
Socio-ecological complexities in mountain tropical regions

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Abstract

The proposal aims to contribute to the evaluation of the timescale of observation of regional landscapes and ecosystems, with special emphasis on the coastal area of the state of São Paulo, a tropical mountain site. The area presents an extraordinary mosaic of ecosystems along with extensive climatic and topographic diversity, but also a major concentration of industries, being highly urbanized. These activities create constant new demands for water, energy, transport, communication and general infrastructure, which might continue to exert strong pressure in the site. However, integration with other mountain tropical regions is also a goal of the study because each tropical region presents unique characteristics, long-term trends and feedback processes, but conversely they are under similar global environmental change pressures. Therefore, it is paramount to identify, for different sites, the weight of global pressures and of their own evolutionary system and socio-ecologic heritage as a component for the region socio-ecologic problems.

In tropical mountain areas landslides are common processes, but despite the recent progresses on evaluating the exposure of mountain areas to hydro-geomorphological hazards, many uncertainties remain, as several processes result from complex factors which are partly unknown. In the area, many human-induced processes like deforestation and the occupation of steep slopes, in association with intense precipitation and high temperatures, have contributed to decrease the stability thresholds. The lack of alternatives for living in safer areas and the inadequacy of infrastructure and organizational systems to prevent or limit the impacts contribute to a continuous increase of society's vulnerability.

Thus, the evaluation clearly requires integration of distinct but complementary domains and innovative procedures that capture the complexity of socio-ecological interactions and their evolution over multi-scale perspective, as the traditional approaches do not accommodate the complexities of modelling uncertainties in a changing environment.

In view of reducing risks in wet tropical mountain areas, a number of factors must be considered: i) What are the risks that a certain mountain area and population are exposed to? Are they changing? ii) How do parameters like elevation, gradient, curvature, among others, control the transfer of mass and energy? iii) What is the impact of reworked soil material that moves down to ecological systems? iv) How to define, in a dynamic perspective, rainfall

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parameters and thresholds that trigger mass movements and control dynamics of sediment transfer for each location? v) to which extent do extreme events result from teleconnection mechanisms and how do they operate? vi) How to transform scientific knowledge into effective actions to safeguard the physical integrity of residents in mountainous areas susceptible to landslides?

Considering all these aspects, the proposal intends to: i) develop a regional strategy for the compilation, integration and modelling of regional datasets across tropical regions, with reliable connected and standardized information; ii) identify the main socio-ecologic drivers for the region's changes and their impacts, such as urbanization, risks from natural hazards and rates of sediment deposits over an extended period and how they contribute for landslides and associated flooding; iii) evaluate climate extremes at different time scales and their evolution over the time, comparing with changes in land cover and land use; iv) identify how rapid tropical regions are changing and how global demands are contributing to these changes; v) evaluate how tropical regions are involved into global networks and how it contributes to and or alleviates internal disparities; vi) analyse how competitive these spaces are in the face of new economic opportunities and how similar are their strategies towards global integration; vii) identify situations where conservation of natural heritage and biodiversity conflicts with economic growth and indicate measures towards a comprehensive development; viii) propose ways to develop a number of scenarios which reflects the linkage of a number of variables, like evolution of CO₂ emissions, GDP per capita, education, demographic changes, deforestation, etc.; ix) promote ways for developing programmes that connect tropical regions in view of stimulating cooperation and thus contributing to the integration of regional multi-decadal data.