



Master thesis in remote sensing and grassland management in mountain areas

Introduction and problem definition

To keep the landscape open is one of the duties of agriculture defined by the federal constitution. This duty is particularly demanding in mountain areas due to the complex and rugged terrain. Using remote sensing to monitor these vast and remote regions is interesting for several reasons:

- 1) Farmers get direct payments to compensate for the high labour required to keep the landscape open. This direct payment obviously should be controlled.
- 2) Natural forest regrowth is a process that, once started, is almost irreversible. Therefore, it is of interest to locate areas susceptible to natural forest regrowth before regrowth takes place.
- 3) Steep and remote areas are often extensively managed and therefore valuable for biodiversity. Preserving biodiversity hotspots is of growing interest.

The aim of the thesis is to investigate how remote sensing can help to identify grassland areas that were unmanaged for a prolonged time period and therefore are susceptible to natural forest regrowth. The outcome should be a map delineating regions with their probability to be managed or to be susceptible to natural forest regrowth.

Proposed research questions

This thesis raises several research questions which can be summarized in three groups:

- 1 Data availability
 - How often are Sentinel 2 data available and cloud-free during the vegetation period?
 - Are they available for the most important stages of vegetation development?
 - Can vegetation development be grouped and characterised (natural vegetation, forest, meadows and pastures)?
 - Could imagery from other satellites (e.g. from the Landsat series) or from several years be combined?
 - By what extent does additional data help to characterise vegetation development?
- 2 Vegetation indices and additional data
 - Which vegetation indices are most robust in the present case?
 - By what extent differ vegetation indices according to e.g. topography?
- 3 Analysis unit
 - Which is the best unit to apply and analyse vegetation indices?
 - Is it possible to evaluate the whole alpine region in one step or should it be subdivided?
 - If it has to be subdivided, what could be a suitable structure?

Technical information

It is foreseen that the candidate uses the Google Earth Engine (GEE) cloud infrastructure to work with the large amount of available satellite data. The GEE can be either accessed with a Python or JavaScript API, the latter being used in a simple, integrated development environment. Although programming skills are not required, the candidate will spend a high fraction of time working with one of the programming languages mentioned.