Submitted Abstract

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Title	Geo-Ecological Succession In The Deglaciating Alps And Andes Combining Satellite Imagery And Multispectral Drone Photogrammetry With Field Data.
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Abstract

Mountain glaciers are melting worldwide, and their ecosystem services are declining, impoverishing local ecosystems and human communities. The emerging ice-free lands, however, represent an opportunity for novel alpine ecosystems to develop. Previous studies have usually focused on wider areas through satellite imagery or over smaller areas using in situ floristic evaluations. Each approach has strengths and limitations: satellite imagery is recurrent and covers large areas, but it lacks fine resolution, and field data collection has the fine resolution but lacks the breadth and is laborious. Here, we couple field data collection, aerial photogrammetry, and satellite analysis to study the distribution and composition of pioneer alpine communities in glacier forelands. For a total of nine proglacial landscapes distributed between the Alps (France and Switzerland) and the Tropical Andes (Peru) we combined satellite imagery and multispectral UAVs models with ground land cover data using an RGN (Red-Green-Near Infrared) camera and in situ floristic and geomorphologic surveys. We test long-term (1950-2020) primary geo-ecological succession in the context of recent climate change. We use the normalized difference vegetation index (NDVI) to assess vegetation development, predict biomass, and to connect field observed variables i.e., species richness, plant cover, and soil properties, with global ecosystem functioning and services and upscale local patterns to regional processes. We have produced nine high-resolution multispectral orthomosaics (3-5 cm/px-) and DEMs (6-15cm/pix) and surveyed a total of 620 plots along the 9 chronosequences of deglaciations. This approach allows to couple the space for time substitution approach with geomorphological dynamics and landforms. We found that spatial heterogeneity reflects gradual successional trajectories related to small variations in physical habitat conditions. And abiotic and biotic processes combine to drive the pioneer stages of plant succession after glacier retreat. These mixed geospatial methods allow for high-resolution terrain mapping, ecological modeling, and global upscaling, and provide a robust tool to guide implementation policies and management of proglacial landscapes.