Mapping cool drops on heating hilltops

Can we map cold landforms and their functions using machine learning approaches?

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Project description

Cold arctic and alpine hillslopes are heating four times faster than the global average, causing rapid landscape and ecosystem changes. Millions of cool, drop-shaped landforms formed by creeping soils, 'solifluction lobes', could mitigate these climate change impacts by storing sediments and carbon and supporting biodiversity. However, we do not know where on Earth how many solifluction lobes are actually located. Consequently, we miss understanding of which role they could play in a warming climate.

In this Bright Minds project, you will carry out a pilot study testing if we can map solifluction lobes and their functions on catchment scales using spatial machine learning (e.g. random forest). You will use a >100 lobes dataset from two catchments in Switzerland (Turtmann Valley, Meretschitälli; Valais). By deriving environmental predictors from elevation models and satellite images (e.g. topographic indices, snow cover, NDVI) you will first analyse the factors influencing lobe occurrence and create a map showing occurrence probability. Using available high resolution orthoimagery, you will validate your mapping. If time allows, you will test in a next step if we can use established relationships between lobe functions (e.g. carbon storage) and environmental properties to map functions for other solifluction lobes.

Your work will contribute to ongoing research projects ("Go or Grow", PROSOIL on global process-informed soil mapping) and take the first step to maybe soon map cool drop-shaped landforms and their functions on hillslopes around the world, improving our understanding of possible future climate change impacts on vulnerable cold hillslopes and ecosystems. The spatial machine learning approaches you will learn are widely applicable for many similar problems and applications in earth and environmental sciences and ecology.

To ensure that you get most out of your work and we achieve great results, we will have weekly meetings to discuss your problems, findings and progress. For urgent questions, we will be available directly on campus or via email and Teams. We aim to prepare a scientific publication together with you on the results.

Can you unravel the secrets of millions of cool drops on heating hilltops?

Job requirements

Most importantly interest in cold hillslopes and landforms. Experience with spatial raster data processing. Experience in statistical/machine learning approaches (e.g. random forest) and coding skills (R) are of advantage.