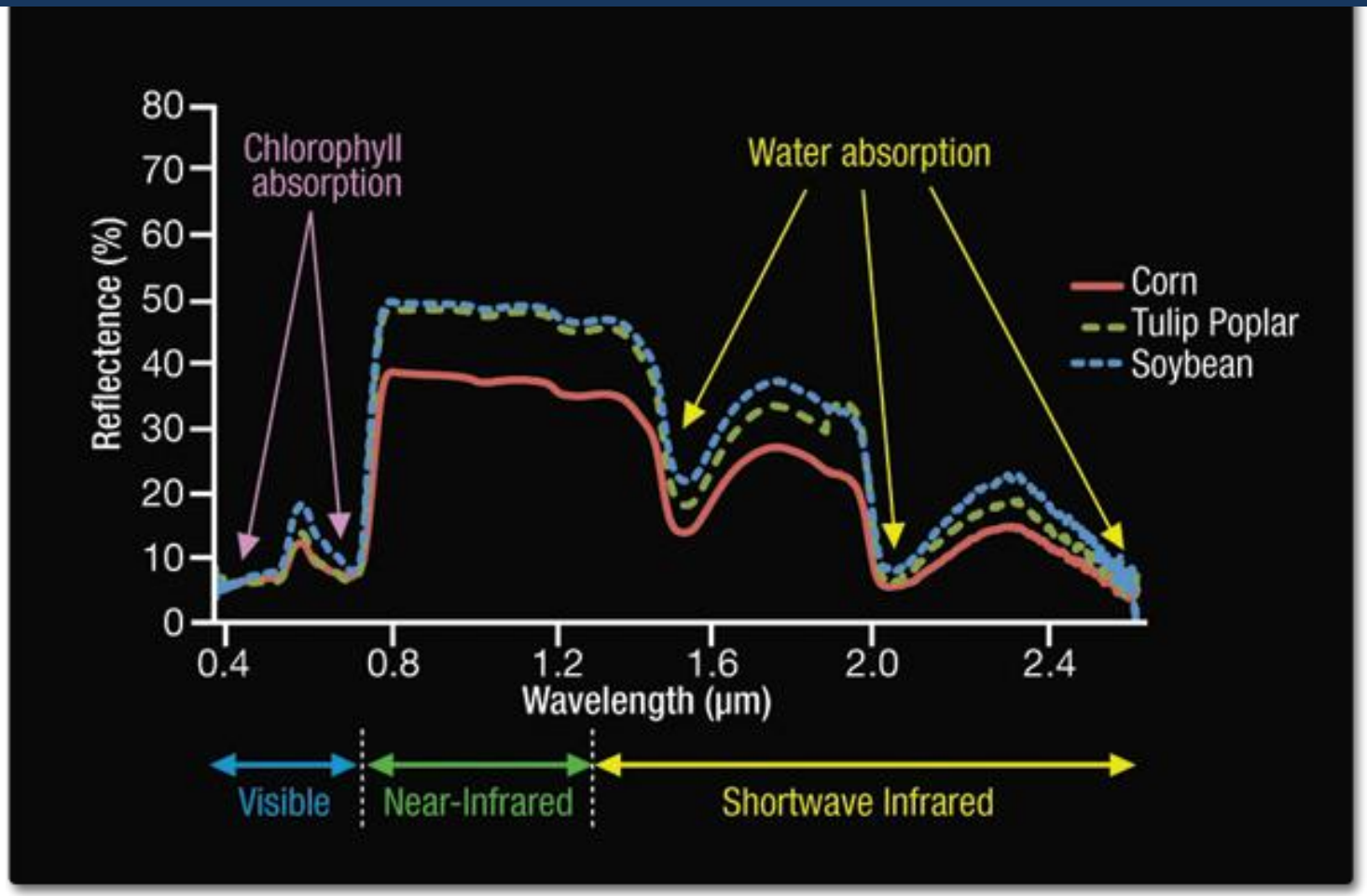
Sources: Digital Globe, openclipart.org, ASD

Remote Sensing



Soruce: National Aeronautics and Space Administration

Remote Sensing of Vegetation



Soruce: National Aeronautics and Space Administration

Remote Sensing of Vegetation Composition

Mountain grassland types of the Greater Caucasus can be distinguished from canopy reflectance.

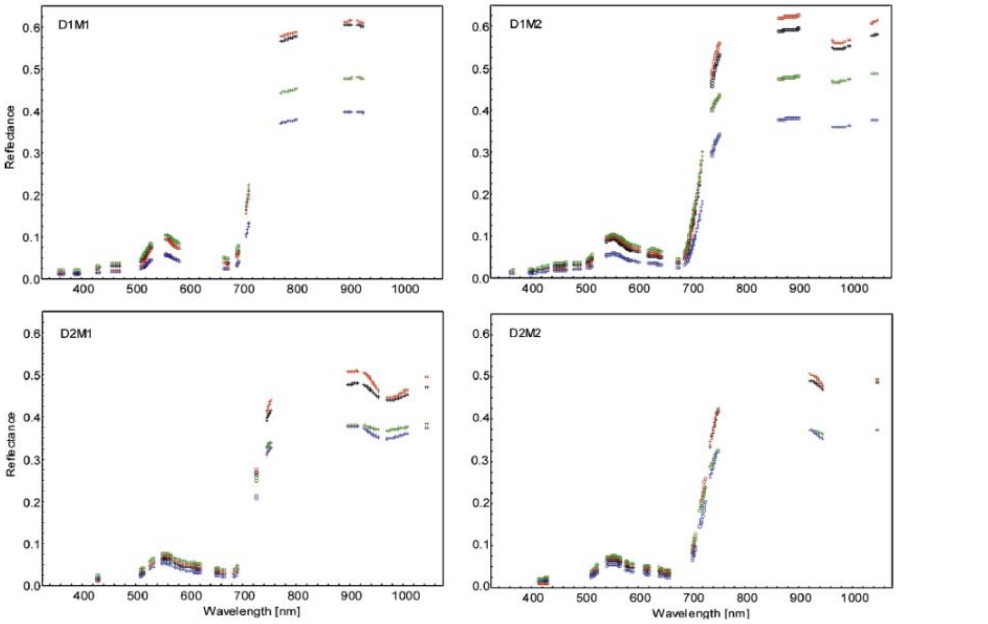


Fig. 4. Averaged reflectance of the significant predictor wavelengths in the PLSR models for the four datasets, averaged for grassland types. ○ Axis 1 model, + Axis 2 models, black = *Hv* meadows, red = *De* wetland, green = *AC* pasture, blue = *Fv* grassland.

Magiera A. et al. (2013): Relating canopy reflectance to the vegetation composition of mountainous grasslands in the Greater Caucasus. Journal of Agriculture, Ecosystmes and Environment (177). p101-112.

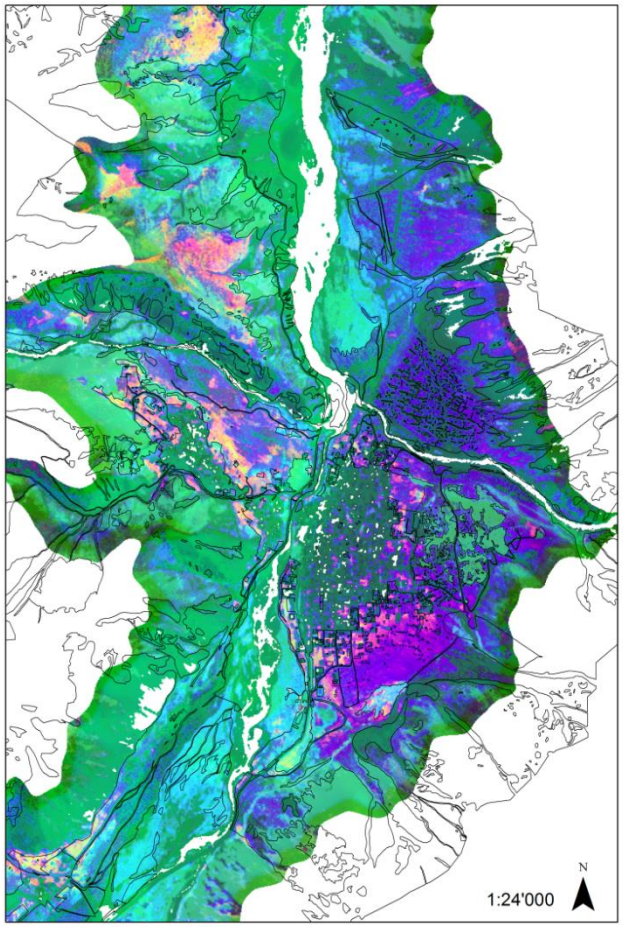
Modelling Productivity

Gradient modeling of vegetation (RandomForest)

Rot → Axis 1: *Hordeum violaceum*

Grün → Axis 2: *Astragalus captious*

Blau → Axis 3: *Gentianella caucasea*



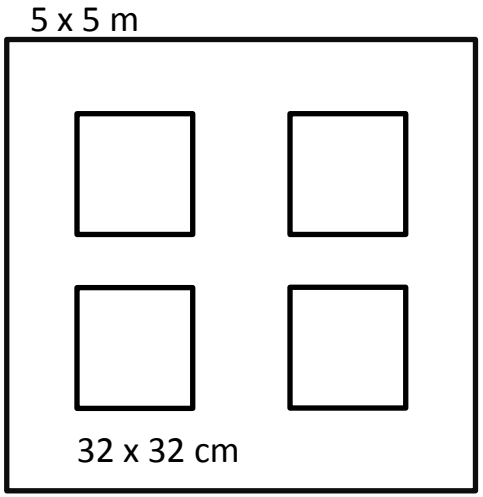
MAGIERA A. et al. (2016): Biomass estimation of mountainous grassland by including a species composition map. (in preparation)

Modelling Productivity

90 Plots in 6 villages

- Topographic variables

- **Biomass Sampling:**
  - ¼ m^2 Biomass sampled
  - Airdrying
  - 48 hrs at 60°C
  - Weighing **(Dry matter [dt* ha^{-1}])**

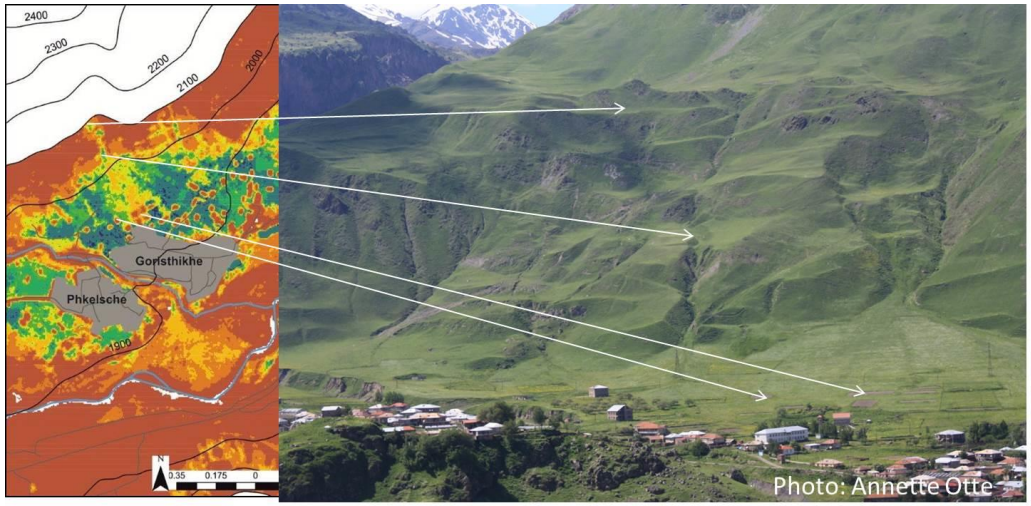


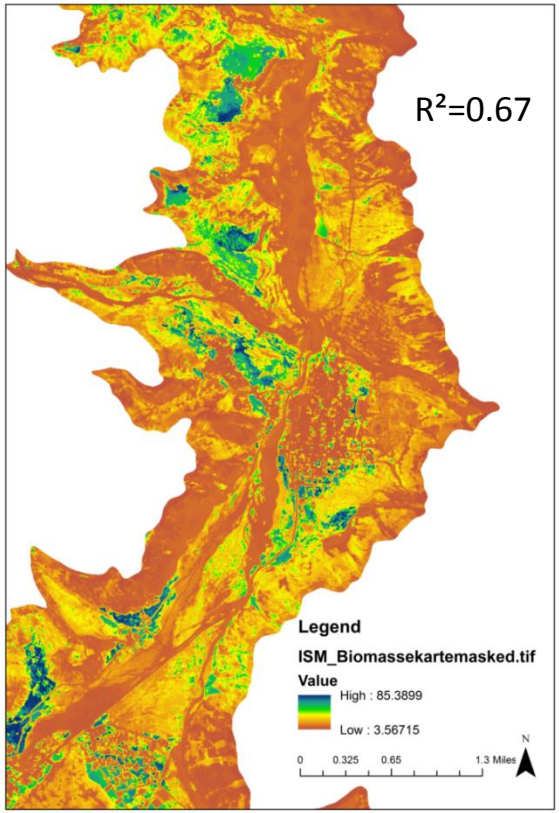
Modelling Productivity

Stepwise incorporation into final model:

- Biomass sampled
- Spectral variables
- Topographic variables
- Gradient models of vegetation

Productivity: 3.6 - 85 dt/ha dry matter





MAGIERA A. et al. (2016): Biomass estimation of mountainous grassland by including a species composition map. (in preparation)

Vegetation gradients

WIESMAIR, M., OTTE, A., WALDHARDT, R.: Relationships between Plant Diversity, Vegetation Cover, and Site Conditions: Implications for Grassland Conservation in the Greater Caucasus. (Submitted).

Modelling grassland degradation

	VegCov1	VegCov2	NMDS1 AX1	NMDS1 AX2	NMDS2 AX1	NMDS2 AX2
R^2	0.83	0.88	0.40	0.04	0.61	0.19
RMSEP	10.75	9.63	0.43	0.31	0.35	0.28

Wiesmair et al. (2016): Ordination vs. Vegetation cover to estimate grassland degradation from hyperspectral reflectance (in preparation)

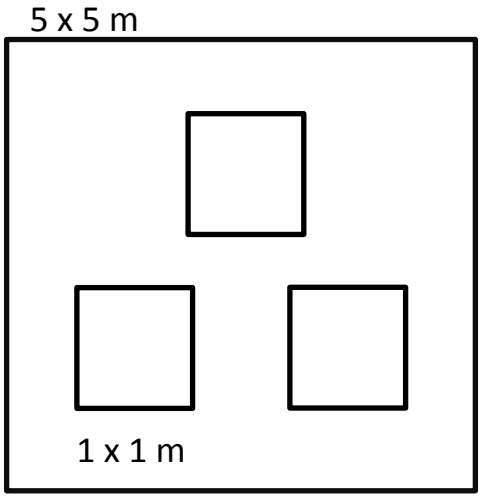
Grassland degradation can be better predicted from vegetation cover than from vegetation composition.

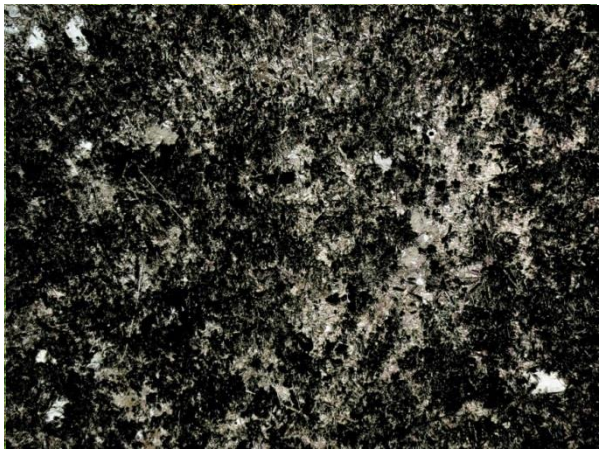
Grassland cover

93 Plots in Mleta

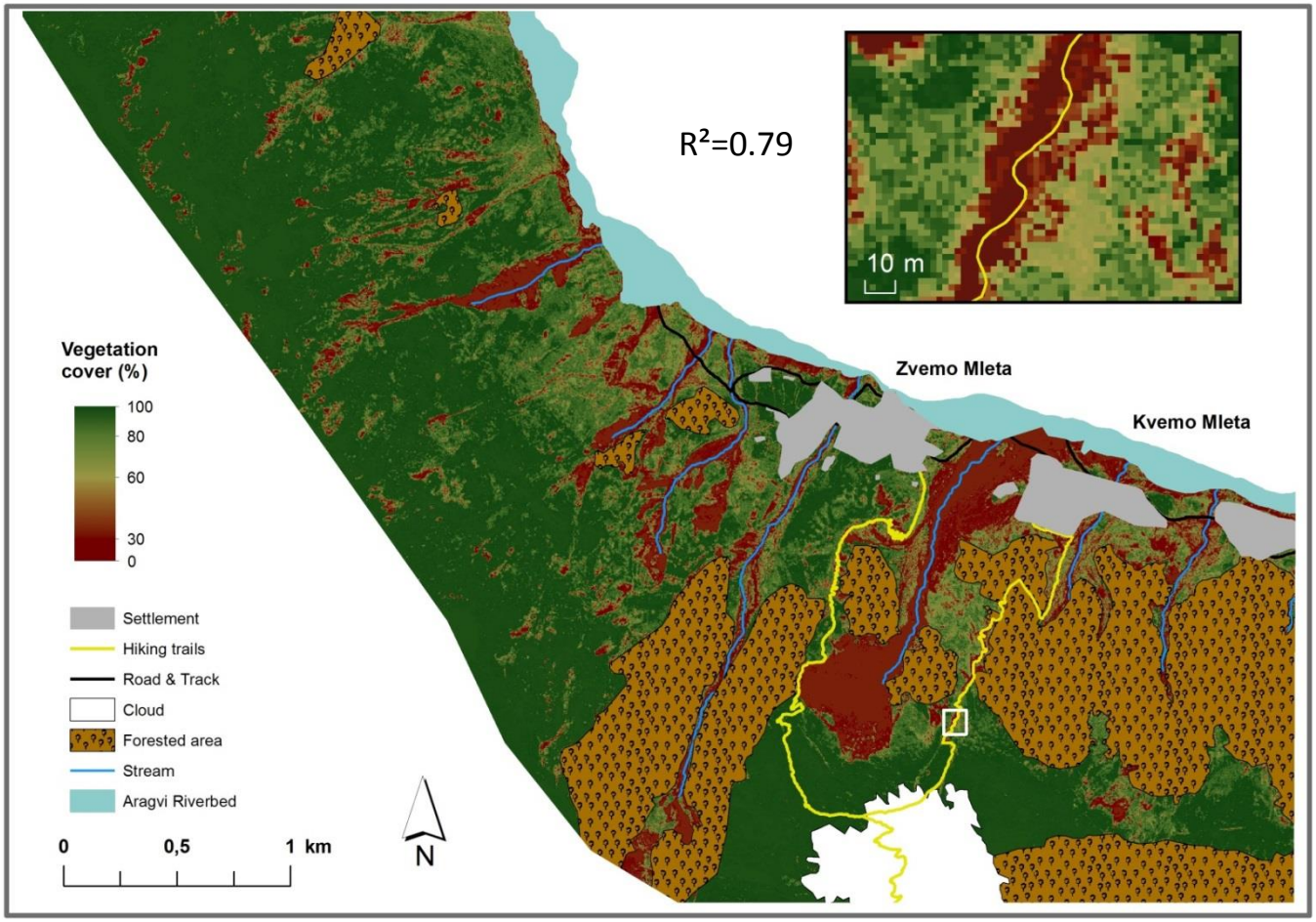
- Cover variables (rock, soil, moss)
- Topographic variables

- **Vegetation cover:**
  - Estimation (too imprecise)
  - Photographs
  - Calculation: Ratio of green pixels to overall pixels (%)





Vegetation cover



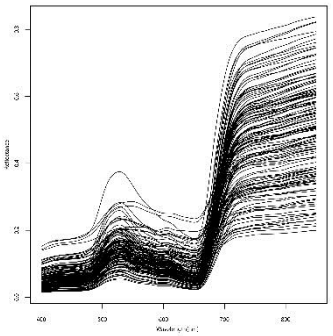
Variables for model:
-Vegetation cover (calculated)
- NDVI

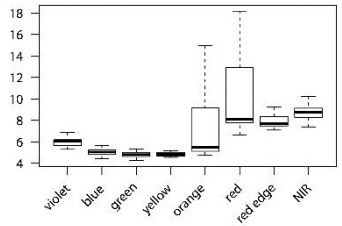
RMSEP: 12.61 %

WIESMAIR, M., FEILHAUER, H., MAGIERA, A., OTTE, A., WALDHARDT, R.: Estimating Vegetation Cover from High-Resolution Satellite Data to Assess Grassland Degradation in the Georgian Caucasus. - Mountain Research and Development 36.1 (Feb 2016).

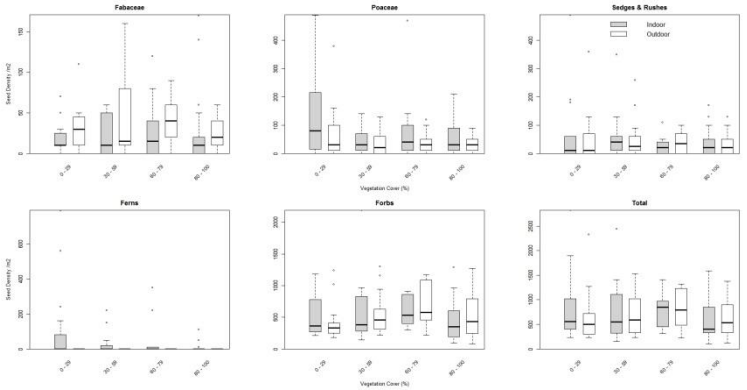
Outlook Martin Wiesmair

Publishing results for hyperspectral remote sensing



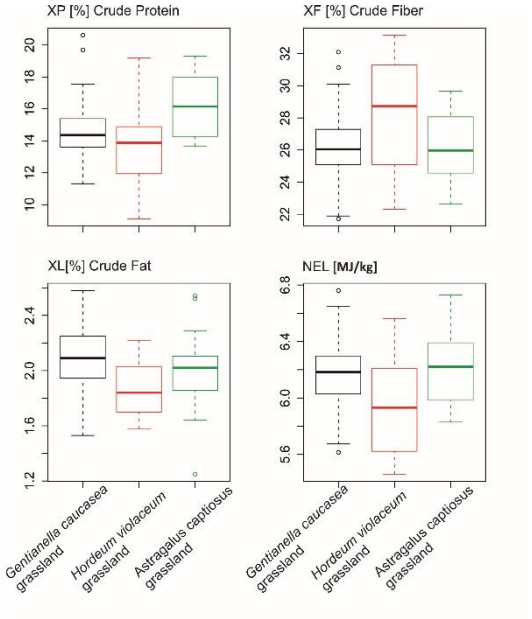


Final analyses of the natural restoration potential from seed bank

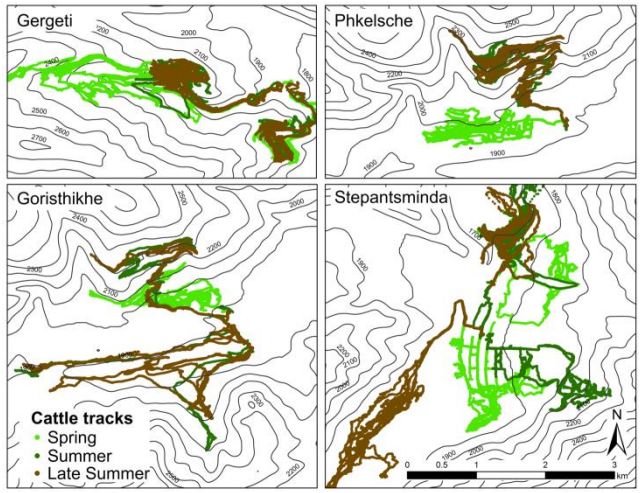


Outlook Anja Magiera

Connecting field spectrometric measurements to fodder quality and functional groups



Further analysis of the cattle grazing behaviour (tracks)



Thank you!