Coffee Agroforestry:

Transforming a vital agricultural sector for a conservation and development 'win-win' in Peru

Lili Ilieva
Chris Henderson

June 2017

PRACTICAL ACTION
Technology challenging poverty

The objective of this paper is to promote collaboration in policy and planning between business-oriented agriculturalists, conservation-oriented foresters and climate change-oriented environmentalists.

The forests, coffee farms and ecosystems in the hills of eastern Peru are being negatively affected by climate change. Multi-strata agroforestry is an affordable and profitable example of Ecosystem-Based Adaptation (EBA) by smallholder coffee farmers which has the potential to deliver both adaptation and mitigation at a national scale. Based on our work with coffee producing communities, the private sector and local and national government Practical Action recommends the following:

1. Integrated agroforestry should be promoted for coffee because it maintains both good productivity and forest cover.
2. Achieving the Sustainable Development Goals (SDGs) needs productive agriculture that does not degrade the land or lead to deforestation. It requires integrated and coherent policies that promote a 'win-win' approach – productive agriculture, environmental protection and sustainable land use.
3. Agriculture, forestry, environment, and land-use policies should incentivize agroforestry over conventional coffee farming and other practices that lead to deforestation or degradation of agricultural land.

Context drives change! The economy, migration and climate change

Coffee is one of the agricultural sub-sectors most vulnerable to climate change (Porter, et al. 2014). Production and quality is affected by variability in rainfall and temperature. As a result many areas of conventionally farmed coffee have become unproductive and moribund. Furthermore the majority of coffee producers are smallholders, many of whom are just scraping a living from this volatile cash crop. They are often resource poor and risk adverse. As a result a common response to the declining yields and risk is for coffee farmers – large and small – to move up-hill to new, more fertile, cooler, often forested land. This migration of coffee to higher altitudes is contributing to the global loss of CO2 absorbing forests and higher emissions from abandoned coffee farms which are used for annual crops or grazing. Direct local impacts include greater soil erosion, a permanent change in the microclimate of the lower altitude lands, greater runoff, floods, landslides and damage to infrastructure and agriculture in the lowlands.

The shift to higher altitudes is also leading to conflicts over land use between farmers, the departments of forestry and agriculture and environmental agencies. To address these problems, and reduce negative impacts on the environment and society (including the rural economy and livelihoods), it is proposed that permission to grow coffee on new plots in the hilly areas of the Peruvian Amazon should be conditional on maintaining (or restoring) forest cover.

Unsustainable coffee farming impacts on the wellbeing of all inhabitants living in the wider watershed of the coffee farms, as well as the global issue of climate change. Failure to maintain the ecosystem within a coffee farm leads to environmental degradation that affects us all (deforestation, soil erosion, loss of biodiversity, and climate change (Millennium Ecosystem Assessment, 2005).

One solution to achieving productive and sustainable coffee is multi-strata agroforestry. **Practical Action** and farmers in San Martin have shown how coffee agroforestry is a 'win-win' solution that can both ensure farmers' income and their ability to adapt to the changing climate.

For the last 4 decades coffee has been the most important agricultural commodity in Peru. More than 425,000 hectares are cultivated with coffee, doubling in area over the last 18 years (INEI, 2013). It is produced in the highland areas on the eastern side of the Andes, mostly by smallholder farmers cultivating less than 5 hectares. The majority of these farmers came from the high Andes to escape the harsh and unproductive environment. It is estimated that more than 150,000 families in Peru currently rely on coffee for their income (INEI, 2013). Most do not have land titles, have limited resources, and are risk-adverse. Some are new migrants with limited technical knowledge or experience in sustainable land management in tropical conditions. The limited capacity (social, economic and technical) and vulnerability of the rural population becomes a driver of land degradation and deforestation of the higher, forested tropical Amazon.

Peruvian coffee farmers are feeling the effects of climate change and recognise the need to farm intelligently in order to have sustainable productivity. One example of an improved farming practice is the use of live fences live fences (closely planted trees or shrubs) to reduce the impact of erosion on and within coffee farms.

There is an urgent need to seek sustainable solutions and address the development and climate challenges affecting smallholder farmers and fragile tropical ecosystems in the coffee production sector.

What is multi-strata agroforestry?

Multi-strata agroforestry systems are composed of several strata of trees and tree crops. While the simplest systems consist of only two strata—a lower layer of tree crops such as coffee, cocoa or tea, and an upper layer of shade trees—the most complex systems is akin to the structural complexity of natural forest and may harbor more than a hundred plant species and varieties. (Michon and de Foresta,1999).

Development of coffee agroforestry in the Lama Province of San Martin:

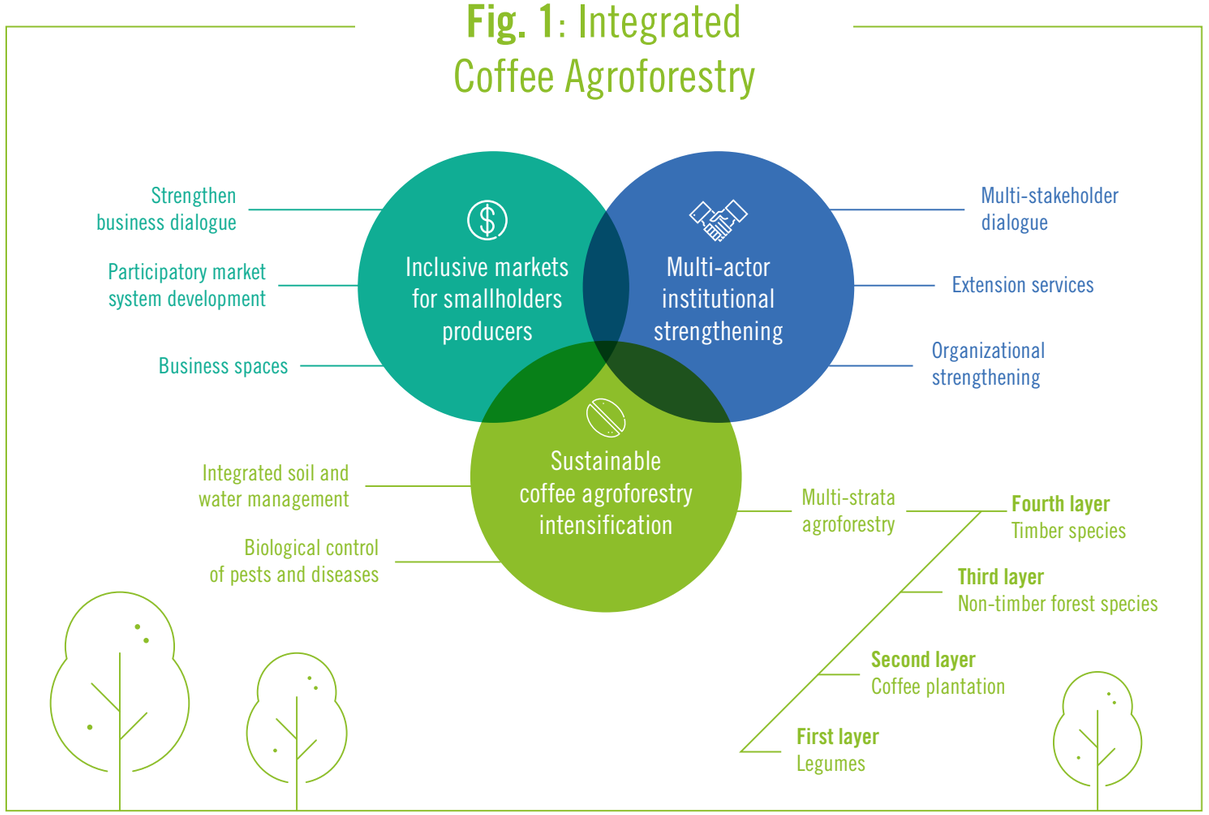
An experience of 180 coffee farming families on 228 hectares.

Practical Action has been working with the communities of Lama Province to improve the long-term sustainability of their coffee based farming systems. The success gained to date has been achieved through addressing the various technical, organisational and market challenges (see Figure 1). Underpinning the technical challenges was the development of an ecosystem approach for coffee intensification. Underpinning the organisational challenges was the strengthening of community organisations. This enabled collective action and better engagement with the private sector – the coffee buyers and processors. The strengthening of both the technical knowledge and practices and organisation of the farmers and communities enabled new discussions with the buyers and better deals regarding price and quality.

Within 3 years the multi-strata coffee plots were generating sufficient revenue that households were not expanding their plantations in the area. Productivity was restored in 228 ha where the coffee had been destroyed by pests and diseases and a lack of management of the shade and soils. Yields doubled from 552 to 1,012 kg/hectare and coffee quality improved. The physical quality of the grain improved from 55% to 73% and the cup quality from 78 to 82 points - most production reached export standards. The smallholder farmers increased their revenue by 63% and their farms had become more resilient to the changing physical and financial climate (Tirabanti, J., 2016).

The evidence generated by the project raised awareness and started a debate on how to up-scale multi-strata coffee agroforestry. The debate moved from community to district extension, regional government then influenced national agricultural and forestry policies. It resulted in the formalization of land tenure for smallholder farmers who use the multi-strata agroforestry system and a coffee NAMA (Nationally Appropriate Mitigation Action) which supports national implementation of the policy.

Fig. 1: Integrated Coffee Agroforestry



Coffee Agroforestry is an example of Ecosystem-Based Adaptation (EbA)

Innovations that use biodiversity, ecology or ecosystem services to improve the productivity or resilience of agricultural systems are forms of Ecosystem-Based Adaptation (EbA).

Improving natural resources management – the ecosystems

Integrating trees and other species in coffee systems, and the reforestation of unproductive coffee farms with timber species, is an effective way of increasing resilience to climate change. In Lama Province the farmers experimented with the introduction of 6 shade tree species (e.g. *mahogany, cedar, leucaena, pumaquiro, estoraque* and *paliperro*) to protect their farms from extreme rainfall, temperature and winds. Tree planting (whether for shade, timber or other uses) conserves soil and water, provides a habitat for diverse species so improving natural pest control, and provides a stable micro-climate in which coffee thrives and is protected from climate change. Diverse and multi-strata agroforestry increase the level of organic matter in the soil. This in turn improves nutrient availability and water-holding capacity, thus enhancing the resilience of the coffee and other crops to drought. Farms with a diverse vegetation structure (above and below ground) are more resilient to climate stresses – droughts, heavy rains, pest outbreaks – than farms with a simple vegetation structure (Altieri et al. 2015). Thus, trees in multi-layer coffee farms provide a range of ecosystem services.

Improving incomes – the livelihood systems

The diversification of economic plants in a farm (timber trees, coffee and annuals) improves the income security and resilience of farmers. It reduces dependence on the seasonal income from coffee and spreads financial risk across several crops or livelihood activities. Developing farmer experiences, knowledge and skills in coffee agroforestry increases their 'adaptive capacity. In addition to building technical capacity, 'adaptive capacity' can be built through the strengthening of farmer organizations and their voice or power in the market system – i.e. 'social capital'.

Diversification within coffee farms strengthens the resilience of the ecological system within the farm and landscape and improves rural livelihoods.

Improving land use and the rural economy – reversing deforestation and land degradation – needs large scale or system change. It means working with all the actors involved in the market system that farmers and other land users depend on: the actors driving trade, the local government, the investors, the innovators, the buyers and most importantly the smallholder farmers - i.e. it requires an 'inclusive' and market systems approach.

Relevance to Adaptation

Adaptation is often thought of as a local issue – changing farming practices to maintain or improve productivity in a changing climate. However, sustainable development also requires adaptation at a large scale – managing adaptation of the watershed or landscape. The protection of forests and other fragile ecosystems within the landscape help ensure large scale adaptation, but they are difficult to implement without local support. Demographic and socio-economic pressures (e.g. migration and the need for rural incomes) drive changes in the landscape – deforestation, increasing cropping intensity, changes in land use – which have negative impacts on the larger ecosystem. Multi-strata coffee agroforestry is a land use which can deliver large scale adaptation because it addresses local needs –

Ecosystem-Based Adaptation (EbA)

As one of the possible elements of an overall adaptation strategy, ecosystem-based adaptation uses the sustainable management, conservation, and restoration of ecosystems to provide services that enable people to adapt to the impacts of climate change. It aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of the adverse effects of climate change. (IUCN 2009).

i.e. addresing the demographic and socio-economic pressures. It is an example of EbA that should be supported within the National Adaptation Plans (NAPs) and climate change funding.

Relevance to Mitigation

Tree crops also sequester carbon and thus contribute to the 'mitigation' of climate change. In addition to carbon sequestered in the trees, protecting the ground from sunlight and maintaining ground cover increases soil organic matter. Perhaps more importantly, multi-level agroforestry prevents deforestation and the release of carbon currently stored in woodland soils and trees into the atmosphere.

Agroforestry is a 'win-win' land use that should be promoted within National Adaptation Plans (NAPs) and Nationally Appropriate Mitigation Actions (NAMAs).

Scaling Integrated Coffee Agroforestry to achieve the SDGs – addressing rural poverty and tackling climate change

The Peruvian experience demonstrates that multi-strata coffee agroforestry is beneficial to both farmers and government. The outcomes of multi-strata coffee agroforestry are directly relevant to the SDGs. It provides:

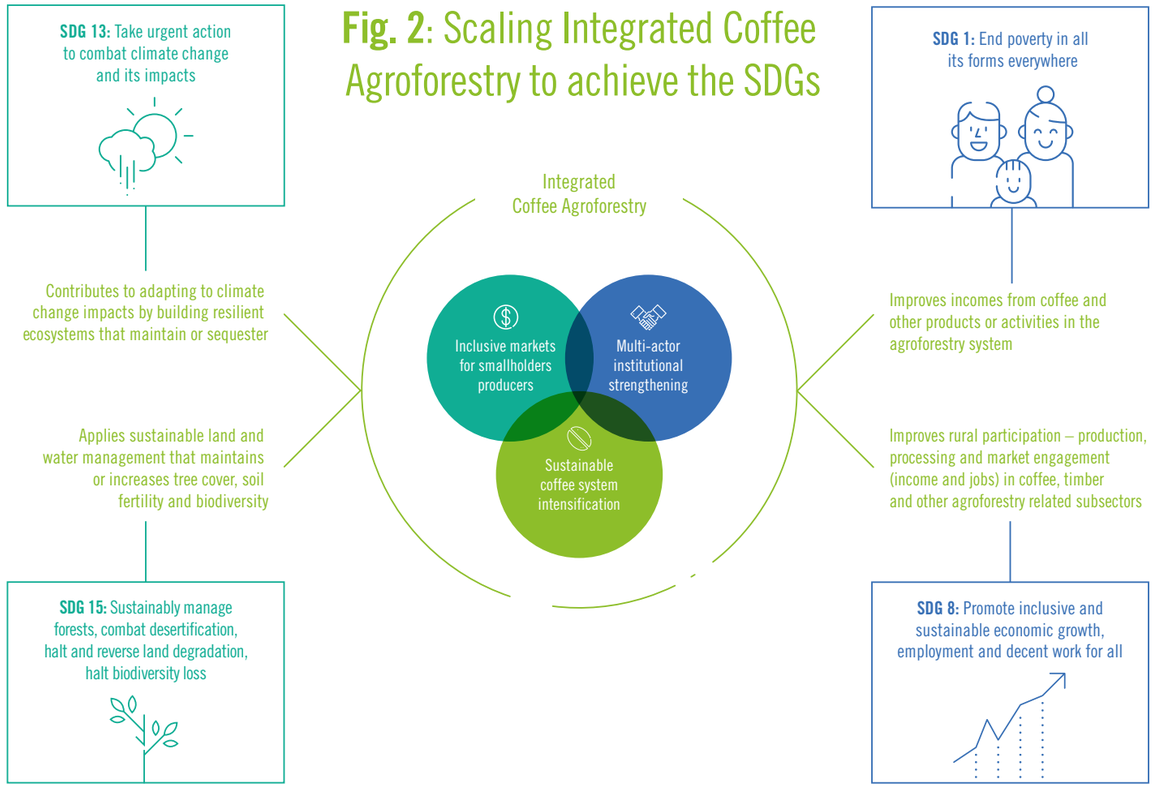


Fig. 2: Scaling Integrated Coffee Agroforestry to achieve the SDGs

- Rural livelihoods (a means of reducing poverty) = SDG1
- Inclusive development of the coffee, timber and other agroforestry related subsectors thereby providing rural jobs and income = SDG 8
- Actions that contribute to both climate change adaptation and mitigation = SDG13, and
- A land use that protects the ecosystem that the wider community depend on = SDG 15.

Multi-strata agroforestry is a 'win-win' land use that needs to be incentivized through coherent national and sub-national land, forest, agriculture, environment and economic policy.

Countries need integrated agriculture and forestry land use policies if they are to achieve a 'win-win' development and environment solution to the SDGs.

Recommendations

Achieving the SDGs needs productive agriculture that does not degrade the land or lead to deforestation. It needs agriculture that provides sustainable and inclusive rural livelihoods, preserves forests, maintains biodiversity and delivers action on climate change.

Multi-strata coffee agroforestry improves the ecology, productivity and diversity of income from coffee farming. It strengthens the ecological and economic resilience of both the farmers and landscape. It is an affordable and profitable example of Ecosystem-Based Adaptation (EbA) by smallholder coffee farmers. It is as a 'win-win' land use that has the potential to deliver both adaptation and mitigation at a national scale.

It compliments other ecosystems management approaches such as community forest management and payment for ecosystem services. To be up-scaled, however, it needs the support of integrated and coherent agricultural, forestry and environmental policies.

Recommendations of international relevance:

1. Agriculture policy should incentivize agroforestry over conventional coffee farming and other practices that lead to deforestation or degradation of agricultural land.
2. Multi-strata coffee agroforestry should be promoted within National Adaptation Plans (NAPs) and Nationally Appropriate Mitigation Actions (NAMAs).
3. The lessons learned in coffee agroforestry should be used to explore the potential of agroforestry with other tree crops for both NAPs and NAMAs (e.g. a cocoa NAMA in Peru).

Recommendations of national relevance:

1. The existing 'coffee NAMA' should be implemented at national scale.
2. There should be a continuation of the process already started to formalize smallholder land tenure in coffee farming areas of Peru on condition that the farmers use multi-strata agroforestry.

In summary, **agriculture, forestry, and environmental policies should be coordinated so that**: agricultural policies insist on ecological integrity; forestry policies accept multi-strata coffee agroforestry as a legitimate land use (especially in areas under pressure from informal conversion to coffee); and, environmental policies use adaptation and mitigation strategies to incentivize 'win-win' practices such as multi-strata agroforestry.

References

Altieri, M.A., Nicholls, C. I., Henao, A., Lana, M.A. 2015. Agroecology and the design of climate change-resilient farming systems. Agron. Sustain. Dev. (2015) 35:869–890.

International Union for Conservation of Nature (IUCN). 2009. Ecosystem-based Adaptation (EBA), Position Paper.

Michon, G., and H. de Foresta. 1999. Agro-forests: incorporating a forest vision in agroforestry. Pages 381-406 in L. E. Buck, J. Lassoie and E. C. M. Fernandes, editors. Agroforestry in sustainable agricultural systems. CRC Press, Washington D.C., USA.

Millennium Ecosystem Assessment (MA) World Resources Institute; Washington, DC: 2005. Ecosystems and human well-being: synthesis.

National Institute for Statistics and Informatics (INEI – Instituto Nacional de Estadística e Informática, Perú). 2013. IV Censo Nacional Agropecuario – 2012.

Porter, J.R., L. Xie, A.J. Challinor, K. Cochrane, S.M. Howden, M.M. Iqbal, D.B. Lobell, and M.I. Travasso, 2014: Food security and food production systems. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 485-533.

Tirabanti, J. 2016. La nueva caficultura en acción: los Sistemas Agroforestales Multiestrato como enfoque para la producción sostenible del café en ecosistemas frágiles. Soluciones Prácticas - América Latina.

Contact

Lili Ilieva, PhD
Thematic leader in Adaptation to Climate Change
Practical Action Consulting Latin America
lili.ilieva@solucionespracticas.org.pe

Chris Henderson
Senior Policy and Practice Advisor in Agriculture
Practical Action United Kingdom
chris.henderson@practicalaction.org.uk

PRACTICAL ACTION
Technology challenging poverty

Regional Office for Latin America: Arequipa Av. 4499, Miraflores, Lima - Peru / www.solucionespracticas.org