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The potential contribution of geomorphology to tropical mountain development: The case of the MANRECUR project

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Abstract

A comprehensive interdisciplinary study of a small Andean watershed in Ecuador [Poats, J.V., 2002. El Angel River Watershed Carchi, Ecuador. Disk 9 of 9. In: Himalayan Andean Collaborative Watershed Project, International Development Resource Centre, Ottawa] has produced practical recommendations for its sustainable management, with emphasis on new governance mechanisms. Comparatively little is said about questions of watershed stability in geomorphic terms, though water supply, sources and sinks are identified as crucially important. In this paper, three alternative frameworks, those of montology, less favoured area investment and panarchy, are examined. It is concluded that each of these frameworks, by insisting on a balance between socio-economic and biophysical analysis, does offer scope for the incorporation of geomorphic concepts though none of them demand explicit geomorphic content. The framework, which seems most flexible, is the panarchy metaphor [Holling, C.S., 2001. Understanding the complexity of economic, ecological and social systems. Ecosystems 4: 390–405.]. Not only does this framework insist on asking questions about the socio-economic and biophysical organisation of the watershed system, but it also leads to some arresting conclusions about the probable imminent collapse of watersheds under increasing population and land-use pressure. The panarchy metaphor identifies collapse and reorganisation as a common characteristic of socio-economic and biophysical systems. If this metaphor is even close to being accurate, the first issue in sustainable management of this small Andean watershed is how to ensure a "creative" collapse leading to a more sustainable system. A significant geomorphic contribution in this context would seem to include the identification of functioning hydro-geomorphic response units, connectivities and spatial-scale effects leading to more nuanced application of management strategies.

Keywords: Sustainable management; Ecuadorean Andes; Panarchy; Watershed response; Scale

1. Introduction

At the outset of the 21st century, it is commonly understood that there is a strong relation between society and ecosystems (Blaikie and Brookfield, 1987; Fraser et al., 2003). But precisely what is the nature of that relation? Alexander von Humboldt expressed eloquently the reflexive relation of society and environment (Glacken, 1967), but there continue to be those who prefer the simplistic assumptions of environmental determinism (e.g., Sachs et al., 2001). The lack of understanding of the reflexiveness of the relation between society and environment is possibly the root cause of continuing environmental degradation (Thompson, 1997). Turner et al. (1990), Meyer and Turner (1992) and Vitousek et al. (1997) have alerted us to the fact that by 1990 land use change had become cumulatively more

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significant than biophysical change at the global scale and yet we appear to continue to attach higher priority to research on climate change than to land use change (Slaymaker, 2001). In the South American context, the Merida de los Andes Declaration (Sarmiento, 2002b) has pointed out that human intervention in Andean landscapes (e.g., mining, agriculture, forestry and urbanisation) is leading to increased vulnerability to volcanism, drought, landslides, avalanches and flooding.

In an effort to understand the potential contribution of geomorphology to sustainability in Andean rural landscapes, and in mountain environments more generally, reference is made to a comprehensive interdisciplinary study of a small Andean watershed, the El Angel River basin in Carchi Province, Ecuador (Poats, 2002). The objective of the study was 'development' and the provision of a greater variety of livelihoods for the residents of the watershed. The primary focus of the recommendations was the provision of new governance mechanisms. There is no doubt that in the immediate short term this focus had the highest priority and few geomorphologists who have worked in this region would doubt the wisdom of such a recommendation. However, it is legitimate for a geomorphologist to ask whether this emphasis is adequate to meet the requirements of sustainability over medium and longer time scales. Indeed, what would seem to be an appropriate conceptual framework within which to meet sustainability criteria? It was therefore decided to explore three different but complementary frameworks for sustainable mountain development (Sarmiento, 2000; Pender and Hazell, 2000; Holling, 2001) and the following two questions were asked:

1. Which framework is most sensitive to sustainability?
2. Which framework is most sensitive to geomorphic vulnerability?

Sarmiento (2000) recommends the implementation of a new science, called 'montology'; Pender and Hazell (2000) propose a new emphasis on 'less favoured areas' within less developed countries, by contrast with traditional development investments in 'favoured areas'; and Holling (2001) advocates a new way of describing the functioning of complex ecosystems, called 'panarchy'.

Each of these three frameworks or approaches provides some insight into sustainability in the Andes. They do not explicitly incorporate geomorphic concepts and expertise but they do provide different levels of sensitivity to potential geomorphic contributions. This is important because geomorphology's potential role in these matters has been greatly underestimated (Slaymaker, 2000a).

2. The context

The El Angel River basin is the site of a major integrated resource management project called MANRECUR

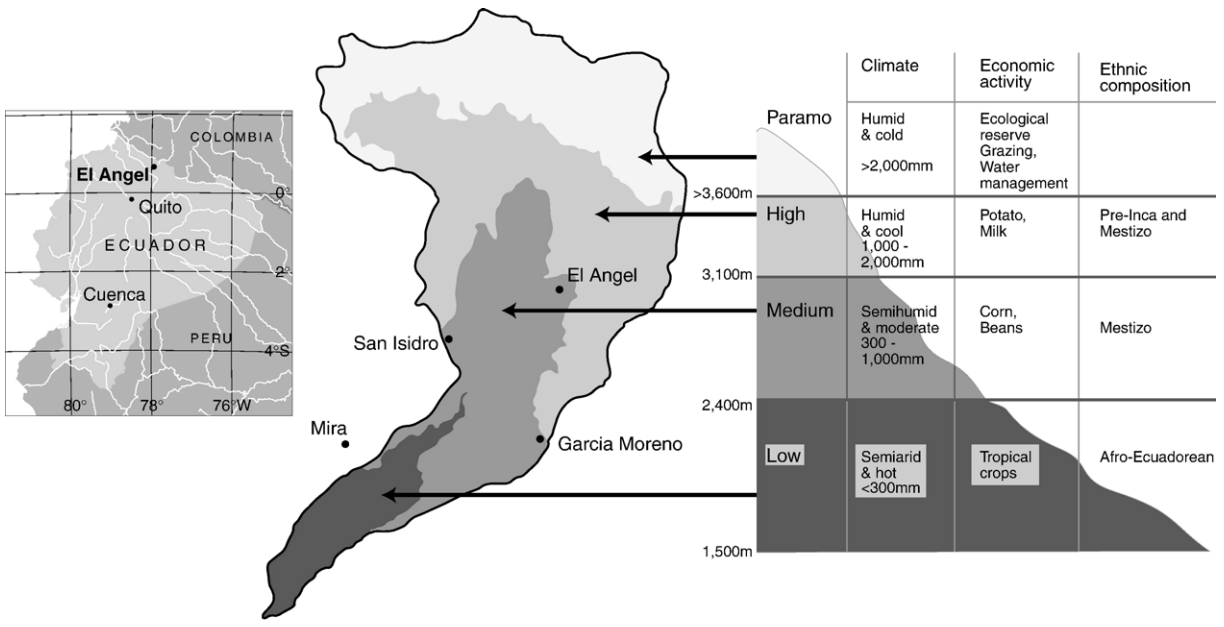

Fig. 1. The ecological zones of El Angel drainage basin, Carchi Province, Ecuador.