

LAND USE AND FLOOD RISK IN TROPICAL MOUNTAINS

THE CASE OF MOCOTIÉS VALLEY (STATE OF MERIDA, VENEZUELAN ANDES)

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In tropical countries, particularly in mountain areas, prevailing visions about natural hazard are dominated by two problems. On the one hand, one points to changes in land use and in agricultural and pastoral practices as the beginning of hydrological processes and the environment deterioration: soil depletion, superficial erosion, mass movements and catastrophic floods... Moreover, this research field receives a revival nowadays with the question of climate change.

On the other hand, the catastrophic dimension of some events might be the result of the great exposure, and so the great vulnerability of urban rather than rural societies. This vulnerability presents several dimensions, among which people poverty, poor sanitary state and ineffectiveness of country and town planning politics. The case of the catastrophic floods, which have affected the Mocotiès valley (Venezuelan Andes, Merida state) in February 2005 (more than 70 deaths), also called the vagada, or the tragedia del Mocotiès, gives the opportunity to return to these problems.

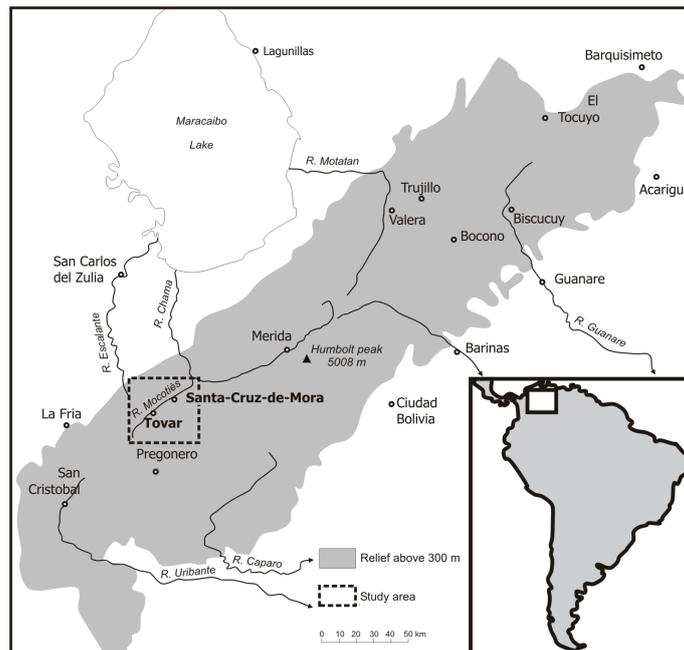


Fig. 1 The Venezuelan Andes and the study area

The Mocotiès valley is one of the main valleys in the Venezuelan Andes, located on the south-south-west Caribbean front of the range (Fig. 1). Mocotiès river, with about sixty kilometers in length, is the main tributary of the Chama river, which runs into the Maracaibo lake. The country is mainly rural

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but, in a context of an high increase of population, there are three urban centers: Santa-Cruz-de-Mora (650 m a.s.l., 8 000 inhabitants), Tovar (952 m a.s.l., 22 000 inhabitants) and Bailadores (1774 m a.s.l., 17 000 inhabitants).

Almost unanimously the causes of floods, which occurred in February 2005, were associated with changes in land use, particularly with the decline in coffee cultivation to pasture land. Roots of the pastoral are shorter than those of coffee, and therefore would set the soils with more difficulty. We believe that this assumption is simplistic. The severity of the disaster is more of an increase of social and physical vulnerability in recent years, which has added a bad crisis management by local and national authorities, rather than an exacerbation of the hazard by cultural practices.

So, at first, we will examine the part of changes occurred in agricultural practices on mountain slopes in the event of February 2005. Traditionally, and since the Spanish colonization in the 16th century, slopes of Venezuelan Andes have been used by tropical cultures at low altitudes (sugar cane, vegetables), coffee between 800 and 1500-1800 m a.s.l., wheat above 2000 m a.s.l., and potatoes up to 3800-4000 m a.s.l. Recently, this pattern has been modified in three ways. In the areas of coffee culture, shade species (cultivated under banana trees and other higher trees) have been replaced with more productive “sun” species. Thus, the slope soil is more exposed to pluvial erosion. Second, in the same areas, the crisis in coffee price would have resulted in replacement of cafetals (coffee plantations) by pastures. Third, we have witnessed the high development of irrigated truck farming between 2000 and 4000 m a.s.l. The hydrologic effect of these three cultural changes will be examined for the February 2005 flood in the small catchment area of quebrada Meija (Santa-Cruz-de-Mora), particularly by mapping and quantifying the recent evolution of land use by photo-interpretation (aerial photographs from 1952, 1966, 1972, 1996, 1987, 1989) and remote sensing (SPOT 5 monospectral images of 2,5 m resolution from the year 2008 and SPOT 5 multispectral images of 2,5 m resolution from the year 2011). We also have maps of land use that have been elaborated by geographers at the University of the Andes in Merida since 1950.

In a second step, we will question about the increase of social vulnerability in urban areas rather than in rural zones. We will examine at first the material or structural vulnerability, through the analysis of the built area evolution since 1952, in the quebrada Meija valley and in the Mocoties valley around Santa-Cruz-de-Mora. This work is based on field work, interviews and social surveys, and also on photo-interpretation and remote sensing. We will see that this process of urbanization and homebuilding has been huge in flood plains. We will also examine the period of five years after the disastrous flood of February 2005, during which the flooded zones have been reoccupied. It will be the opportunity to review protective- and flood control policies, as well as their implementation in a federal institutional system. Finally, social vulnerability will be approached by the risk perception of stakeholders (riverside people, elected representatives, administrators...). These two last parts are based on questionnaires.

Keywords: torrential flood, tropical mountains, land use, urban and land use planning, vulnerability