EGU2020-10618
https://doi.org/10.5194/egusphere-egu2020-10618
EGU General Assembly 2020
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Area-wide detection and spatial modeling of signs of bioturbation activity along a climate and elevation gradient in Chile using UAV and their dependence on vegetation and soil characteristics

Paulina Grigusova[1], Diana Kraus[2], Annegret Larsen[3], Alexander Klug[1], Robin Fischer[1], Sebastian Achilles[1], Peter Chifflard[4], Nina Farwig[2], and Jörg Bendix[1]

[1]Department of Geography - Laboratory of Climatology and Remote Sensing, Philipps University of Marburg, Marburg, Germany (grigusop@staff.uni-marburg.de)
[2]Department of Biology - Conservation Ecology, Philipps University of Marburg, Marburg, Germany (farwig@staff.uni-marburg.de)
[3]Department of Soil Geography and Landscape, Wageningen University & Research, Wageningen, Netherlands (annegret.larsen@wur.nl)
[4]Department of Geography - Soil and Water Ecosystems, Philipps University of Marburg, Marburg, Germany (peter.chifflard@geo.uni-marburg.de)

The impact of soil dwelling animals on the terrain shaping is assumed to be largely coupled with vegetation and soil characteristics, particularly in arid and semi-arid regions. The vegetation determines the habitat availability by providing necessary resources such as food and shelter while the burrowing activities of soil dwelling animals impacts at the same time soil properties and nutrient fluxes needed for plant growth. This important relationship and feedbacks between bioturbators, vegetation, climate, soil conditions and landscape shaping is to date completely understudied, particularly the dependencies between soil animals and the vegetation cover. Thus, comprehensive studies to gain a detailed understanding are urgently required. Here, we modeled the presence of all signs of bioturbation (burrows, holes and mounds) within a study area of 1 km^2 with an elevation gradient of 100m height difference in a semi-arid (Santa Gracia, Chile) and Mediterranean (NP La Campana, Chile) zone of coastal Chile using UAV (unmanned aerial vehicle) images. We then compared their relationship between the two climate zones in regard to the vegetation, elevation and soil characteristics. The images were obtained at a flight altitude of 15-60 meters above one study area per each climate zone by means of a Solo quadropter drone equipped with a RGB GoPro camera. Ancillary *in-situ* data were measured within 10 plots per study area with a size of 10m x 10m. Within the plots, the amount and size of the burrows and mounds as well as the vegetation cover was quantified. In addition, the GPS coordinates of several holes and mounds with a diameter of 10cm and above were measured. Twenty representative soil samples in regard to the land cover, vegetation type and presence of bioturbation activity were taken along the elevation gradient and analyzed for skeleton fraction, soil texture, bulk density and water content. The RGB images obtained by the drone system were firstly used for a supervised land-use classification and to calculate the vegetation density across the study area. The surface roughness was estimated by creating the point cloud of the area and calculating the

standard deviation of the point cloud and original images using moving window of 5x5 pixels/points. The presence of soil animal activity was modeled using random forest where drone images, digital elevation model, surface roughness and land cover characteristics (land use, vegetation density and type) were used as predictors. The results showed modeled spatial distribution of burrows and mounds within the study areas, and a dependence of the predicted bioturbation activity on vegetation density and type as well as on elevation and soil conditions along the elevation gradient at both sites. The dependencies are finally compared between the two climate zones.