OBSGESSION

Multiscale, multimodal and multi-temporal understanding and predicting of biodiversity response to global change in the European Alps

ABOUT

Within this pilot, OBSGESSION members aim to explore how biodiversity reacts to environmental changes in alpine ecosystems. The main focus is placed on examining patterns of biodiversity and how ecosystems function over various spatial and temporal scales, blending hands-on field observations with cutting-edge remote sensing technologies. The research takes place in alpine locations across Switzerland and France, including the Swiss National Park, the Chamonix and Lautaret regions of the French Alps, and the Laegern forest in Switzerland. The main ecosystems the pilot focuses on include alpine grasslands, forests, and wetlands, which are especially vulnerable to the impacts of climate change and other environmental pressures.

CURRENT PROGRESS

To date we have concluded the field and airborne sampling camapigns at all of the sites and are currently eagerly analyzing the data. A set of preliminary outcomes of the pilot include: presentations at Living planet symposium and at the BioSpace conference where the data sets were summarized "Testing AVIRIS-4 for Monitoring Grassland Biodiversity through Imaging Spectroscopy", and "Integrating AVIRIS-4 Imaging Spectroscopy and In-Situ Data for Grassland Biodiversity Monitoring". In this work we showed the in situ and airborne data collected for understanding alpine grassland ecosystems. Beyond these outcomes we are currently working on developing models after a data processing phase which included processing the airborne data, processing the field data, conducting lab analyses of traits, and developing the analytical tool box to calculate and incorporate uncertainty in our modeling process.

SCOPE & BACKGROUND

Forests play a crucial role in climate regulation, carbon storage, and biodiversity conservation. However, forest ecosystems are increasingly affected by climate change, extreme weather events, pest outbreaks, and other disturbances. Monitoring these impacts requires models capable of simulating ecosystem processes and predicting how forests respond to environmental stressors. The pilot therefore combines ecological models with Earth Observation data to monitor forest productivity and ecosystem functioning across large spatial scales.

OBSGESSION'S CONTRIBUTION

Within the OBSGESSION project, this pilot integrates multiple biodiversity data sources to develop advanced monitoring approaches. The project combines long-term in-situ biodiversity observations with airborne imaging spectroscopy collected with the AVIRIS-4

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sensor. These datasets are used to develop artificial intelligence pipelines that link field measurements of biodiversity with remotely sensed indicators of ecosystem structure and function. The pilot also applies the Detection-Attribution-Modelling framework developed in the project to identify the drivers of biodiversity change and assess how environmental variables influence biodiversity patterns. An important component of the work is testing the scalability and transferability of biodiversity models by applying approaches developed at Swiss sites to comparable locations in the French Alps. Through these activities, the pilot contributes to developing operational biodiversity monitoring methods based on the integration of remote sensing and ecological observations.

EXPECTED RESULTS

Within the scope of this pilot, OBSGESSION is expected to produce several scientific and operational outputs. These include remote sensing–based biodiversity indicators that capture ecosystem structure, community composition, and genetic diversity across alpine ecosystems. Project members will also develop AI-based modelling pipelines capable of linking airborne spectral data with field observations. Another important outcome is the evaluation of the ability to transfer models between regions, demonstrating whether approaches developed in one alpine area can be applied to others. The pilot will further generate spatial maps showing how environmental drivers such as climate variability influence biodiversity patterns, accompanied by uncertainty assessments to support robust decision-making.

STAKEHOLDERS

The results of this pilot are relevant to conservation authorities and protected area managers responsible for alpine ecosystems, including national parks and biodiversity monitoring networks. They also support policymakers implementing the EU Biodiversity Strategy for 2030 and other international biodiversity monitoring frameworks. Scientific institutions and environmental monitoring organisations interested in remote sensing–based biodiversity monitoring also represent key stakeholders.

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