Climate Change, Vulnerable Communities and Adaptation

LIVELIHOODS AND CLIMATE CHANGE

COMBINING DISASTER RISK REDUCTION, NATURAL RESOURCES MANAGEMENT AND CLIMATE CHANGE ADAPTATION TO REDUCE VULNERABILITY AND POVERTY

Information Paper 2 December 2003

Today's climate-related disasters foreshadow the likely adverse future impacts of climate change, signalling an urgent need to minimize current vulnerabilities. For poor communities living on fragile and degraded urban and rural lands, such as steep hillsides, drylands and floodplains, actions must address the deteriorating environmental conditions that undermine their livelihoods and capacity to cope with disasters. IUCN, IISD, SEI and Intercooperation are working together to strengthen the role of ecosystem management and restoration activities in reducing the vulnerability of poor communities to climate-related disasters and climate change. Protecting and enhancing natural services through activities such as watershed restoration, mangrove reforestation and rangeland rehabilitation, can help these communities secure their livelihoods and improve their capacity for adapting to the impacts of climate change.

In an effort to encourage the use of such activities and their integration into emerging policy frameworks, this series of Information Papers has been developed to highlight success stories from around the world. It is hoped that the lessons learned in these stories will inform ongoing and planned adaptation efforts.

IUCN The World Conservation Union
http://www.iucn.org

SEI Stockholm Environment Institute Boston Centre
http://www.sei.se

iisd International Institute for Sustainable Development / Institut international du développement durable
http://www.iisd.org

inter cooperation
Natural Resource Management
Rural Economy
Local Governance and Civil Society
http://www.intercooperation.ch

Increasing the Resilience of Tropical Hillside Communities through Forest Landscape Restoration

Vulnerability focus: Tropical hillside communities

Tropical hillsides in Latin America, Africa and Asia cover nine per cent (13 million km^2) of the world's landmass. Holding half of the world's tropical forests and 20 per cent of the world's fresh water, they represent important and diverse ecosystems.[1] With approximately 525 million people living and farming on these lands, tropical hillsides also represent an important basis for livelihoods. Hillsides are intrinsically fragile, however, and difficult to cultivate. Soil is easily eroded, which can limit the future productivity of the land, destabilize human settlements and negatively impact lowland areas through siltation and flooding. In fact, each year the world's tropical hillsides lose nearly 25,898 km^2 of tropical forests to deforestation and 13 billion tons of topsoil to erosion, exacerbating already vulnerable and unstable conditions.[2]

For the 40 per cent of hillside inhabitants who live in absolute poverty, such environmental degradation makes life even harder. The poor are often left with no choice but to settle on marginal lands situated on steeper, more remote hillsides. This geographic isolation and social and political marginalization, leave them with few employment opportunities and limited access to public services and institutional support. With deteriorating environmental conditions reducing the agricultural productivity of hillsides, communities are left cash poor and even more vulnerable to the impacts of external shocks such as floods, droughts and other climate-related disasters. Reducing the vulnerability of these communities therefore requires measures that generate income, promote livelihood security, halt erosion and deforestation, and restore hillside ecosystems.

Building resilience on hillsides: A Central American experience in forest landscape restoration

Background

Since 1992, PASOLAC (*Programa para la Agricultura Sostenible en las Laderas de América Central*) has been helping local communities in Nicaragua, Honduras and El Salvador to increase the agricultural productivity of their hillsides through improved soil and water management. Financed by the Swiss Development Cooperation (SDC), the regional program has been designed and implemented through a partnership arrangement between local organizations and Intercooperation.

Hillsides cover between 60 and 80 per cent of the continental territories of Nicaragua, Honduras and El Salvador. These areas represent the economic base for the majority of the rural population in Central America, as the bulk of basic grains, important export products (such as coffee) and various other agricultural goods come from hillside production. Unfortunately, these hillsides are also characterized by severe soil and landscape degradation. Due to an overall deterioration of watersheds, mainly attributed to deforestation, the absorbing capacity of exposed soils has been reduced, water infiltration rates have decreased, groundwater levels have lowered and springs have dried up. Water shortages during drier seasons and floods during extreme rainfalls are becoming more frequent. Droughts and floods have had severe impacts

[1] "Scientists and Farmers Are Revolutionizing Tropical Hillside Agriculture: Goals Are to Raise Incomes, Prevent Ecological Disasters." CGIAR and Future Harvest News Release, Sunday, October 24, 1999. Available at: http://www.worldbank.org/html/cgiar/press/hillside.pdf

[2] *Ibid*

Farmers sowing crops. Photo: PASOLAC

on hillside livelihoods through decreased agricultural productivity, yield losses, malnutrition and, in recent years, deaths from starvation, particularly among children.

The risk of droughts and floods will most likely increase as a result of climate change. While the El Niño Southern Oscillation (ENSO) is largely responsible for interannual variations in temperature and precipitation in Central America, climate change is likely to exacerbate El Niño's impacts, exposing the region to more weather extremes. In fact, local observations of climate conditions have supported IPCC projections of more frequent and prolonged drought periods, more irregular rainfall patterns, and more frequent and intense extreme rainfall events and hurricanes.

Due to the dependence on local production and the lack of resources and skills to face extreme events, hillside livelihoods are becoming increasingly vulnerable to the impacts of climate variability and climate change. Measures to reduce vulnerability and adapt to climate change should therefore include *inter alia* rehabilitation of degraded hillsides, diversification of production systems and building local capacities for more sustainable landscape management.

The program

PASOLAC offers technical, methodological and financial support to more than 50 member organizations that work with local farmers and communities on the hillsides to implement sustainable agriculture practices, particularly Sustainable Soil and Water Management (SSWM) techniques. The program is characterized by a participatory and demand-driven approach, which aims to build capacities and cooperation among member organizations and encourage long-term adoption of SSWM practices by the farmers. Through its "pilot actions," the program is also validating three innovative methodological approaches in carrying out its activities:

1. "*Invertir la Mirada*" (IM), ensuring the active involvement of farmers in the identification and specification of training demands in order to increase the efficiency and quality of technical assistance;
2. "*Pago por Servicios Ambientales*" (PSA), compensating farmers for the maintenance and management of natural resources and services (especially water) through cash or in-kind contributions; and
3. "*Mercados para Agricultores de Laderas*" (MERCASEL), aiming to insert rural production into the market.

To date, PASOLAC has achieved the following:

- establishment of a network of organizations working on sustainable agriculture and forestry (including agroforestry) on hillsides;
- validation and implementation of approximately 50 soil and water management techniques by farmers in all three countries;
- creation of a competitive fund that partially finances project activities that seek to implement SSWM at the farm and local community level; and
- design and application of tools for participative monitoring, validation and evaluation, as well as for knowledge transfer.

Contribution to vulnerability reduction and adaptation

Although the impacts of climate variability and climate change were not considered in its original program design, PASOLAC's focus on water and soil conservation clearly seeks to address problems that are accentuated by extreme climatic events, such as water scarcity during droughts and soil erosion during heavy rainfall. Since the frequency of these extreme climatic events is expected to increase with climate change, PASOLAC's activities are likely to reduce the vulnerability of people to these events and enable them to adapt to the changing climate.

In spite of a lack of baseline and project data, there are several project activities and results that provide evidence that the program is helping to reduce the vulnerability of local communities to droughts and heavy rainfall. Soil and water conservation, agricultural diversification, and improvement of soil fertility through organic fertilizers have proven to be effective against droughts. Also, there is evidence that soil and water conservation practices can increase the resistance of agroecosystems against heavy rainfall.

Vegetable crop stubble.
Photo: PASOLAC

Some concrete indicators demonstrating the increased ability of local livelihoods to adapt to climate hazards include:

- *Reduced water shortages:* A study measuring the water content in soil during 1993–97 demonstrated that water retention in the top 20 cm of the soil improved on average by three per cent, which is equivalent to 60,000 litres of water per hectare, or to six mm of rainfall.
- *Increased drought resistance:* In 2001, farmers of León (Chinandega, Nicaragua) lost their cornfields to drought. The only cornfield that produced a harvest belonged to a farmer who applied stubble and weed management techniques promoted by PASOLAC.
- *Restored water supplies:* One case has been documented, and at least five others have been reported, where water has started to flow again year-round after the construction of dams in streambeds that used to dry up during the dry season.
- *Increased resistance to heavy rainfall:* A study conducted on 16 basic beans-producing small farms (0.7–1.4 ha) in Nicaragua revealed that the loss of soil after three days of heavy rainfall was between 40 and 300 tons per farm, while those farms that had a dense vegetation cover did not suffer visible erosion damage. Similarly, a study conducted after Hurricane Mitch on 902 pairs of plots (one with SSWM and the other with traditional management) in 360 communities in Guatemala, Honduras and Nicaragua examined the impact of SSWM techniques on the incremental resistance of hillside agro-ecosystems to heavy rainfall, bringing the following results:
  - The fertile soil layer was 1.1–2.6 cm thicker in the plots treated with SSWM. This is equivalent to a conservation of 109–258 tons of soil per hectare.
  - Water in the soil was found 0.3–1.8 cm deeper in the parcels with traditional management. This difference is equivalent to 1,490–8,970 litres/ha.
  - The loss of topsoil (the most fertile part of the soil) due to erosion was 34 per cent higher in the traditional plots.
  - Rills and landslides were more frequent in plots not using SSWM.

Transferring PASOLAC's lessons to climate change adaptation

By improving the capacity of people living on hillsides to cope with droughts and heavy rainfall, PASOLAC is addressing problems that will be exacerbated by climate change and can therefore be qualified as an adaptation program (see Table 1). Lessons learned and methods developed by PASOLAC have a clear potential to contribute to the design and implementation of adaptation strategies in areas with similar social and ecological conditions and climate change scenarios. Some of the most important lessons have indicated a need for the following:

- An integrated approach combining improvements in human and social capital (*IM*) with advances in locally-adapted resource management techniques (SSWM) and the creation of financial instruments (*PSA*) for long-term forest landscape restoration/rehabilitation.
- A solid understanding of the needs and priorities of local communities. The PASOLAC experience has demonstrated that this emphasis on a human-based approach is one of the pillars for the acceptance of innovations and better practices.
- Familiarity with the main climate risks in the region and how they link to livelihood vulnerability/resilience. In the case of PASOLAC, the main climate-related livelihood issues were reduced crop yields due to drought, and soil erosion due to heavy rain.
- The development of a legal and institutional framework that promotes the rehabilitation of the forest landscape as an element to achieve sustainable livelihoods.
- Further linkages between the climate change adaptation, disaster risk reduction and natural resource management

Corn cultivation. Photo: PASOLAC

communities. Future applied research and project work should include: definition of vulnerabilities at the local level, baseline scenarios, risk analysis, development of monitoring procedures, databases on vulnerability indicators, as well as the identification of social strengths and weaknesses relevant to improving community resilience.

- Incorporating strategies that predict and manage extreme events into the design and implementation of measures that increase livelihood resilience.
- More applied research to evaluate the real potential of similar activities in other regions.

Table 1. PASOLAC's contribution to adaptation by activities

	Technique/method	Contribution to adaptation
Social organization	Payment for Environmental Services Invertir la mirada (IM)	The community is aware of the environmental significance of natural resources and is better organized and motivated to manage them in a sustainable way. Farmers receive payments for measures that improve infiltration rates and reduce runoff, erosion and contamination. Water availability and quality is expected to increase.
Living barrier	Forest landscape restoration and rehabilitation through agroforestry and plantation	Improved soil quality increases the resistance of cultivations to droughts. Agroforestry and small-scale plantations increase the resistance to heavy rainfall and erosion.
Agroforestry	Cultivation in alley Agroforestry with natural regeneration	Agroforestry systems can be less vulnerable to droughts. The tree component is often more resistant than other crops and contributes to the diversification of income opportunities, which reduces social vulnerability.
Water management	Construction of reservoirs Water collection from roofs Water storage systems Construction of pumps EMA Micro trickle irrigation systems Construction of dams	More water is available to humans and agriculture, which reduces their vulnerability to droughts. Water is used in a more sustainable way, reducing water losses.
Productive strategies	Crop rotation Agricultural diversification Living fences Reforestation and agroforestry	A diversified agriculture is less vulnerable to climatic extremes because income opportunities are diversified, and climatic risks are better distributed.
	Access to markets (MERCASEL)	Improved liquidity due to access to markets increases food security. Social vulnerability to extreme climatic events is reduced because basic needs can be better satisfied.
Coverage cultivation	Intercalated cultivation Associations Green fertilizers	More sustainable nutrient cycles are less vulnerable to additional stress factors from the environment, such as droughts.
Organic fertilizers	Earthworm cultivation Organic fertilizer Manure	Increased agricultural production and reduced dependence on artificial production means. This will also improve the financial performance of the system, which reduces social vulnerability.
Farming systems	Contour lines sowing No-fire, stubbles and weeds management Incorporation of stubbles and weed into the soil, no-fire Ecological plow	As many of the above techniques, maintaining and enhancing soil fertility and water availability reduces vulnerability to droughts. Contour lines sowing protects against erosion.

The IUCN Commission on Environmental, Economic and Social Policy
http://www.iucn.org/themes/ceesp/index.html

Funding for this series has been provided by
the Swiss Agency for Development and Cooperation (SDC) and
the IUCN Commission on Environmental, Economic and Social Policy (CEESP)

Swiss Agency for Development and Cooperation
http://www.sdc.admin.ch/