MAPPING OF HIGH-ELEVATION ALPINE GRASSLAND COMMUNITIES BASED ON HYPERSPECTRAL UAV MEASUREMENTS

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Mountain environments are particularly vulnerable to ongoing climatic and environmental changes. Specifically, alpine grasslands are seriously threatened by shallow erosion which has been increasingly detected during the last decades on alpine meadows and pastures. It has been suggested that a high plant species diversity of alpine grassland communities may increase the erosion resistance of soils, mainly through positive effects on root length, number of root tips and foliage abundance. Moreover, high plant biodiversity has shown to stabilize water channels by giving slope instability.

OBJECTIVES

Mapping the grassland communities based on high precision ground measurements and hyperspectral remotely sensed datasets:

+ Investigate and delineate the main lawn communities present in the area
+ Define the dominant grassland species and determine the approximate coverage of them
+ Based on spectral signatures distinguish the main grassland communities
+ Using remotely sensed datasets classify the different vegetation types in the area

Our study area (Fig.1) is a steep, approximately 5 ha large site, in Puez-Geisler National Park, Funes Valley. It is at 2190-2300 m a.s.l. and highly endangered by shallow erosion.

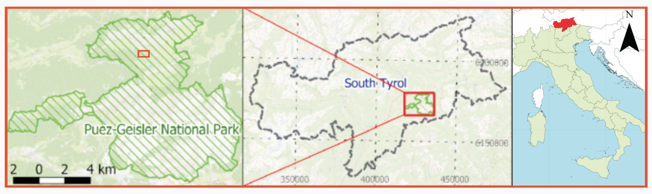

Figure 1. Study area:Funes Valley in Puez-Geisler National Park

MATERIALS & METHODS

During the field survey, within the framework of the ERODYN project, among others, we conducted a botanical survey and UAV flights. The ground measurements were taken, using 50x50 centimeters wooden frames (quadrats) - Fig.2.

- UAV flight with RGB camera
- UAV flight with Hyperspectral Rikola camera:
  - 40 bands: 506-896 nm
  - 5 cm spatial accuracy
- 3 measurements with Spectroradiometer (Spectra Vista) from 1 meter high in each quadrat
  - range: 340-2500 nm
- Sampled vegetation

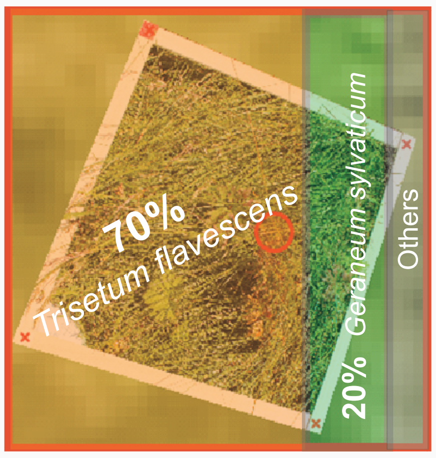

Figure 2. Results of the detailed botanical survey in a quadrat of Class 3

Based on the quadrats and on the botanical survey we were able to define 5 main vegetation classes. These classes were delineated on the field and these, high precision delineated areas (GNSS RTK GPS) served as ground truth data.

For validation, we used the areas of quadrats whose exact contents were precisely defined during the study.

RESULTS

The reached overall accuracy is 75.57% using Support Vector Machine (SVM) classification - Table 1.

Confusion matrix - Ground truth (percent)						
	Class 01	Class 02	Class 03	Class 04	Class 05	Total
Class 01	61.61	0	0.78	0	0	7.33
Class 02	0	32.19	0	0	2.88	5.29
Class 03	38.39	35.36	89.3	0	0	22.47
Class 04	0	1.06	7.83	80.15	3.69	30.97
Class 05	0	31.4	2.09	19.85	93.43	33.95
Total	100	100	100	100	100	100

Table 1. The validation of the SVM classification results for the 5 defined grassland classes according to confusion matrix

False positive results were not significant, misclassification occurs to a lesser extent. The main challanges were the overlapping species and the similarities of the spectral signature between classes.

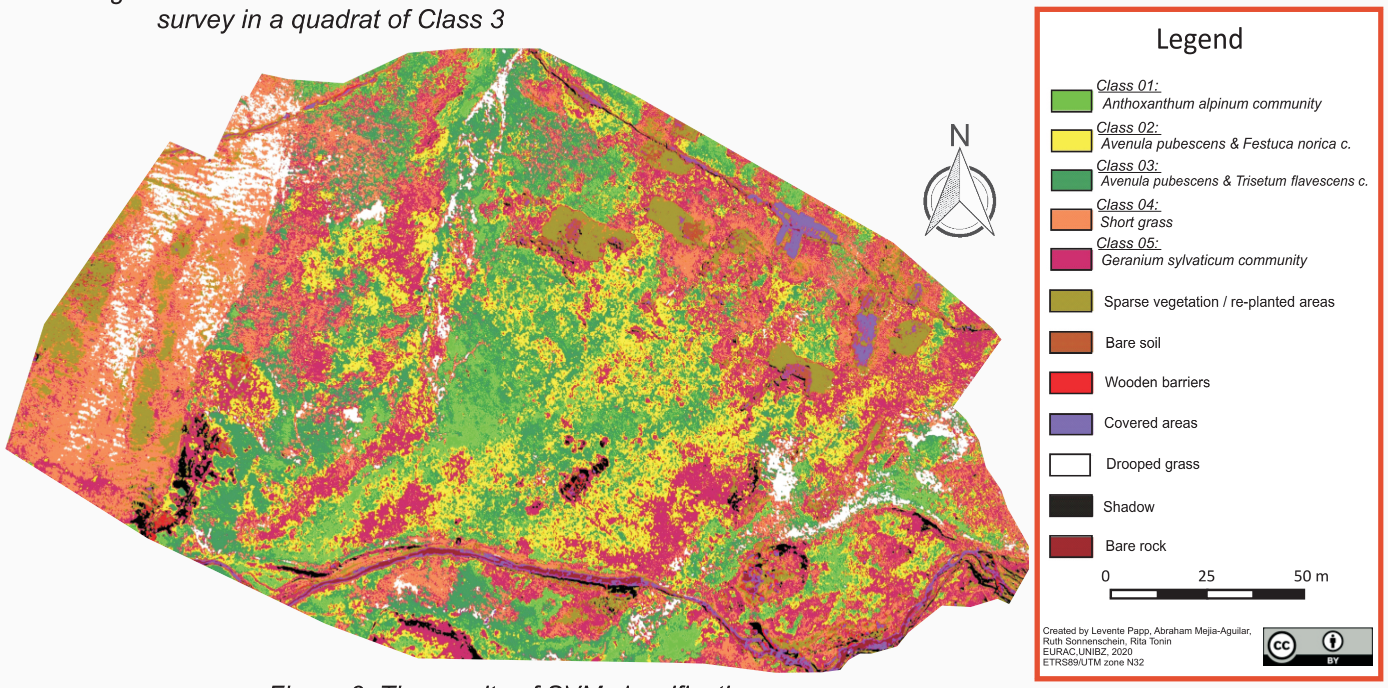

Figure 3. The results of SVM classification

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