

Increasing the Resilience of Hillside Communities in Bolivia

Authors: Robledo, Carmenza, Fischler, Martin, and Patiño, Alberto

Source: Mountain Research and Development, 24(1) : 14-18

Published By: International Mountain Society

URL: [https://doi.org/10.1659/0276-4741\(2004\)024\[0014:ITROHC\]2.0.CO;2](https://doi.org/10.1659/0276-4741(2004)024[0014:ITROHC]2.0.CO;2)

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Carmenza Robledo
Martin Fischler
Alberto Patiño

Increasing the Resilience of Hillside Communities in Bolivia

Has Vulnerability to Climate Change Been Reduced as a Result of Previous Sustainable Development Cooperation?

14



Climate change scenarios predict impacts in Bolivia that include longer dry seasons and more frequent storms. Can the local population cope with these changes? How resilient are the social systems and local ecosystems? A case study prepared by Intercooperation (IC) for “Vulnerable Communities and Adaptation,” an IC/IISD/IUCN/SEI project on

Climate Change, investigated how Swiss development cooperation has helped reduce vulnerability to climate change in a community in the Altiplano of Bolivia. Regardless of considerations of climate change during planning and implementation of the project, one collateral benefit has been improvement in the resilience profile of the Khuluyo community.

Reducing vulnerability and increasing resilience

Climate change impacts natural and human systems, either directly or in synergy with other determinants, and alters the productivity, diversity and functions of many ecosystems and livelihoods around the world. The poor in mountain areas are particularly vulnerable to climate-related risks. Settlement on marginal or unstable lands such as steep slopes or floodplains increases their exposure to the impacts of climatic hazards. Heavy dependence on ecosystem products and services can put their welfare and survival at the mercy of environmental conditions. With limited capacities and resources at their disposal to respond to drought, landslides, and floods, their ability to meet basic needs and escape poverty is constrained (Figure 1). Climate change threatens to exacerbate these existing vulnerabilities and further entrench development disparities, with

the poorest of the poor standing to lose the most.

Increasing the capacity of poor communities to adapt to climate change first of all requires actions that target and reduce the vulnerabilities they currently face, allowing them to build more resilient and secure livelihoods. Given the reliance of the poor on ecosystem services for their livelihoods, a central element of this approach should be ecosystem management and restoration activities such as watershed rehabilitation, agroecology, and restoration of forest landscape. In fact, protecting and enhancing the natural services that support the livelihoods of vulnerable communities has the advantage of meeting immediate development needs while also contributing to longer-term capacity development that will create a basis for reducing future vulnerability. The case study presently under discussion investigated how a Swiss reforestation project in Khuluyo, Bolivia helped to increase the resilience of the local community.



FIGURE 1 Climate change constitutes a threat to poor rural mountain communities, whose livelihoods depend on productive ecosystems. (Photo by Carmenza Robledo)

Climate change and vulnerability in Bolivia

Modeling results using all 3 scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) allows a general assessment of potential impacts in Bolivia. In all scenarios, agricultural regions are affected by climate change. Some zones are more vulnerable than others. In the Altiplano, for example, a probable increase in temperature could be favorable for crop production if adaptation measures such as irrigation systems and improved cultural practices are put into place.

Studies on the vulnerability of water resources to climate change show important variations in runoff levels, depending on the national and global scenarios considered. In any case, impacts on water resources would increase vulnerability in many sectors such as agriculture and forestry, and also affect water consumption systems. Climate change directly and indirectly affects social systems in Bolivia. Extreme events such as extended dry periods or storms cause forest fires, floods and landslides. These in turn have an impact on health and affect the production of food and fodder, transport systems (damage to vital infrastructure), and delivery of forest goods and services. In addition to variations in climatic patterns, vulnerability in Bolivia is made more acute by the high level of poverty. In addition, local communities are dependent on monocultures.

The reforestation project in Khuluyo

The Swiss Agency for Development and Cooperation (SDC) began its activities in Bolivia in 1969. Several projects were implemented in agriculture and forestry for almost 2 decades, with an emphasis on improvement of quality seeds, sustainable land management, and erosion control. In this context 2 large forestry projects, the Programa de Repoblamiento Forestal (PROFOR) and the Plan Agroforestal Chuquisaca Norte y Centro (PLAFOR), were developed in the departments of Cochabamba and Chuquisaca, respectively.

Land degradation on the hillsides of the Khuluyo community, Department of

Cochabamba, results from high demand for agricultural land, pastures, and fuelwood. In addition to degradation of natural resources, vulnerability to climate change is heightened by the use of inappropriate agricultural practices such as burning, cultivation on steep slopes, heavy use of pesticides, overgrazing, etc. PROFOR was developed as a technical answer mainly to the local demand for fuelwood and wood for construction. When the project started 15 years ago, primary forest was non-existent on the hillsides. Local communities used existing young secondary forests in an uncontrolled way to satisfy their demand for fuelwood.

The objectives of extensive plantations in Khuluyo were two-fold: 1) to create a source of raw material for the timber industry, and 2) to promote soil conservation, recreation, and environmental protection. The main emphasis in PROFOR's approach was on communal forestry. Implementation of this approach included:

- Initial consultation with the community to explore interest in establishing tree plantations;
- Creation of a communal forest committee as a direct interlocutor with PROFOR;
- Establishment of contracts governing afforestation and forest use between communities or individual landowners and PROFOR, which defined the rights and responsibilities of both parties from the time of planting to the time of forest product use;
- Use of incentives for the establishment of tree plantations: initially these consisted of food rations (food-for-work approach), tools (picks) and tree seedlings. In moving to a more participatory approach, however, the program eliminated most of these incentives, except the provision of tree seedlings.
- Training and technical assistance in tree nurseries and planting, forest planning and management, and stabilization of steep hillsides prone to landslides.

The community resilience profile and climate change in Khuluyo

PROFOR did not consider climate change as a variable; hence there is no baseline that describes vulnerability or the adaptation

“For poor people, vulnerability is both a condition and a determinant of poverty, and refers to the (in)ability of people to avoid, cope with or recover from the harmful impacts of factors that disrupt their lives and that are beyond their immediate control. The resilience of poor people represents their ability to withstand the impact of the trends and shocks described above, absorbing them while maintaining function.” (IISD et al 2003)



FIGURE 2 Soil detachment resulting from *lluvias locas* ("crazy rains"), which now occur more frequently. It seems that afforestation has slowed down the process (see left). (Photo by Carmenza Robledo)

FIGURE 3 Afforestation is now meeting the demand for fuelwood and is also a source of livelihood enhancement, eg, through production of eucalyptus oil as depicted in this view of a plant run by a local association in the neighbor village of Larathi. (Photo by Carmenza Robledo)



capacity of local communities at the outset of the program. This made it difficult to define a resilience profile for the Khuluyo community before PROFOR began its activities. However, observations of the present impacts and vulnerability of neighboring

communities outside the PROFOR project area suggest that a resilience profile of the Khuluyo community would be characterized by: 1) a low level of community organization; 2) frequent human-induced fire to clear land for agriculture; and 3) gradual watershed degradation. Based on these specifications, the Khuluyo community would be highly vulnerable to variability or changes in climate conditions, especially changes in rain patterns.

Such changes have already taken place. The local community reports 2 major changes in climate patterns: a decrease in total annual rainfall, estimated at about 30-50%, and an expansion of the dry period. Due to the reduction in rainfall and the extended dry period, the community now depends on irrigation for timely sowing; the scarcity of water makes it very vulnerable. The community also reports more frequent storms or *lluvias locas* (crazy rains). These storms cause soil detachment on the hillsides and landslides, especially along creek beds (Figure 2). Settlements and agricultural land in the downstream area are very vulnerable to the effects of storms.

Owing to a lack of data, it is very difficult to prove the extent and origin of changes in climate patterns at the local level. However, the changes reported by members of the Khuluyo community are congruent with the results of modeling for this region, as presented in the first national communication of Bolivia and in other studies made by the Bolivian National Program on Climate Change (PNCC).

PROFOR's contribution to increasing community resilience

Increases in the resilience profile of the Khuluyo community can be summarized as follows:

- One of the most important impacts of PROFOR is stabilization of the hillsides. This has reduced soil detachment and landslides.
- Once the first plantations were fully established, *aliso* (*Alnus acuminata*) appeared naturally on the soil removed by landslides. With the support of PROFOR technicians, the Khuluyo community started to promote management and

TABLE 1 PROFOR's contribution to enhancing resilience in the Khuluyo community.

	PROFOR activity	Contribution to building local resilience
Strengthening community organization	<ul style="list-style-type: none"> • Creation of forest committees • Establishment of rules and responsibilities 	Improvement of the planning and negotiation skills of the Khuluyo community. Advances in ownership rights are especially significant for future projects aiming at adaptation and mitigation in the Khuluyo community.
Capacity building	<ul style="list-style-type: none"> • Tree planting and management... • ...with non-timber forest products (NTFPs) such as eucalyptus oil 	Improvement of local knowledge and skills that make it possible for the local community to have access to new products and sources of income. This has a dual function: it diversifies the basis for production while diminishing dependence on agricultural production, and increases the resilience of the local community in extended dry seasons.
Wind barriers	<ul style="list-style-type: none"> • Establishment of <i>cipreces</i> (<i>Cupressus macrocarpa</i>); • Introduction of <i>kiswara</i> (<i>Buddleja coriacea</i>) 	Increased resilience in local communities by: Reducing wind and water erosion during storms and protecting against morning frosts (<i>heladas</i>) Protecting agricultural crops during storms
Restoration of forest land	<ul style="list-style-type: none"> • Promotion of natural regeneration of <i>aliso</i> (<i>Alnus acuminata</i>) 	Improvement of the water cycle in the micro-watershed. This increases resilience during extended dry periods. Stabilization of hillsides reduces the vulnerability of settlements and agricultural land to soil detachment and landslides.
Plantations	<ul style="list-style-type: none"> • <i>Pinus radiata</i> • <i>Pinus patula</i> • <i>Pinus montesuma</i> • <i>Pinus pseudostrobus</i> • <i>Eucalyptus globulus</i> 	<p>Stabilization of soil and hillsides, reducing vulnerability to soil detachment and landslides caused by more frequent storms.</p> <p>Improvement of micro-climate (protection against extreme winds during storms and <i>heladas</i> during the dry and cold season).</p> <p>Reduced pressure on secondary forests in first succession phase, promoting succession and soil stabilization in areas with secondary forests.</p> <p>Diversification of the basis of production, helping to reduce dependence on agricultural production. This is especially important during extended dry periods, when the local community cannot plant agricultural crops according to the usual schedule.</p>

expansion of this important tree species that fixes nitrogen. Today a healthy *aliso* forest stand exists in the area.

- The Khuluyo community reduced the use of human-induced fires to clear land for agriculture. It promotes soil conservation on community land and succession processes in secondary forests.
- Today, timber and non-timber products (eg eucalyptus oil) are a supplementary source of income for the Khuluyo community (Figure 3), which traditionally depends on agricultural products. Timber revenues have allowed the community to acquire seed and fertilizers for

agricultural production. However, the sustainability of the plantations is not yet guaranteed, and the community needs more know-how and support to regenerate plantations, undertake thinning and forest harvesting, and transform timber products.

- In the neighboring community of Larathi, forest stands have been planted closer to the settlement. Villagers report an improvement in the microclimate and a reduction in morning frost (*heladas*).

As previously mentioned, tree plantations in the Khuluyo community helped to

FIGURE 4 Apart from stabilizing landslide-prone slopes, the PROFOR project led to community development, thus increasing the community's resilience. In the case of Khuluyo, women are now actively participating in the Reforestation Committee. (Photo by Carmenza Robledo)



FURTHER READING

This article is based on a case study prepared for *Vulnerable Communities and Adaptation*, an IC/IISD/IUCN/SEI project on Climate Change. The study will be available in early 2004, in Spanish and English.

IISD, IUCN, SEI-B [International Institute for Sustainable Development, IUCN-The World Conservation Union, Stockholm Environment Institute-Boston Center]. 2003. *Livelihoods and Climate Change: Combining Disaster Risk Reduction, Natural Resource Management and Climate Change Adaptation in a New Approach to the Reduction of Vulnerability and Poverty*. Winnipeg, Canada: IISD. Also available on the Internet at www.iisd.org/pdf/2003/natres_livelihoods_cc.pdf

AUTHORS

Carmenza Robledo
Intercooperation, Maulbeerstrasse 10,
3001 Berne, Switzerland.
Crobledo@intercooperation.ch

Carmenza Robledo works at the Swiss Federal Laboratories for Materials Testing and Research (EMPA)-Intercooperation. She has expertise in the areas of climate change and natural resource management.

Martin Fischler and Alberto Patiño
Programa Agua Tierra Campesina (ATICA), Cochabamba, Bolivia.
fischler@entelnet.bo

Martin Fischler is a forestry expert working as a special adviser with ATICA in Cochabamba.

Alberto Patiño is a forest technician at ATICA in Bolivia and has worked for the Programa de Repoblamiento Forestal (PROFOR).

reduce the pressure on other woody species in young secondary forest stands. Nevertheless, this does not mean that the area of secondary forests has increased. Neighboring communities that did not participate in PROFOR activities are still collecting fuelwood from these forest stands.

Even though PROFOR was not designed to consider climate change variables, the project has gradually increased the resilience of the Khuluyo community with respect to the negative impacts of variability and climate change mentioned above (Table 1). Finally, although climate change is considered a national priority in Bolivia, there is no institution or mechanism in place at the local level that considers the implementation of national policies and strategies.

Lessons learned

Analysis of PROFOR activities in Khuluyo reveals some interesting lessons:

- Measures aimed at promoting sustainable livelihoods through forestry activities can build resilience to climate impacts not only in forestry, but also in agriculture and watershed management, as well as settlement safety.
- The sustainable livelihoods approach makes it possible to work in an intersectoral and multidisciplinary way. This is important, as variability and change in the climate system affect many sectors at the same time (eg the scarcity of

water due to extended dry periods affects agricultural production as well as water supply and energy production).

- Countries need support to develop their institutional and legal frameworks further in order to implement programs and projects related to the UNFCCC adaptation strategy. This implies consideration of issues such as regulation of national laws at local level or local governance issues. Within such support programs, issues concerned with ownership rights to forest goods and services are of central importance.
- Social organization plays a definitive role by increasing resilience. Communities that are organized have better chances to negotiate with multiple actors (ie municipalities or intermediaries). Moreover, organized communities can plan actions for sustainable management of their natural resources, reducing their vulnerability and increasing resilience against climatic events (Figure 4).
- Finally, sustainable management of natural resources can play a decisive role in improving the resilience of local communities in developing countries. However, these communities lack skills, knowledge and the financial means to make sustainable management possible. Future development cooperation that considers climate change as an issue should include sustainable management of natural resources as a strategy to improve resilience in rural livelihoods.