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. Against this background, we used Earth Observation to map grassland communities and to understand the link between species diversity and the presence of shallow erosion spots in an alpine region.

Our study site is within the valley of Funes in South Tyrol, Italy where shallow erosion spots have multiplied in the last years and decades. The study site is over 2300 m above sea level and covers an area of approximately 5 ha. We mapped the grassland vegetation in this area with using different technologies: The main data source was a hyperspectral image with overall 28 spectral bands (506 nm to 896 nm) and a 5 cm spatial accuracy acquired from a UAV flight campaign in 04.09.2019. Our reference data set comprised detailed ground measurements within 50x50 centimeter plots. Overall, we acquired field spectroradiometer measurements covering the spectral range from 339 nm to 2500 nm (1024 spectral bands), ground-based hyperspectral measurements and sampled the different grassland communities within the plots. Based on the data integration of two different scaled field measurements and the UAV mapping we were able to detect the main grassland community occurrences and hotspots in species-level with high accuracy.