8-2

Incentives for Soil Conservation in Peru

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Executive Summary

Soil erosion poses a serious threat to agricultural production in developing countries, especially in regions such as the Andes, where soil erosion is widespread and affects the livelihoods of farm households. Despite considerable program efforts to promote soil conservation practices among farm households, the uptake is often disappointing. Often these practices are not cost-efficient for the farm households. To counteract the lack of benefits, natural resource management programs intervene by providing households with direct incentives to promote soil conservation practices. The use of direct incentives is criticized, however, because farm households tend to abandon soil conservation practices once the program withdraws its assistance. The situation in the Andes is further complicated by the limited productivity of agriculture and by market failures. As a result, farm households have little interest in investing in agriculture. Although soil conservation practices have the potential to increase agricultural productivity, farm households cannot convert these benefits into income, and this situation explains farm households' resistance to these practices.

In this case study, the main stakeholders are the users of the land—that is, the farm households—and the society (represented by the government). Two government programs, PRONAMACHCS and MARENASS, are promoting soil conservation practices throughout the Andes. These programs are not sufficient, however, to guarantee sustainable natural resource management, and they should be supported with agricultural or development policies. Several policy options are being considered to improve rural livelihoods and promote natural resource protection.

Your assignment is to design a policy for natural resource protection in the Peruvian Andes, focusing on soil conservation in particular, within a rural development strategy.

Background

Agricultural production is essential for the livelihoods of many farm households in developing countries. Because these farm households often have limited means to increase production through artificial inputs, soil productivity determines potential crop production. Thus soil forms an essential input for the livelihoods of farm households in developing countries.

On-Site Impacts of Soil Erosion

When the rainfall intensity or irrigation rate exceeds the infiltration capacity of the soil on sloping farmland, the excess water runs off the land and three processes that affect agricultural production begin: water is lost; seeds and fertilizers may be lost as they are carried away by the runoff water; and soil erosion takes place. The first two processes have a direct negative effect on crop growth. The third process has a less visible effect on agricultural production but is nevertheless detrimental. Soil erosion decreases the productivity of the soil as soil fertility, soil depth, and water storage capacity are reduced and the soil structure is degraded. Soil erosion induced by inappropriate farming practices is thus considered a major constraint to agricultural development in developing countries, and consequently a constraint to rural development and poverty reduction (Ellis-Jones 1999). It is estimated that each year 75 billion metric tons of soil are removed from land worldwide by erosion, resulting in the destruction and abandonment of 12 million hectares of arable land annually, a loss that poses a threat to food security (Pimentel et al. 1995).

Off-Site Impacts of Soil Erosion

Soil erosion can also have serious off-site impacts if the eroded soil particles are carried off-site by overland water flows and deposited elsewhere. These off-site impacts include negative effects such as pollution of rivers, silting up of reservoirs, and muddy floods that damage properties and roads. Some of these negative off-site impacts impose a direct financial burden on society (for example, the cost of sediment removal from water reservoirs or roads), whereas other costs are less tangible and difficult to quantify. This difficulty with quantification especially applies to diffuse water pollution, which arises from many small sources in a catchment. Pollution caused by soil erosion on a single field might be negligible, but the total sum of pollution caused by soil erosion on all fields collectively can result in significant pollution of the water bodies in a catchment. Its control requires soil-

conserving land management practices at a catchment scale. Large-scale land degradation due to erosion can also be considered a cost to society, because less productive land is left for future generations.

Ecosystem Services Delivered by Soil

Besides prevention of off-site impacts caused by soil erosion, it is also in society's interest to combat soil erosion because of the ecosystem services provided by soil.[1] Soil erosion threatens a number of ecosystem services, such as carbon sequestration, nutrient cycling, water retention, food and fiber production at present and in the future, the amenity of well-managed soils and landscapes, and tourism (many tourists are attracted to the ancient terraces in the Andean landscape), and cultural identity (keeping a good relationship with Pacha Mama—Mother Earth—is an important part of the identity of the indigenous people in the Andes).

Soil Conservation Interventions

Soil erosion has been of interest to policy makers and nongovernmental organizations (NGOs) for decades. Soil conservation practices have been promoted to prevent soil erosion and maintain or improve soil productivity. Common soil conservation practices are agricultural terraces, reforestation, and improved soil management (for example, use of compost or cover crops). The results of soil conservation programs in developing countries are often discouraging, however, with limited uptake of soil conservation practices among farm households. Many economists argue that a major reason for the limited adoption of soil conservation practices is that they are not financially profitable for the farm households who should implement them: the investment costs are high, but the benefits are low, uncertain, and long term, as the effects on crop production of improving degraded land become apparent only after many years (Bunch 1999; Graaff 1996). To counteract the limited short-term benefits of soil conservation, governments and NGOs intervene by providing incentives to promote these practices. In many cases, however, farm households abandon soil conservation practices as soon as soil conservation programs withdraw their assistance and incentives (Bunch 1999). This situation raises the question of whether it would be more appropriate to develop a system of permanent support for farm households implementing soil conservation practices. But others argue that soil conservation practices should be encouraged only if they are financially profitable for farm households, without accompanying incentives (Bunch 1999; Giger 1999).

Rural Poverty in the Peruvian Andes

This case study is set in the southern Andes region of Peru. Peru can be divided into three main regions: the coast, the Andes, and the Amazon Basin. The arid coastal area along the Pacific Ocean makes up around 11 percent of the total territory but is home to more than half of the total population of Peru. The majority of the cities are situated in this coastal area, and this region's industrial activities are important for the national economy. The Andes cover a third of the Peruvian territory. Because of its limited accessibility, this region has few industrial activities. The largest part of Peruvian territory (58 percent) lies in the Amazon Basin, which is largely covered with humid rainforest and is sparsely populated.

Of the estimated total population of 28 million people, about half are considered poor and one-quarter are considered extremely poor. Large proportions of the poor (34 percent) and extremely poor (56 percent) are found in the rural area of the Andes (Table 1) (Escobal and Validivia 2004). These rural poor are mainly farm households that depend on subsistence farming and nonfarm activities such as seasonal migration and handicrafts.

The Peruvian Andes region has four characteristics that affect rural development (Tapia 1996):

- *Inaccessibility.* Because of the location, altitude, slope, and physical conditions of the Andean region, access to and within the region is difficult, resulting in isolation and limited mobility.
- *Fragility.* Areas with steep slopes and light soil formations are susceptible to degradation. Inappropriate management and overexploitation make natural resources even more vulnerable. Also, the economic structures (for example, markets and access to credit) are fragile.

[1] For more information on ecosystem functions and services, see Groot (2006).

Table 1: Proportion of Poor People in Peru (percentage)

Region	Poor (including extremely poor)	Extremely poor
Lima	34.1	2.8
Coast, urban	43.5	9.1
Coast, rural	62.2	24.6
Andes, urban	48.1	16.0
Andes, rural	81.2	57.4
Amazon Basin, urban	57.1	29.8
Amazon Basin, rural	71.3	43.3
Peru	53.5	23.4

Source: Escobal and Validivia 2004.

- *Marginality*. The region hardly benefits from investments in productive activities because of its isolation and remoteness.
- *Diversity*. The heterogeneity caused by altitude, climate, and geological conditions results in many diverse ecological zones and a huge diversity of plants and animals. This ecological heterogeneity determined the development of various agricultural systems, ranging from fallow systems to permanent cropping systems and from intensive to very extensive livestock production systems.

The Agricultural Sector in Peru

Agriculture was Peru's most productive sector until the 1940s. After World War II the government facilitated foreign investment in the mining industry to meet the increasing demand for minerals. Industrial production took off in the 1950s but was dependent on the growth of mineral exports. The increasing employment in the coastal cities stimulated the migration from the rural to the urban areas. Internal demand for agricultural products for urban consumption and agroindustrial use grew rapidly between 1950 and 1975, but export demand and rural markets for agricultural products grew slowly or not at all. As a result, Peru turned from a net exporter of agricultural products into a net importer in the 1980s and 1990s (Sheahan 2001). Thanks to the expansion of agricultural land and increased productivity, agricultural production and exports have increased since the mid-1990s. The increased agricultural production and exports consist mainly of crops such as coffee, asparagus, and mango, which are grown in the coastal region. Although the production and export of Andean crops such as potato, maize, and barley increased as well, Andean producers did not benefit, because the prices of these crops dropped drastically. Whereas the incomes of agricultural producers in the coastal region and the Amazon Basin have increased since the mid-1990s, the incomes of agricultural producers in the Andes have remained the same (Escobal and Validivia 2004).

The low productivity of agriculture in the Andes is mainly due to a lack of dynamic markets (Kervyn 1988). As migration has swelled the urban population, the large-scale, modern farms on the coast have increased their production to meet increasing urban demand. Additionally, the government started to import cheap food from neighboring countries to keep food prices low. The small-scale farmers in the Andes dropped out of the market because they lacked the capital, technology, and access to markets to be able to compete. Given their low productivity, high transportation costs, and high risks, it is not profitable for them to sell their products to urban markets.

The general sense about peasant economies in developing countries is that they are tied to the wider political economy. It is assumed that the peasantry provides not only cheap food to the urban economy, but also cheap labor. This notion of functional dualism does not apply, however, to the peasant economy of Peru. Most of the agricultural products of small-scale farmers in the Andes are traded in rural markets, not in urban markets. Barter is still common in the remote rural areas. The peasantry does not supply cheap labor to

coastal urban areas either, because these areas have sufficient labor available owing to previous high migration and in fact now have high unemployment. Niekerk (1994) depicted the rural economy in the Andes as a situation in which the peasantry limps along with low-productivity agriculture and seasonal migration to rural towns within the Andes.

Soil Conservation in the Andes

Soil erosion is considered among the most serious environmental problems throughout the Andes. It is assumed that 57 percent of the land in the Andes is affected by moderate to severe erosion (Felipe-Morales 1993), resulting in low agricultural productivity. Ironically, the Andes have a long history of terracing. Before the Spanish conquest in 1532, indigenous societies built terraces to support large populations. During the empire of the Incas (between 1250 and 1532), terracing was organized as part of a systematic policy of land improvement and food security. Inhabitants of the Inca Empire were compelled to pay taxes in the form of labor, which contributed to the construction of many terraces. These terraces facilitated agriculture on steep slopes and the modification of the microclimate in order to create favorable conditions for crops such as maize and tuber crops. It is estimated that 75 percent of these ancient terraces, especially the non-irrigated terraces, are now abandoned (Treacy 1998). The region's irregular rainfall makes labor and seed investment too risky given the low crop prices obtained, so agricultural land use has shifted from predominantly cultivation of crops toward mixed farming (livestock keeping and cultivation of crops). The resulting neglect and use of terraces to graze cattle and sheep lead to erosion and collapse of walls (Inbar and Llerena 2000). Attempts have been made to rehabilitate these terraces, but doing so is difficult because traditional materials and workmanship have changed, as has the indigenous society. In the Andean economy, crop production has gone from being the main activity to just one of many income strategies of farm households. Also, communities are now more fragmented and heterogeneous, with weakened traditional authorities and abandoned traditional systems of land management (Rodríguez and Nickalls 2002).

Nevertheless, soil conservation practices such as terraces are successful in reducing soil erosion and improving cropping conditions (Posthumus 2005). Once installed, terraces also result in significant labor savings if manual tillage is applied. Taking into account the investment costs, however, terraces are only profitable if farmers take advantage of the improved cropping conditions by growing a crop with a high commercial value or by increasing production by growing two crops a year. Despite the potential benefits of terraces, the desirability of these benefits for a farm household depends on the functioning of factor and output markets. Farm households are not motivated to install terraces when they cannot convert the potential benefits into cash because of a lack of markets for agricultural produce. Although farm households in the Andes depend on agricultural production for their food consumption, they rely on nonfarm activities to generate income for meeting their other consumption needs. Therefore, it is financially more profitable for a farm household to grow crops on eroding soil than to invest in soil conservation practices such as terraces (Yanggen et al. 2002). Motivating farm households to implement terraces requires attaching immediate benefits to them. Such benefits could be created by increasing the value of agricultural production on terraces, providing other incentives linked with soil conservation, or both.

Policy Issues

Use of Incentives in Natural Resource Management

Incentives are commonly used in natural resource management. The aim of sustainable natural resource management is to use natural resources in such a way that production is adequate for present needs (short-term private objective), ecosystem services are maintained (short-term social objective), and the productive capacity is maintained for future use (long-term social objective). These objectives can conflict when present use jeopardizes the future use of the natural resource, when private use limits public use, or the other way around. In the case of soil, present agricultural practices can induce soil erosion, jeopardizing future soil fertility and causing negative off-site impacts that impose costs on society. Incentives play a role in equating private and social objectives if they conflict. If interventions favor public use at the expense of private use, incentives can be used to fund the costs (for example, the investment costs of soil

conservation practices) to the private user (the farmer). If the private user benefits from the resource at a cost to society or to future use, however, disincentives like taxes or legislation might be more appropriate. In the first case, the beneficiary pays; in the second case, the polluter. The polluter-pays principle is mainly applied in developed countries (for example, through an eco-tax) and is considered inappropriate for developing countries, because subsistence farm households would not be able to afford these taxes. Furthermore, because of the diffuse nature of soil erosion, it can be difficult to trace the source of soil erosion that is causing negative off-site impacts.

Arguments against and in Favor of Using Incentives for Soil Conservation

Soil erosion is an externality of agriculture, meaning that the cost of soil erosion is not included in the price of agricultural produce. The implementation costs of soil conservation practices, however, are borne by the farmer. As already explained, the profitability of soil conservation practices for farm households is often limited because of the high investment costs. Soil conservation programs in developing countries often provide direct incentives (such as food, money, fertilizers, or tools) to resource-poor farm households to reduce or compensate for implementation costs. The use of incentives is often justified by the argument that subsistence farm households are too poor to make huge investments and that society benefits from these investments as well. The use of direct incentives, however, has been challenged because of unintended side-effects (Giger 1999). In some cases, farm households were more interested in the incentives than in the technologies. As a result, farm households did not develop ownership of the soil conservation practices and abandoned them as soon as the funding ended and the project withdrew its assistance. Furthermore, it is argued that the incentives create a paternalistic dependency that makes a farm household believe it is unable to implement soil conservation practices without external help (Bunch 1999). Soil conservation projects are also accused of using direct incentives to achieve quick results, without paying attention to long-term impact.

Payments for Environmental Services

More recently attention has been given to payments for environmental services (PES), as society realizes that ecosystems and the services they provide are under threat owing to increasing human pressure. This emerging scarcity makes these environmental services potentially subject to trade. Payment schemes and markets are now emerging for ecosystem services in order to reward the communities, often rural, that allow for the provision of these services. In developing countries there is an increasing interest in PES because it is hoped that these schemes will have a positive effect on poverty alleviation. Most PES schemes so far have been state run, focusing on catchment management or forest conservation. These PES schemes resemble the traditional public subsidy schemes for soil protection, but more emphasis is now put on monitoring the compliance of recipients of the payments. Although PES schemes are promising methods for making private and public use of natural resources consistent, implementing these schemes is difficult: defining the beneficiaries, determining the amount of payments, and establishing rules for compliance are difficult ethical issues in a rural development context. PES are seen as a reward to poor farm households who take care of the environment and "produce" environmental services. From an efficiency point of view, however, only those who constitute a threat to environmental services provision should be paid (Wunder 2005). Thus in some cases the rural poor do not benefit from PES at all.

Increasing the Value of Soil Conservation for Farm Households

In an ideal situation, soil conservation practices should be incentives in themselves by providing benefits to the farm household. Soil conservation practices should not be seen as a goal but be incorporated in the rural livelihood strategies and ecosystem services. At present, agricultural production is not generating enough income for farm households to meet their consumption needs. The commonly grown crops (potato, maize, and barley) have a low value because these crops are imported for low prices. Farm households would find terraces more financially attractive if they grew crops with a higher commercial value, such as fruits or herbs. Yet because of the high risk of crop failure (due to unreliable climate, pests, and diseases) and high transportation costs, agricultural production in the Andes is not competitive. Farm households are competitive in growing typical Andean crops such as quinoa, *tarwi*, *oca*, *ulluco*, and *maca*, but

marketing channels for these Andean crops are poorly developed.

Stakeholders

The main stakeholders in soil conservation are the users of the land (the farm households) and society. Furthermore there are many NGOs—large and small—that seek to improve rural livelihoods in the Andes. Some of these NGOs (such as Arariwa, Masal, and Cusichaca Trust) address soil conservation, but normally it is a minor component of their programs. For the purpose of this case study, two government programs are considered because these are the most prominent soil conservation projects in the southern Andes in Peru.

Farm Households

In the Andes, most farm households look for income opportunities besides agricultural production, because the revenues from agriculture are not sufficient to meet their consumption needs. About half of the net income of Peruvian farm households originates from activities other than farming (Escobal 2001). Nevertheless, agricultural production remains important for the farm household for food consumption. Farm households try to minimize variation in production, income, and expenditure—in other words, to minimize risk. Risks are taken (for instance, temporal migration to find off-farm employment) once the minimum income is assured (Kervyn 1988). Because the aim of agricultural production is mainly to meet minimum household consumption needs, Andean farm households are normally not very responsive to markets for agricultural produce. Instead of aiming for profit maximization in agriculture, farm households minimize the amount of labor allocated to agriculture (subject to the constraint of meeting the basic consumption needs) in order to pursue nonfarm income-generating activities. Nevertheless, the agricultural calendar dictates when labor is allocated to the different farming and nonfarming activities (Figueroa 1989).

Society

As already argued, society also has a stake in soil conservation that encourages the delivery of certain environmental services and reduces negative off-site impacts. Peruvian society is heterogeneous in terms of ethnic groups, culture, wealth, and political power (Sheahan 2001). Spanish descendents in the coastal region still control most of the country's wealth and political power, whereas indigenous Peruvians in the rural Andes make up the majority of the poor. The Gini coefficient for Peru is 0.498, indicating that income is unequally divided within the society (World Bank 2005). Causes of this inequality are, among other things, unequal access between urban and rural populations to education and the lack of economic and political attention to the indigenous people (Sheahan 2001).

Soil Conservation Programs in Peru

The two most important soil conservation programs in the Southern Andes are PRONAMACHCS (Programa Nacional de Manejo de Cuencas Hidrográficas y de Conservación de Suelos) and MARENASS (Manejo de Recursos Naturales en la Sierra Sur). Table 2 summarizes the main differences between these two programs.

The Peruvian government became increasingly aware of the problems with deforestation and soil erosion in the early 1980s. The government program PRONAMACHCS was launched in 1981 with the main objective of promoting sustainable management of natural resources in the Andes. PRONAMACHCS is the most important program promoting soil conservation practices like terraces, infiltration ditches, and reforestation. The program started with a food-for-work approach but now provides tools to farmers as an incentive for the implementation of soil conservation practices. According to PRONAMACHCS, lack of knowledge is the principal restriction stopping farmers from implementing soil conservation practices. Technology transfer is therefore considered to be the solution to promote soil conservation. By involving the farmers in the soil conservation activities, the program allows farmers to learn how to implement these practices and at the same time to observe the impacts. PRONAMACHCS organizes activities to implement soil conservation practices in a community once a week, under the direction of a technical engineer. In 2000 PRONAMACHCS worked in 866 watersheds in the Peruvian Andes and was estimated to reach 232,772 households. The area with soil conservation practices was estimated at 38,920 hectares, with the majority of this area consisting of terraces. PRONAMACHCS applies a top-down approach where the technical engineer is responsible for deciding on the type and location

Table 2: Main Distinguishing Features of PRONAMACHCS and MARENASS

Feature	PRONAMACHCS	MARENASS
Aim	Natural resource management, soil conservation	Improvement of rural livelihoods, soil conservation incorporated into technology package
Approach	Top-down	Grass-roots level
Duration of program	20 years	4 years
Level of intervention	Andes	Pilot project in southern Andes
Operation	Activities once a week, directed by technical staff	Frequency and type of activities decided by participants
Who decides on location and type of soil conservation practices	Technical staff	Participants
Extension	Knowledge transfer from technical staff to participants	Farmer-to-farmer extension, farm visits
Incentives	Tools for work	Farmer competitions, awards (money)

of soil conservation practices. This approach results in catchment management plans and widespread implementation of soil conservation practices, especially on degraded soils in the upper parts of the catchments. Because PRONAMACHCS takes the lead in implementation, some farm households develop little ownership of the soil conservation practices and abandon some of them.

In 1998 the Peruvian government launched the pilot program MARENASS. MARENASS works in a community over a four-year period. The program's main objective is to improve rural livelihoods by facilitating a range of activities such as improvement of grassland, soil conservation, house improvement, horticulture, construction of sanitary facilities, animal breeding, construction of corrals, production of handicrafts, public works at the community level, and improvement of community dynamics. The distinctive feature of the program is its participatory, demand-driven approach. Farmer competitions are organized to motivate participants to undertake new activities. At the community level, farm households compete in their performance and uptake of new practices. At district level, communities compete against each other as well. Cash awards can be won at each competition. The knowledge about new technologies is transferred through farmer-to-farmer extension methods and is driven by community demand. In total, MARENASS has worked in 360 communities, reaching about 33,000 households (Zutter 2004). Farm households also decide themselves on the type and location of soil conservation practices they will implement, if any. Although this approach has resulted in an increased sense of ownership of the soil conservation practices among farm households, implementation has been limited and terraces have been installed solely on the more productive soils, in order to intensify agricultural production,

rather than preventing soil erosion in the catchments. The program's impact on controlling soil erosion is therefore disputable.

Policy Options

Although programs are important instruments in the initial adoption of soil conservation practices, whether farm households continue to use these practices is influenced by market and policy-related factors. A farm household will only implement and maintain soil conservation practices if it provides sufficient permanent benefits. This section presents several policy measures to promote soil conservation representing different views on the issue of soil erosion and rural poverty in the Andes. These measures are not exclusive and could be combined into a national policy for natural resource management.

Policy Measure 1: Empowerment of Farm Households through Participatory Approaches

Past soil conservation programs have seen farm households as part of the problem rather than the solution. Knowledge transfer was considered to be the solution to persuade ignorant farm households to adopt the "right" technologies developed on experimental farms. If these approaches failed to consider the needs and priorities of farm households, however, a lack of ownership became an important constraining factor for continued adoption of soil conservation practices. Participatory approaches such as MARENASS aim to address the problems and interests of farm households rather than imposing the program objectives on participants. Participatory programs encourage farm households to take charge of solving their problems. Active farmer participation is central to this approach, and indigenous knowledge, experimentation, and adaptation are seen as crucial to developing appropriate practices that address farm households' needs and conserve natural resources in a way that is compatible with their farming systems (Kessler 2006). Soil conservation might receive less attention in participatory programs, however, because other more urgent needs of farm households (such as access to education, health care, or credit) are likely to be prioritized.

Policy Measure 2: Provide Permanent Support for Soil Conservation

Achieving the full benefits of soil conservation interventions often takes longer than the lifespan of a soil conservation project. Therefore, a soil conservation project should be embedded in an ongoing national or regional program that facilitates the maintenance and implementation of soil conservation practices after project closure (Bodnár 2005; Kessler 2006). For example, large numbers of terraces were constructed during the Inca Empire in order to enhance the government policy of food security. Because terracing was considered important for the sustenance of society, inhabitants were forced to supply labor for a limited period as a national service. Likewise, if a current society (or government) prioritizes soil conservation in national development plans, a permanent support system should be developed to promote soil conservation. The national program PRONAMACHCS could be continued and improved, whereby terracing would be considered a form of public work (like road construction), carried out by farm households but paid for by the government. Permanent government support for soil conservation is controversial, however, as soil conservation practices are implemented on private or communal land and not everyone will have access to or directly benefit from it (in contrast to roads).

Policy Measure 3: Payments for Environmental Services

As discussed earlier, there is an increasing interest in using PES schemes in natural resource management. Compensation for environmental services revalues the role of rural spaces and communities within society. PES are based on the principle that people who benefit from environmental services should compensate those who make it possible to generate these services. Subsidies or transfer payments (the transfer of funds between buyer and seller through intermediaries) can be given to the provider of environmental services as remuneration for specific actions or practices. Implementation of these schemes, however, is not always straightforward. It is difficult to quantify the services provided and their value in monetary terms for beneficiaries. Furthermore, ensuring that the money is spent properly on environmental stewardship can be even more difficult (Wunder 2005). In the case of soil erosion, negative off-site impacts will be

prevented only if the majority of the land users in the catchment apply soil conservation practices. Even then, soil erosion might still occur owing to natural events that are beyond human control (such as extreme rainfall).

Policy Measure 4: Improvement of Infrastructure

Improvement of infrastructure is a vital component in the development of remote rural areas. Infrastructure investment can reduce transaction costs and improve market integration, which facilitates rural development (Escobal 2005). Improved access to markets for food crops can stimulate farmers to invest more in agriculture in order to increase this production. Investment in soil conservation practices such as terraces becomes financially attractive when these terraces enable the production of cash crops on sloping or marginal land. Adoption of such practices is only likely to happen, however, when agriculture is the main livelihood strategy for farm households. Improved infrastructure would also improve access to off-farm labor markets, and in this case, farm households would turn to off-farm activities and seasonal migration as their main livelihood strategies and decrease their investments of labor and capital in agriculture. The incentive to invest in soil conservation thus declines as farm households' dependence on agriculture for their livelihoods decreases (Posthumus 2005).

Policy Measure 5: Promotion of Andean Crops

Another way to improve market integration and enhance agricultural production is by promoting the consumption and export of typical Andean crops. This strategy would require investments in the entire food chain but would improve the economic position of farm households in the Andes. The marketing of Andean crops could be strengthened by incorporating environmental attributes, such as soil conservation, into the production process through certification. Certification and labeling of agricultural products is another compensation mechanism to reward environmental services (see policy measure 3). This mechanism assumes that consumers are willing to pay more for products using environmentally friendly production processes (Rosa et al. 2003). Vertical marketing systems in particular (in contrast to conventional market channels) are likely to be beneficial for soil conservation. Vertical market channels are coordinated systems where members aim at common goals in order to achieve greater efficiency and effectiveness in market functions such as those related to improving quality, marketing high-quality products, delivering services, branding, and increasing market power. Vertical marketing systems stimulate long-term planning horizons for farm households, allowing stable market relationships and a higher commitment to soil conservation. Coordination of marketing functions makes vertical marketing systems more able to stimulate and maintain a common marketing policy, which is particularly important for the production and marketing of environmentally friendly products (Castaño 2001). In such a system, agricultural products can be promoted (among consumers as well as producers) as having limited environmental externalities, such as soil erosion.

Assignment

Your assignment is to design a policy for natural resource protection in the Peruvian Andes, focusing on soil conservation in particular, within a rural development strategy.

Additional Readings

All recommended readings are available on the Internet.

On Rural Livelihoods in the Andes

Bebbington, A. 1999. Capitals and capabilities: A framework for analyzing peasant viability, rural livelihoods, and poverty. *World Development* 27 (12): 2021–2044.

On Economic Aspects of Soil Erosion

Knowler, D. J. 2004. The economics of soil productivity: Local, national, and global perspectives. *Land Degradation and Development* 15 (6): 543–561.

On Using Direct Incentives for Soil Conservation

Giger, M. 1999. *Avoiding the shortcut: Moving beyond the use of direct incentives.* Development and Environment Report No. 17. Berne, Switzerland: Centre for Development and Environment.

On Payments for Environmental Services Schemes

Rosa, H., S. Kandel, and L. Dimar. 2003. *Compensation for environmental services and rural communities: Lessons from Americas and key issues for strengthening community strategies.* San Salvador, El Salvador: Programa Salvadoreño de Investigación sobre Desarrollo y Medio Ambiente.

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