Land Use Management and Coping Behaviors with Climate Change: A Case Study of Southern Zambia

H. Miyazaki (RIHN), Y. Ishimoto (RIHN), M. Yamashita (Survey College of Kinki),
H. Shinjo (Kyoto Uni.), U. Tanaka (Kyoto Uni.)

Abstract

In the semi-arid tropics, variability in precipitation has dramatic impacts on crop production. Farmers must adopt various strategies to cope with food shortages. The purpose of this presentation is to examine land use management activities and coping strategies related to climate change in southern Zambia, an area that exhibits considerable climate variability.

We present findings from 3 study sites located along a topographic gradient in the Southern Province of Zambia where the annual rainfall is approximately 700 mm concentrated from November to April. The three sites are located in lower terrace, mid-escarpment and upper terrace topographic regimes, respectively. Rain fed maize is the predominant crop and is cultivated during the rainy season. To understand their land use management and coping behaviors, we developed a crop allocation map using a portable GPS to measure field boundaries for households during the rainy season of 2007/2008 and the dry season of 2008. We also collected data from farmers regarding crop diversity, fertilizer applications and other farming practices.

We found that individual farmers own fields dispersed across various topography conditions during the rainy season. In the lower terrace site, the ratio of area allocated to cotton was high compared with mid-escarpment and upper terrace locations. The upper terrace site has the most land allocated to gardens where vegetables are planted in the dry season. We discuss how these specific different management practices mitigate exposure to climate variability in the context of semi-arid tropic ecosystems.

An Agent-Based Model of Climate Variability, Land Use, Smallholder Resilience and Coping Behaviors in Rural Zambia

Tom Evans, (Indiana Uni)

Abstract

Rural livelihoods in many parts of the world are dramatically affected by climate variability and its corresponding impact on water availability and crop production. This is particularly the case in the semi-arid tropics (SAT), which contain 22% of the world's population and high concentrations of chronic poverty and inadequate food consumption. Much of the vulnerability of smallholders within the SAT is driven by surface hydrological dynamics; both directly through rainfall variability and indirectly through additional human- or climate-induced land and water degradation.

We explore social and biophysical disturbances affecting smallholders in rural Zambia, a location with chronic crop failures due to both flooding and drought. We use an agent-based model designed to analyze smallholder coping strategies in the context of climate variability. Spatially explicit household survey data are used to map the resilience of smallholders at local and regional scales of analysis (community to district levels). Coping behaviors are categorized into internal vs. external strategies. External strategies are those where the household is dependent on an external source including labor exchange, food aid or wage labor opportunities. Internal strategies are those that do not require some external source such as skipping meals or removing children from school to work in fields. This distinction is important as it relates to adaptive capacity of households to respond to climate variability in different social and biophysical conditions. Our results show that the use of internal vs. external strategies varies geographically and we discuss social and biophysical explanations for these differences.

Recovery of Agricultural Fields from the 2004 Tsunami in Nagapattinam District, Tamil Nadu, India

Takashi Kume (RIHN), Chieko Umetsu (RIHN) and K. Palanisami (IWMI)

Abstract

This research examined the recovery of agricultural fields from shocks associated with the 2004 tsunami disaster to address vulnerability and resilience in the coastal area of Nagapattinam district, Tamil Nadu, India. We analyzed the recovery of vegetation and groundwater in paddy agricultural fields after salinization associated with seawater inundation from the tsunami. Soil salinity steeply increased after the tsunami event, however, it returned to pre-tsunami levels in the following year. And groundwater salinity returned to pre-tsunami levels at one and a half years. MODIS NDVI values showed that damaged paddies recovered to pre-tsunami state by the next rice cropping season. These rapid rates of desalinization were due to monsoon rainfall leaching salt from the highly permeable soils in the area. The results show that the agricultural fields recovered from salinization effects to pre-tsunami levels within one and a half years. From these results, engineering resilience, which expressed as recovery time, of the system can be quantitatively defined one and a half years in this case. Although coastal areas in this region are vulnerable to damage from tsunami events and Nagapattinam district clearly suffered from exposure to a major tsunami event in 2004, agricultural fields in the area can be characterized as highly resilient to the shocks associated with the tsunami. In other words, although vulnerable to tsunami events, this system is relatively resilient because the magnitude of precipitation in this area enables relatively rapid recovery from the salinization consequences of seawater inundation.

Shock sensitivity, land use recovery and resilience: Lessons learned from the Indian Ocean tsunami victims in Tamil Nadu, India

Thamana Lekprichakul[1], Chieko Umetsu[1], K. Palanisami[2], M. Shathasheela[3], Takashi Kume[1]
[1] Research Institute for Humanity and Nature (RIHN), Kyoto, Japan
[2] IWMI-TATA Policy Research Program, International Water Management Institute (IWMI), Hyderabad, India
[3] Tamil Nadu Agricultural University, Coimbatore, India

This study investigates impacts of the Indian Ocean tsunami on incomes, land use and livelihoods of the affected farming households. The objectives of our study are to quantitatively determine the extent of income shock, livelihood recovery, and recovery paths and to identify factors that enhance farmers' resilience to the devastating impacts of the tsunami. To answer these research questions, we conduct three waves of socio-economic surveys on a panel of 200 farming households in Tamil Nadu, India and supplement the social surveys with a series of ground water and soil chemistry tests to determine whether the conditions of agricultural fields have recovered from the adverse changes brought on by the tsunami. A simple income growth model is used to empirically test various hypotheses. Our results indicate that, on average, households have lost as much as 30 percent of their income to tsunami. Although the ecological conditions of the agricultural fields have quickly returned to the pre-shock levels in slightly over a year after the tsunami, the recovery of the livelihoods lagged behind. Household incomes artificially appear to recover in the following year by relief funds provided by NGOs and governments and through the central government's community employment program. However, it took three years for the land use and livelihoods to recover albeit unevenly across income groups. Accesses to factor markets have played important roles in enhancing household resilience. Implications and lessons learned for future disaster relief interventions and rebuilding efforts are discussed.