Potential ecological and land management impacts of climate change on Andean ecosystems and agropastoral communities

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Abstract

Mountain ecosystems are distributed across all continents, covering about 27\% of the world’s land surface. These regions support 1.1 billion people worldwide, about 15\% of the global population, with 91\% in developing countries. Mountains are social-ecological systems characterized by vertical gradients of climate and cultural and natural diversity. Rapid shifts in topography and climatic regimes make mountain ecosystems susceptible to climate change. People in these regions use rangelands for extensive livestock production. However, many rangelands previously used by local communities are currently under protection with different use levels. Although it is anticipated that the effects of climate change will be significant in the tropical Andes, the extent of these impacts is still not well understood. This research explores climate change’s potential ecological and land management impacts on two agropastoral communities neighboring Huascaran National Park in the Peruvian Andes. For this, we created the Agent-based model of Land management Dynamics and Ecosystem Services (ANDES) linked to L-Range, an ecosystem-process model. L-Range simulates biogeochemical processes and vegetation dynamics, e.g., monthly primary production, N and C cycling, and plant population dynamics for rangeland ecosystems. Implementing L-Range required parametrizing 54 climatic, edaphic, and plant variables and using landscape and climatic information, e.g., fractional vegetation cover, topographic features, soil properties, temperature, and precipitation. The ANDES model is a spatially explicit model of livestock grazing behavior, land and livestock management, and households’ economies. The assessment of the model will involve using a pattern-oriented approach, such as comparing simulated responses of the daily fraction of biomass consumed by livestock and daily distance traveled with information from reports and peerreview journals. The validation of the L-Range model results also will require comparing the model outputs, such as net primary production and vegetation cover, to historic remotely sensed data. This research is in the phase of model validation and data analysis. Thus, we present the methodology for building the coupled model and preliminary findings.
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