ASISTENCIA A LOS PAÍSES ANDINOS EN LA REDUCCIÓN DE RIESGOS Y DESASTRES EN EL SECTOR AGROPECUARIO

POLICY BRIEF 3. RESILIENCE OF NATURAL RESOURCES & CLIMATE CHANGE

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How can the resilience of the natural resource base be strengthened in order to ensure food security and enhance rural livelihoods in the context of the challenges arising from climate change?

In the context of the current climate change, both food security and the resilience of rural livelihoods can be enhanced by adopting regenerative and low-input agricultural practices which substantially increase yields, even in currently unimproved or degraded areas, while at the same time are able to protect and even regenerate the environment. The best practices described demonstrate that the crucial issue is related to the need for strengthening (or creating) formal and informal institutions, regulating markets, and enacting the policies that condition the incentives offered to farmers and their capacities to use those technologies.

These current practices, however, which are based on the belief that the best way to both protect the natural environment and to guarantee the resilience of the farmer livelihood strategies, is to keep farmers managing their farms, contrasts with the simplistic ideas of separating people from the environment which were formerly predominant. Therefore, to correctly manage the existing agro-ecosystems under current CC conditions, it is necessary to create the policy and institutional conditions for the permanence of these small farmers in the high tropical Andes. Besides promoting some needed structural changes at the national or regional level, the implementation of some policy interventions (e.g. agricultural extension, economic incentives, and strengthening rural production organizations) are crucial also at the local level.

Climate change is increasing inter-annual rainfall variability and the frequency of extreme events, leading to accelerated rates of degradation of soil and water resources upon which farming communities depend for their livelihoods. Worse, climate change is also interacting with a number of 'structural' and/or 'policy-induced' factors (such as non-appropriate macroeconomic policies, population growth, rural poverty, rural-urban migration, etc.) which not only limits the possibility of equitable economic growth and compromises the sustainability of the poor rural farmers´ livelihoods, but also enhances the environment deterioration.

In many Andean rural landscapes, where access to inputs like fertilizer is limited, farming households and communities have to meet their food demands through either the agricultural frontier to marginal and vulnerable lands (so-called '***agriculture extensification***'), or by adopting '***unsustainable farming intensification***' practices which lead to an increased environmental deterioration.

The challenge, therefore, is to adopt a win-win policy strategy creating incentives for the adoption of natural resource management cum agricultural practices which might be not only economically and environmentally sustainable, but socially sustainable (i.e. poor-friendly) as well.

Sustainable and unsustainable agricultural systems

How to compare agricultural systems? How to know if a modern regenerative and low-input agriculture is superior to a conventional agriculture practice?

Sustainability is usually the criterion, although it is a complex and contested concept. To some it implies the persistence and capacity of a practice (e.g. an agricultural technology) to continue for a long time. To others it implies not damaging or degrading natural resources (i.e. environmental sustainability).

Having both meanings in mind, the point we want to stress here is that by adopting regenerative and low-input agricultural practices substantial increases in yield are possible, even in currently unimproved or degraded areas, whist at the same time protecting or even regenerating the environment. Appropriate technologies for sustainable agricultural intensification are already available. The crucial issues are basically related to the need for strengthening (or creating) formal and informal institutions, regulating markets, and enacting the policies that condition the incentives offered to farmers and their capacities to use those technologies.

Given this renewed institutional context, the adoption of sustainable agriculture intensification practices is possible. Following Reardon et al (1999), sustainable agricultural intensification is here defined by two criteria: (i) environmental: the that technology protects and enhances the farm natural resource base, maintaining or improving land productivity; and (ii) socio-economic: the technology that helps the farmer achieve his/her production goals (e.g. food consumption and/or market-oriented agricultural production incomes). In most cases, satisfying these two criteria requires 'capital-led intensification', based on substantial use of non-labour inputs that enhance soil fertility (such as inorganic and organic fertilisers), and land and water conservation infrastructure increasing labour productivity (e.g. grass strips, anti-erosion ditches, hedgerows, bunds, and terraces). By contrast, unsustainable intensification processes occurs when the farmer basically depends on non-qualified labour and/or increasing the use of natural resources to extend the production process. The point is that any increase in non-qualified labour use should be channelled towards increasing labour productivity, otherwise it will go towards either increase natural resource use (e.g. deforestation) or towards unsustainable labour intensification (Reardon et al 1999).

Sustainable agricultural technologies suppose a thorough incorporation of natural processes such as nutrient cycling, nitrogen fixation, and pest-predator relationships into agricultural production processes, so ensuring profitable and efficient food production, and reducing the use of external and non-renewable inputs which may damage the environment or harm the health of farmers and consumers. The goal is to minimize costs, and allowing for greater productive use of local knowledge and practices in order to ensure the long-term sustainability of current production levels.

If this is complemented by an increased diversity of productive activities by the household, not only farm incomes may be increased, but also the impact of production practices on the environment may be reduced (Röling et al 1998).

The pre-condition for the adoption of these appropriate sustainable intensification technologies is the previous need to develop local institutional arrangements that encourage local farmers to abandon their former unproductive and non-sustainable agriculture systems. The end result should be, however, to strengthen the livelihood conditions of the rural populations.

Why NRM must be environmentally sustainable?

Between 1980 and 2005, most conservation policies and strategies of governments were founded on the simplistic idea of separating people from their environments. Vast areas of the tropics were declared protected areas for conserving biodiversity and ecosystem services, often without corresponding increases in resources or capacity building for management. Moreover, some of these state land areas, in fact mono-crop plantations labelled as forests, were assumed to be rich in environmental services without carefully considering if this was really the case (Lebel and Daniel 2009).

In our view, to be regarded as '**environmentally sustainable',** agricultural practices must maintain and/or enhance the productive and regenerative capacity of their natural resource base, including practices which --besides guaranteeing the resilience of the farmer livelihood strategies-- end up protecting water-recharging zones, preventing erosion, facilitating the absorption of precipitation in the soil, retaining humidity, and increasing biodiversity.

It is true that some modern agricultural technologies have led to global improvements in agricultural production, although some these current modern technologies have also created havoc in most natural ecosystems. Yet, in regions such as those of the tropical Andes in particular, large numbers of small poor farmers have not been able to take advantage from most of the alleged positive aspects of these technologies.

Therefore, to improve these farmers´ livelihoods, there is an urgent need for developing alternative approaches that might intensify production, while conserving the natural resource base, maintaining biodiversity and keeping alive valuable traditional knowledge and practices.

Agro-ecology is one of these possible approaches. Agro-ecology according to FAO´s definition is:

> "the application of ecological concepts and principles to the design and management of sustainable agro-ecosystems (…) Agro-ecology has emerged as a scientific discipline, with a conceptual framework and defined methodology for the holistic study of agro-ecosystems, including human and environmental elements, and the provision of principles for the design and management of sustainable agriculture and food systems." (ftp://ftp.fao.org/SD/SDA/SDAR/sard/SARD-agroecology%20-%20english.pdf

Promoting and adopting environmentally sustainable agricultural practices is, thus, a critical component of any strategy to combat both poverty and ecosystem degradation. The goal, therefore, should not be a one-sided conservationist approach, attempting a return to a void wilderness that probably never existed, but to correctly manage the currently existing agro-ecosystems, so they can provide both for the livelihoods of their rural populations, while safeguarding their basic environmental services.

In the tropical Andes people should not leave their farms. Just the contrary, small farmers are needed in these regions, so that they can manage through their farms and other productive strategies the natural resource base. Furthermore, as climate change decreases the resilience of this natural resource base, appropriate human interventions are required de rigueur to ensure that these natural ecosystems and agro-ecosystems continue providing environmental services.

Why NRM must be economically sustainable?

Agricultural practices, to be regarded as economically sustainable, must provide for the current livelihood strategies of these farmers, reduce their vulnerability and strengthen their own livelihood strategies.

In rural poor communities and vulnerable mountain landscapes, as in most the tropical Andes, sustainable farming practices are those which reduce the farmers´ vulnerability and strengthen their own livelihood strategies, both meeting their nutritional needs and enhancing the productive and regenerative capacity of their natural resource base. But, how is it possible to design and implement these practices?

We must first understand the small farmers´ specific rationale. The two basic goals of a typical Andean smallholder farmer are: first, avoiding survival risks through the production of household-oriented foods; and, secondly, raising additional incomes via the production of marketable surpluses. The economic incentives (and disincentives) that these small farmers have to face --via the customary operation of markets or through the intended (and/or unintended) results of public policy interventions-- are also part of the equation.

Although, given the customary ways both markets and policies work in most Andean rural territories, some farmers have to adopt agricultural practices that often result in environmental degradation. The challenge is thus to understand the factors and processes causing the adoption of these environmentally unsustainable practices in order to design and implement mechanisms (policies and institutions) that will provide these farmers with the economic incentives to adopt sustainable natural resource use and management practices.

One possibility is that farmers end up adopting unsustainable practices either because this is their only viable solution, depending on their access to natural resources and other productive assets (e.g, financial capital, unskilled and skilled labour, etc) and markets, or because they are not fully knowledgeable (or aware) of the long-term consequences of their decisions.

The other possibility is to provide farmers with the appropriate incentives so they might adopt sustainable economic practices to increase the productivity of their own labour, and/or to pay salaries that might compete with other environmentally harmful options (such as mining or illegal drug-related activities).

Policy design for a double environmentally and economically sustainable strategy

Business as usual is no longer a viable option. At the small farm household level, food security and income generation will deteriorate further, unless public policies (at different levels) are designed and implemented to stabilize rural populations, conserve aquifers and soils, and restrain the use of current non-appropriate industrial inputs to increase yields. In relation to sustainable agricultural practices, common policy goals, therefore, become:

1. To increase food production, while minimising the negative impacts of modern industrial technologies

2. To develop and improve low-cost farming practices and technologies particularly adapted to these small farmers´ environments, so that they become able not only to increase their local food production, but also to generate incomes by producing profitable marketable surpluses

3. To provide farmers with knowledge about a basket of options to optimise their production systems, as well as improving their livelihoods on a sustainable basis

To increase financial funding for bottom-up farmer agricultural research & development, as well as extension services that combines the benefits of modern science with those of appropriate traditional knowledge and practices through demonstration farmer to farmer and farmer field school type of orientation.

Policy Implementation

On-farm research and training approaches to knowledge and practices

Adapting current participatory research-and-knowledge approaches to the local environments of these Andean farmers is a must. Two new approaches seem particularly relevant: the 'farmer first' and the 'farmer-to-farmer approach'.

The basic rationale of the 'farmer field' approach (so-called in Spanish *Escuelas de campo*) is that much of the problem with the adoption of non-sustainable agricultural practices by small farmers lies with the processes of generating and transferring technologies traditionally adopted by agricultural extension programmes, and that much of the solution lies within the farmers´ own capacities and participation in the research and training processes.

The *Yapuchiris* of the Bolivian Andean highlands, illustrated by UNAPA´s (the Unión de Asociaciones de Productores del Altiplano) case study, is an excellent example of how a "farmer-to-farmer" approach contributes to the basic idea behind the farmer first approach. The *Yapuchiri* is, in fact, a highly-respected local farmer whose basic goal is to interpret the signals emitted by biological and climatic indicators to the rest of the community, helping them to design their own early warning systems and productive strategies. Yet the key lesson here is how the knowledge and practices developed through generations by the farmers themselves are reinterpreted by the *Yapuchiris* to respond to the current local conditions, thus helping farmers to optimise their production systems. The dilemma remains as to whether this service should be paid and/or whether such payments carry risks with them that will boicot the very role Yapuchiris can play.

Lessons Learned

- **Reorientation of agricultural research systems.** Focusing on improving the local crops and animals that poor farmers use, such as cassava, potatoes, and indigenous livestock breeds
- **Reorientation of agricultural extension systems.** A shift is needed from top-down agricultural research and extension to bottom-up participatory approaches that promote local innovations and target the complexity of local environments where the small and poor Andean farmers live, using demonstration based methodologies.
- **Scaling-up.** Diversifying livelihood and strengthening producer organizations leading to their increased participating in governance

Strengthening rural producer organisations

The cornerstone of producer organisations is their capacity to empower farmers enabling them to enhance not only their livelihood strategies (at both the individual household and aggregated collective levels); but even to help them participate with a strong collective voice in the whole community public policy decision-making.

The key for sustainable collective action within producer organisations is their ability to develop a shared understanding for co-operation based on inter-personal trust.

Depending on local conditions, small farmers build-up producer organisations with different goals in mind: input and product market cooperatives, participatory mechanisms for the management of natural resources (e.g. a watershed, a commonly-owned forest, etc), or even as a lobby to attain some privileges from local or national governments.

Market-oriented organisations, whether they refer themselves as coops or not, help small farmers generate scale effects and develop market power vis-à-vis other agents in the marketplace, by the sheer weight created by increasing the numbers of people acting in similar ways. Cooperation, thus, strengthens the already existing entrepreneurship capacity of individual farmers, helping them to access in much better conditions to dynamic markets. On time they may also lead to create networks with other producer organisations, helping them not only to protect their incomes but also to diversity their productive and service activities reducing their vulnerability and raising their economic returns.

As mentioned before, the final result might be not only to economically empower these small farmers but make them fully-fledged members of governance institutions at the local level and even beyond. An enhanced participation by small farmers in public decision-making which would be expected to lead not only to better designed projects, better targeted benefits, and more equitably distributed project benefits with less public corruption and other rent-seeking activity.

Potato crop cultivation in taqanas and canchones fields in Bolivia

Context

The case study that supports this good practice is the community of Jacho Suyu Pakajaqi in the province of Pajaces at the department of La Paz, Bolivia. In the Bolivian highlands, each year communities have to face three major environmental risks: drought, soil erosion due to heavy rains, and frost. Hail used to be an additional problem; however, its occurrence has been escalating. Climate change is not considered to be the causal factor of these phenomena, although their frequency and magnitude are greater than ever. This has a negative impact on the community, which often leads to food insecurity.

Description

Potato cultivation in *taqanas* and *canchones* are traditional practices which date back to the pre-Inca period of Tiwanajotas (750-1200 AD). The *taqana* is a growing practice aimed at adaptation to steep slopes, in which embankments are built to protect soils from erosion. By placing rocks and digging furrows along the side of the slope, it is possible to recreate small terraces with arable areas of 2-5 square meters. *Taqanas* differ from large-scale terraces in their irregular distribution on the slope.

In *taqanas*, potato production is subject to crop rotation every 15 years. After each harvest, farmers "wrap the ground to take care of it", i.e. cornering the floor to the wall of rocks so that the rain does not erode it. *Taqanas* lessen erosion and, at the same time, they make possible the absorption of rainfall and soil moisture retention, resulting in higher yields.

Canchones, on the other hand, are slots enclosed by mud walls which are built close to the house. In these small areas, kitchen leftovers and livestock waste are deposited alternating periods of fertilizing and rest. In a typical *canchón*, the ground is used as stockyard for about four years, then it lies fallow through the fifth year, and potato is grown during the sixth year. Along with proper hilling, the aim of this practice is to increase crop resistance to stress caused either by frost or as a result of fertilization.

The role of two major local institutions is worth mentioning: family and community. On the one hand, families pass on knowledge about seeds and their cultivation from generation to generation. As a result, the use of more than twenty varieties of potato in the *taqanas* performs important functions for the protection of genetic biodiversity: it prevents losses resulting from weather disasters and controls weeds, pests and diseases. On the other hand, the organization of farmers in communities also plays an important role as most of the tasks required for soil preparation would be virtually impossible to carry out individually. Both institutions contribute to the development of a food production system that takes into account the sustainability of soil while mitigating weather impact and reducing the vulnerability of potato crops. All of these ensure food security of households in the community.

Lessons Learned

The survival of these practices demonstrates their resilience and their effectiveness as strategies to mitigate weather impact inherent to the climate of the Andean highlands. The ways in which the community articulates its social organization set up the conditions for proper and informed management of natural resources. Existing institutions have proven to be suitable vehicles for the transmission of environmental awareness to future generations, as evidenced by the fact that various civilizations (beginning with the Tiwanakotas, the Omasuyos, the Incas and, currently, the Aymaras) have made use of *taqanas* for more than 1,000 years.

It is remarkable how the knowledge of these risk management practices is based solely on the way the community is structured. That is to say that these practices would not be inherited if the community had a different organization. The structure of the community and ancestral practices are mutually reinforcing. This shows that institutional strengthening, risk mitigation practices and improved production methods should be promoted simultaneously, providing an interdisciplinary solution to the problem.

Policy Lessons

- **Adapting traditional agricultural practices to the current livelihood strategies and conditions of small farmers in the tropical Andean region**. Small, and often resource-poor farmers, continue to farm a diversity of landscapes with complex traditional agricultural practices. These practices were created through past experience and a profound understanding of these local ecosystems. Traditional agriculture depends on local, natural resources rather than external chemical inputs; conserves agricultural biodiversity through use; relies on various local crop and animal varieties with different traits, and generally sustains the long-term productivity of the agro-ecosystem. Although many traditional agricultural practices could be improved through the application of modern knowledge, such as agro-ecology
- **Local adaptation of agro-ecology principles.** Sustainable agriculture is not a single set of practices or a technological package that can be applied irrespective of local conditions. Traditional agricultural systems, such as those identified as Globally Important Agricultural Heritage Systems (GIAHS), offer a wealth of knowledge, principles, practices and biodiversity that cannot be replaced by modern science. They provide a good basis to which scientific knowledge can be applied to increase their effectiveness, productivity and adaptability. Several approaches, including integrated pest management (IPM), conservation agriculture and agro-ecology, combine traditional agriculture practices with modern science.
- **Increased food production and access to productive assets**. Eradicating hunger and poverty and meeting the world´s growing food needs do not depend solely on increasing the aggregate level of food supply by improving the productivity of agriculture. Although increasing food production is necessary, it is even more important to provide small farmers with access to the knowledge, technologies and productive resources needed by them to increase their local food production in sustainable ways.

Policy Priorities

How to implement this win-win policy strategy? Besides promoting some structural change policies –which probably will have to be adopted at a national or regional level-- at the local level, the implementation of some policy interventions seem crucial:

i) education/knowledge/awareness (agricultural extension);
ii) economic incentives; and
iii) strengthening rural production organizations

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http://www.fao.org/climatechange/55804/en

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