

# Case Study

ELLA Area: Environmental Management

ELLA Theme: Adaptation in Mountain Environments



ELLA

Evidence and lessons  
from Latin America

Small-scale coffee and cocoa farmers in northern Peru are successfully adapting to the challenges of climate change and enjoying higher incomes thanks to an innovative agroforestry project.

## INNOVATIVE MOUNTAIN ADAPTATION: A CASE STUDY IN AGROFORESTRY'S ECONOMIC, ENVIRONMENTAL AND SOCIAL BENEFITS



### SUMMARY

In mountain regions throughout the world, agricultural production is at risk from unsustainable production techniques, destructive human activities and the impacts of global climate change, all of which are accelerating deforestation and desertification. Across Latin America, South Asia and Africa, agroforestry represents one of the most successful strategies for meeting these challenges. Between 2006 and 2007, [Soluciones Prácticas \(Practical Action - Latin America\)](#)<sup>1</sup> implemented an innovative agroforestry project in the tropical rainforests of northern Peru aimed at reducing small-scale coffee and cocoa producers' vulnerability and strengthening their capacity to adapt to climate change. By integrating environmental conservation into local economic development priorities, capitalising on local knowledge and strengthening social organisation, the project opened-up access to international markets leading to increases in household income levels. This case study presents the local context, methodological approach, key results, innovations and lessons learned, as well as contextual and enabling factors, all of which could be useful for informing the design of similar initiatives in mountainous zones in other contexts.

### COMMON CHALLENGE: AGRICULTURAL VULNERABILITY TO CLIMATE CHANGE

Agroforestry is an approach to agricultural production that can reduce the impacts of human activities and global climate change on the local environment. Agroforestry systems integrate commercial crop production into the natural forest environment, harnessing trees for a variety of benefits: improving soil structure, drainage and nutrient levels; preserving biodiversity; increasing forage, firewood and other organic materials that are recycled and used as natural fertilisers; helping to regulate the water cycle; and providing shade. Agroforestry can improve the resilience of agricultural production to current climate variability

<sup>1</sup> *Soluciones Prácticas* is the Latin America Regional Office of the international NGO [Practical Action](#).



as well as long-term climate change through the use of trees for intensification, diversification and buffering of farming systems. For example, trees improve soil quality and fertility by contributing to water retention and by reducing water stress during low rainfall years. Trees can also reduce the impacts of weather extremes such as droughts or torrential rain.

This case study reflects a history of work in agroforestry throughout the region. For over 30 years, agroforestry systems have been researched and implemented across Latin America's mountain regions from Mexico to Central America and the central Andes of Peru and Bolivia. In Mexico, notable research has been carried out by the [Agroforestry Center for Sustainable Development](#) at the University of Chapingo in Mexico (led by Professor Dr. Laksmi Krishnamurthy)<sup>2</sup>. The leading organisation generating and applying knowledge in this field in Central America is the [Tropical Agricultural Research and Higher Education Center \(CATIE\)](#) in Costa Rica (led by Dr. Muhammad Ibrahim)<sup>3</sup>. Perhaps some of the most emblematic work being carried out in the Andean region on agroforestry, mountains and climate change is being led by the Food and Agriculture Organization (FAO)<sup>4</sup> and by the [Institute for Hydrology, Meteorology and Environmental Studies in Colombia](#) (IDEAM) via a [national programme for adaptation to climate change in high mountain ecosystems](#).

## THE LOCAL CONTEXT

In northern Peru, San Martin is one of the largest coffee and cocoa producing zones in the country. The rural families that cultivate these crops actually come from the Andean highlands, mainly from Cajamarca, one of Peru's poorest and most highly populated regions. These families possess little knowledge of how to farm within a tropical rainforest ecosystem and the agricultural techniques they adopt are basic and based on slash-and-burn practices. About 80% of the land parcels used are between one and three hectares. Productivity levels are low due to poor soil fertilisation and lack of knowledge about alternative production methods. The quality of coffee and cocoa produced here is varied due to poor post-harvest practices.

In the Sisa river basin, where the project was implemented, gradual deforestation has been taking place over decades, with

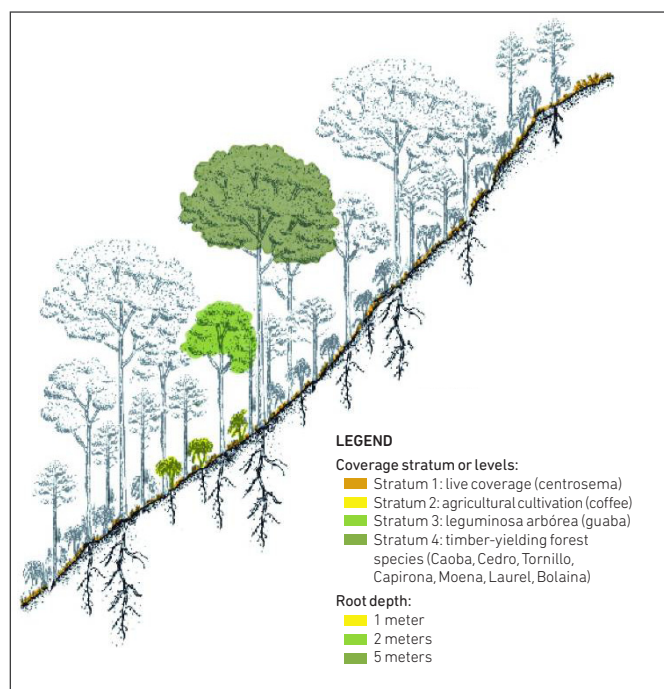


Figure 1: Multi-strata Agroforestry System  
Source: Torres, J., Tenorio, A., Gomez, A. 2008. *Agroforestería: Una Estrategia de Adaptación al Cambio Climático (Agroforestry: A Strategy for Climate Change Adaptation)*. Soluciones Prácticas (Practical Action - Latin America), Lima.

huge swathes of forest swept clear for large-scale corn and cotton production that now occupies almost 80% of the middle and lower river basin. Cotton and corn production quickly drain the rainforest soils of nutrients, leading to demand for new agricultural land. The result is high rates of logging, increasing the risk of flooding, mudslides, soil erosion and biodiversity losses. Both global climate change and these practices themselves are having significant impacts on the micro-climate in the river basin. More intense rains and prolonged periods of drought are accelerating desertification processes, putting the livelihoods of coffee and cocoa farmers at risk.

## AGROFORESTRY APPROACH

In response to these challenges, *Soluciones Prácticas* initiated a two-year agroforestry project in 2006. Working in partnership with 300 small-scale coffee and cocoa producers, local NGO [Capirona](#) and the [Oro Verde Cooperative](#), the project was organised around three key components and included a broad range of activities, as shown in the chart below.

<sup>2</sup> Callo Concha, D., Krishnamurthy, L., Alegre, J. 2002. Secuestro de Carbono por Sistemas Agroforestales Amazónicos ([Carbon Sequestration By Amazonian Agroforestry Systems](#)). *Revista Chapingo Serie Ciencias Forestales y Ambiente* 8(2) 101-106.

<sup>3</sup> Gamboa, H., Gómez, W., Ibrahim, M. 2009. Sistema Agroforestal Quesungual: Una Buena Práctica de Adaptación al Cambio Climático ([Quesungual Agroforestry System: A Good Practices in Climate Change Adaptation](#)). In: *Políticas y Sistemas de Incentivos para el Fomento y Adopción de Buenas Prácticas Agrícolas: Como una Medida de Adaptación al Cambio Climático en América Central*. CATIE, Turrialba.

<sup>4</sup> Cahuana, M., Palomares de los Santos, B. 2010. *Sistematización de Experiencias de Agroforestería, Manejo Integrado de Cultivos y Manejo de Semilla de Papa en las Comunidades Campesinas* ([Systematisation of Experiences in Agroforestry, Integrated Crop Management, and Management of Potato Seeds in Rural Communities](#)). FAO, Lima.



Project Component	Main Activities
1. Implement <b>sustainable agricultural practices</b> to support producers to become established in a specific locality thereby avoiding migration and reducing processes of desertification	<ul style="list-style-type: none"> <li>• Farm diagnostic to identify agricultural practices, productivity levels and biodiversity</li> <li>• Farm management plan developed with producers including activities such as pruning, using organic fertiliser and compost, constructing 'live' fences (hedges), crop selection and cultivation, and incorporating native forest species</li> <li>• Three hectare minimum cocoa production established per family to diversify and raise household income</li> <li>• Technical support for implementing post-harvest technologies and collection points</li> <li>• Community nurseries established to improve access to native plant varieties</li> </ul>
2. Strengthen <b>social organisation</b> to enable producer families to manage their own livelihood activities and develop their capacity to negotiate with partners and intermediaries and use financial and administrative tools	<ul style="list-style-type: none"> <li>• Stakeholder mapping</li> <li>• Cooperative membership promoted via information sharing events</li> <li>• Awareness raising and capacity building for producers via workshops and site visits</li> <li>• Training focused on organisational, administrative, financial and commercial issues such as participatory fair trade production, budgeting, accounting and registering producers' associations</li> <li>• Improve collaboration between producers' committees and local government officials</li> </ul>
3. Improve the <b>commercialisation</b> of coffee and cocoa to enable small-scale producers to sell on international markets	<ul style="list-style-type: none"> <li>• Farmer membership in the Oro Verde Cooperative promoted. The Cooperative organised coffee and cocoa exportation, paid higher and more stable prices than local intermediaries and offered bonuses for high quality crops.</li> <li>• Producers organised into community and district level committees responsible for identifying farmers with the capacity to manage collection points. These farmers were trained in harvest and post-harvest practices, quality control, administration and financial tasks, such as registration documents, invoicing and accounting</li> <li>• Organic and fair trade certification carried out with Biolatina and Flo-Cert</li> </ul>

## FROM INNOVATIONS TO LESSONS

What key innovations offer lessons for other regions?

**Innovation 1: Integrate environmental conservation into local economic development objectives.** The project re-introduced the natural forest environment into local production systems and taught farmers how to benefit from planting multi-strata native tree varieties on their land. By demonstrating the direct links between biodiversity and soil conservation with a higher quality product, farmers were motivated to take up other complimentary practices such as applying organic fertilisers. Consequently, the project not only led to improvements in local environmental conditions, but also supported farmers to increase their income levels. Agroforestry therefore represents a key strategy for addressing the main challenges of climate change in mountain areas while also providing economic incentives for farmers and policymakers.



Figure 2: Community nursery  
Source: Soluciones Prácticas (Practical Action – Latin America)

**Innovation 2: Capitalise on local knowledge.** The agroforestry strategy could not have been successful were it not for local knowledge. Farmers provided vital information on local biodiversity including the range, uses – such as food or medicinal – and production methods of different native forest species. This knowledge was used to design farm management plans that could be implemented at a low cost and with locally-available materials. The fundamental role played by local knowledge in increasing biodiversity and household income underlines the importance of farmer participation and respect for local culture for sustainable climate change adaptation in mountainous regions. Project planners and policy makers should therefore ensure that climate change adaptation strategies make the most of existing knowledge, which can then be complimented with capacity building and technical expertise provided by suitably qualified external agencies.

**Innovation 3: Open-up access to international markets.** The project commercialisation strategy was orientated towards improving the access of small-scale producers to international markets where higher prices could be earned for coffee and cocoa beans. The two crops promoted in the project – the African coffee bean and the American cocoa bean – were selected based on international market demand and suitability to local conditions, including both current and anticipated impacts of climate change. Furthermore, by integrating the agroforestry and cooperative production models, two niche markets – organic and fair trade – were also opened up for local producers who were certified as meeting required standards. Overall, the project shows how an agroforestry approach to commercial



production can be used with success to enable small-scale farmers to access new market opportunities, generating higher incomes and driving local development.



Figure 3: Coffee production in an agroforestry system  
Source: Soluciones Prácticas (Practical Action – Latin America)

**Innovation 4: Promoting producer associations to increase competitiveness.** Although coffee and cocoa production in northern Peru – and in many of the world’s mountain regions – is dominated by small-scale farmers, international markets demand high quality and quantity of production that cannot be achieved if these farmers continue to work individually. To meet these challenges, the project promoted farmer membership in the Oro Verde Cooperative which improved technical capacity and commercial viability of small-scale production. Strengthening producer associations therefore provides a key mechanism for increasing market competitiveness. Locally-appropriate social organisation models are a core component of projects that aim to facilitate climate change adaptation by strengthening productive activities.

## MAIN RESULTS

What were some of the key project achievements?

- **Increased biodiversity** by introducing plant, shrub and tree varieties into 135 hectares of coffee and cocoa plantations. The *caoba* and *cedro* trees served as wind-breakers, while *guabas*, *pumaquiro*, *estoraque* and *palipero* provided essential shade. Live fences were constructed with *Erythrina sp* and provided stability and protection from soil erosion. Organic composting with harvest residues increased nutrient recycling.
- **Improved technical capacity of farmers** to produce high quality coffee and cocoa beans using sustainable techniques. Farmers increased yields and diversified

production by introducing native forest species, fruit trees and cocoa plantations, and by processing new products like jams, chocolate and liquors. Farmers made use of planning tools to improve farm management.

- **Strengthened social organisation** by establishing sector committees and promoting farmer membership in the Oro Verde Cooperative. The Cooperative operates with 19 producers’ committees and facilitates access to national and international markets. Links were strengthened with local government by inviting representatives to participate in Cooperative meetings.
- **Improved household income levels.** Various elements contributed to increased household incomes, including:
  - 200 farms certified as organic and 278 farms awarded with the fair trade mark, enabling producers to access international markets and earn higher prices. 25% of all coffee and 45% of all cocoa achieved the quality required for international markets, with the remainder being sold locally and nationally.
  - Oro Verde Cooperative’s presence in the zone helped to regulate and maintain prices paid by intermediaries above the averages of the last five years. This has benefited all producers in the region.
  - Improved pruning techniques increased cocoa productivity from 350 to 500 kg/year.
  - Increases in the net value of coffee production led to a 34% increase in producers’ income levels compared to their income before the project; similarly, the net value of cocoa production increased producer income levels by 7%.



Figure 4: Capacity building workshop for farmers  
Source: Soluciones Prácticas (Practical Action – Latin America)

# CONTEXTUAL FACTORS

# ENABLING THE PROJECT'S SUCCESS



Peru's [National Strategy for Climate Change](#) prioritises adaptation and mitigation policies and programmes in fragile mountain ecosystems. This has driven the implementation of adaptation initiatives across the San Martin Region where agroforestry projects have attracted substantial support from international development agencies such as USAID. Furthermore, the [San Martin Regional Government has pioneered the use of Ecological-Economic Zoning \(EEZ\)](#), a land-planning tool that promotes sustainable natural resource use and biodiversity conservation to reduce desertification and facilitate adaptation. The Peruvian Government is now considering implementing EEZ at the national level.

Policies to liberalise the Peruvian economy were introduced in the 1990s. After the year 2000, the government and international development agencies began supporting projects promoting higher productivity and better agricultural quality to prepare Peru to participate in world markets at a larger scale than ever before. At the same time, bilateral trade agreements were signed with the United States, the European Union and several Asian countries. The opening-up of markets generated positive effects on coffee and cocoa production because these crops never had a high degree of protection through customs tariffs and because national demand is low compared to supply. Global demand for speciality beans, such as organic, fair trade and gourmet, is increasing; Peru significantly increased its competitiveness on world markets thanks to producers and exporters identifying new niche markets and producing high quality products in response. Increases in coffee prices led to higher profit margins, which in turn enticed companies to invest in Peru.

The majority of Peru's coffee and cocoa production is carried out by small-scale producers on land units of 0.5-5 hectares. Production through associations and cooperatives increased significantly over the last decade, which probably indicates that this form of production is best suited to social

and cultural norms. The indigenous populations living in rainforest ecosystems have an intimate relationship with their environment and the agroforestry approach respects this.

San Martin has a long history of agroforestry projects using both traditional and modern technologies to improve coffee and cocoa production. International donors such as [USAID](#) and [GIZ](#) have channelled significant funds into promoting coffee production for export. Access to affordable technologies makes coffee and cocoa production an attractive opportunity for small-scale farmers, especially cooperative members who also have access to financial resources. The younger population, in particular, demonstrates a keen interest in adopting new technologies.

Three distinct organisations made up the project implementation team, and the particular characteristics of each proved instrumental to the project's success. The Oro Verde Cooperative provided an appropriate mechanism for organising producers into committees representing their particular geographical zone. These committees enabled farmers to become active participants throughout the project and created a space in which farmer concerns could be heard, debated and incorporated into project activities. The Cooperative has a strong reputation working in the San Martin Region and is well respected by local government, which helped foster trust between the farmers and the Cooperative and raised the project's profile.

Second, the NGO Capirona provided vital expertise, particularly related to climate change impacts in the area and knowledge of local production systems, customs and culture. This experience meant the project reflected local priorities and incorporated local knowledge into project design. Finally, *Soluciones Prácticas*, an NGO with regional experience in agroforestry, climate change, technology and capacity building, provided the technical assistance and project design and management skills required to execute the project successfully.

## CONTACT THE AUTHORS

To learn more, contact the authors: Juan Torres, an expert in climate change adaptation in mountains and deserts, [jtordes@solucionespracticas.org.pe](mailto:jtordes@solucionespracticas.org.pe), and Carlos Frías, Quality Assurance Manager, [cfrias@solucionespracticas.org.pe](mailto:cfrias@solucionespracticas.org.pe), of [Soluciones Prácticas \(Practical Action – Latin America\)](#).

## FIND OUT MORE FROM [ELLA](#)

To learn more about climate change adaptation in Latin America's mountain environments, read the [ELLA Guide](#), which has a full list of knowledge materials on this theme. To learn more about other Ella Development issues, browse other [ELLA Themes](#).



ELLA is supported by:



The views expressed here are not necessarily those of DFID.

