A transition towards bio-economy development in Colombia: challenges, opportunities, and policy responses for sustainable agri-environmental systems in cattle ranching and cacao production.

GROW Colombia is a four-year bioscience research and capacity building project to preserve, restore and manage biodiversity through responsible innovation in Colombia. The project will conclude at the end of 2021. This multidisciplinary initiative is funded by the UK Government's Global Challenge Research Fund and involves a wide, international collaboration of academic and civil society partners united in a shared vision to conserve biodiversity, achieve sustainable prosperity and secure lasting peace in Colombia. The project has a strong socio-economic component involving the University of Sydney, Universidad de Los Andes and led by the University of East Anglia.

Colombia is the second most biodiverse (in terms of plants, animals, and habitats) country on Earth. Colombia's biodiversity is a vast store of wealth, providing humanity with multiple benefits - known as ecosystem services – including food, shelter, livelihoods, cultural and other gains, together with the life support system itself. This stock of natural capital can provide a secure foundation for a sustainable bio-economy development path.

Although we recognise that contemporary environmental challenges faced by all countries, such as climate change, demand urgent action, including consideration of social limits to growth, we advocate a measured, monitored and appraised transition process involving both macro and micro policy switches. This evolutionary transition towards a sustainable, low carbon bio-economy must be facilitated by a national "Green Growth" investment strategy. This approach will promote economic development, maintaining incomes and improving livelihoods, whilst conserving biodiversity resources and fostering climate change mitigation and adaptation.

Agricultural systems can play a crucial role in this transition. Agricultural production is a key contributor to the economic growth and the welfare of tropical and sub-tropical countries like Colombia. However, increasing domestic and international food demands and lifestyle changes have led to pressures resulting from land use change with ranching, plantations and resource extraction activities all impinging on previously intact ecosystems as a result of agricultural expansion and intensification. This is causing a range of adverse environmental consequences such as increased deforestation, loss of biodiversity, habitats and ecosystem functioning, and increased greenhouse gas emissions.

The transition to more sustainable, "green" agricultural practices requires institutional responses that enable participatory actions and support mechanisms such as payment for ecosystem services and other innovative financial mechanisms. To assist the policy /project choice process and consequent trade-offs, the GROW Colombia project supports the 'Balance Sheet Approach'. This is a decision support appraisal system encompassing multi-disciplinary data across a range of spatial dimensions and plural assessment criteria, including distributional equity, as well as conventional economic efficiency. The 'Balance Sheet' therefore includes both monetary and non-monetary valuation methods and techniques.

In the GROW Colombia project, we apply components of this toolbox to selected policy areas in the agricultural context as one component of the bio-economy transition:

1. Cattle ranching activities and the impacts on biodiversity, with a particular emphasis on deforestation impacts, and the benefits/costs related to a switch away from extensive ranching towards cattle regimes within a silvo-pastoral setting (a form of agroforestry characterised by a combination of trees, shrubs, forage resources and animals in the same agricultural system).

2. Production of cacao for high quality chocolate, including an assessment of the national and international potential market demand and farmer production opportunities and constraints.

Cattle ranching

Livestock farming is an activity of great importance for both the rural economy and the Colombia's food security. The livestock sector contributes more than half of the agricultural value added, adding 3.5% to the national GDP, as well as directly generating 950,000 jobs. More than 37 million hectares (32% of the entire national territory) are dedicated to livestock farming with an average stocking rate just above 0.6, implying that each head of cattle uses in excess of 1.6 hectares of Colombian land. The simplest, most common cattle ranching system in Colombia consists of extensive systems on pasture lands without shrubs or trees. Areas devoted to such practices are both less biodiverse and more vulnerable to threats such as climate change.

Key challenges

- Extensive cattle ranching systems in Colombia have long been characterised by low land use efficiency and low productivity and are also typically associated with high environmental impacts (e.g., greenhouse gases emissions, land degradation, water pollution, loss of biodiversity).

- Extensive cattle ranching is one of the key drivers of deforestation in Colombia. In 2022 total deforestation is expected to reach 300,000 hectares. More than 80% of Colombian deforested land is currently used for cattle ranching.

Silvo-pastoral systems (a form of agroforestry characterised by a combination of trees, shrubs, forage resources and animals in the same agricultural system) can help meet development pressures while mitigating the environmental costs of cattle ranching through an improved use of ecosystem services and a more sustainable land use. They can enhance biological diversity and the provision of ecosystem services (e.g., carbon sequestration and biodiversity conservation) in cattle-dominated landscapes while leading to higher economic benefits to farmers through the rise in cattle productivity, both in terms of milk and meat, as well as the potential diversification of farmers' sources of market income.

However, there is a low uptake of the more sustainable silvo-pastoral systems in cattle ranching:

- Smallholder farmers have low investment capacity, and the adoption of silvo-pastoral systems presents high initial fixed costs in terms of both financial and time investments, coupled with delayed returns.

- The adoption of silvo-pastoral systems is perceived as risky due to the lack of skilled workers, and the information and the technology required to establish the new systems and manage them.

Key recommended actions

- Projects, policies and action enabling the switch towards more sustainable silvo-pastoral systems must be appraised in a holistic way (e.g., using a decision support system such as the Balance Sheet Approach) accounting for the full spectrum of costs and benefits, not only in financial terms but also related to all relevant ecosystem services gains and losses. The inclusion of ecosystem services values (i.e., emissions reductions and additional soil fertility) makes silvo-pastoral systems profitable from a societal point of view and at higher levels of intensification also from a private farmer point of view.

- Recognising that not all aspects of nature can be monetarily valued, as many as possible ecosystem services should be meaningfully valued this way to avoid zero value status in the appraisal of cattle ranching and silvo-pastoral systems investments.

- Opportunities to develop mitigation projects in the cattle ranching sector related to methane, nitrous oxide and carbon dioxide emissions need to be further explored and supported.

- Policy makers, practitioners and farmers have to be provided with decision support systems and tools allowing them to holistically evaluate and assess cattle ranching investments and recognise the full spectrum of gains and losses in comparing extensive silvo-pastoral systems.

- Intensive silvo-pastoral systems are profitable for farmers and the society as a whole as they provide gains in productivity and ecosystem services benefits. A switch away from extensive ranching practices must, therefore, consider radical land use changes beyond pastures enhancement to full silvo-pastoral systems.

- Farmers need to be supported in the transition to intensive silvo-pastoral systems through the implementation of payments for ecosystems services, markets for carbon emissions reduction, public loans and credits, and innovative financial mechanisms.

- The sustainability switch proposed requires shared responsibility with and support from the industrialised economies, given the global net benefits of such nature-based efforts to tackle climate change.

Cacao farming

Cacao farming stands out as a rural development strategy in the post-conflict Colombia and has been adopted by the government as a strategic crop. Approximately 75% of the net income of 35,000 families in the rural area of the country depends on cacao production. Colombia has the potential to participate in the fine chocolate market since the genotypes that are grown in the country have achieved worldwide recognition for their quality and can be positioned in the niche of special cacaos. The country is ranked as the 10th largest cacao bean producer worldwide and the total cacao production grew from 36,731 tons in 2000 to 54,796 tons in 2015. Whilst only roughly 25% of cacao production is exported, most of these exports are of 'fine and flavour' cacao.

Key challenges

- The productivity of the sector has been mainly driven by the extension of harvested areas in the last decades. Environmental factors (ageing of crops, inadequate seeds or genetic material, shade excess or deficit, bad tree structure, presence of pests and diseases) and socio-economic issues (low technological development, unequal distribution of income; problems of a lack of trust and integration of agents in the supply chain, lack of knowledge of the quality requirements and limits) have been limiting productivity.

- Even though Colombia's cacao production mainly depends on traditional smallholder cultivation systems, the national cacao market is mainly controlled by a few large companies. This limits the distribution of benefits to rural communities and the implementation of more sustainable cacao farming systems such as agroforestry.

- In addition, on-farm benefits of agroforestry alone are insufficient to justify its adoption, as farmers would need to benefit from the cacao price premium as well as from payment for the ecosystem services protected or enhanced by agroforestry systems.

- Currently, financial incentives to encourage farmers to enter the cacao market, in general and through agroforestry practices, are insufficient to foster the transition. The premium prices for growing special cacaos do not appropriately reflect farmers' additional effort in growing sustainable cacao.

Key recommended actions

- Initiatives such as the Zero Deforestation Pact need to be further supported and promoted by institutional and sectoral stakeholders. These initiatives incorporate practices and technologies that can enhance cacao productivity, help to close the agricultural frontier, make for more sustainable land use, protect strategic ecosystems and ensure ecosystems preservation.

- Smallholders' cacao production is not technically efficient. Initiatives should be scaled up to support a wider use of technology, a more efficient use of inputs, and farmers' skills through capacity building and knowledge sharing.

- Additional financial incentives such as payment for ecosystem services specific to the cacao sector need be implemented to support smallholder farmers in adopting agroforestry practices

that protect ecosystems and biodiversity and the genetic variety of native 'fine taste and aroma' cacao genotypes.

- The GROW Colombia project's research survey data indicate that national and international consumers are willing to pay a price premium for chocolate from cacao farming that avoids deforestation, is marketed as using agroforestry practices, is organic, and results in fair rewards to farmers and local communities. Certifications recognising and communicating these positive aspects of cacao farming need to be developed. Farmers and cacao producers should therefore be encouraged to focus on organic and fair agroforestry practices avoiding deforestation, in order to benefit from a price premium on national and international markets.
- The sustainability switch proposed requires shared responsibility with and support from the industrialised economies, given the global net benefits of such nature-based efforts to tackle climate change.

Further reading

GROW Colombia website: www.growcolombia.org

Colombia's Natural Capital. GROW Colombia Project Report 1

Biodiversity Protection in Colombia: An Economic Perspective. GROW Colombia Project Report 2

Perspectives on a Bio-Economy Development Path for Colombia. GROW Colombia Project Report 3.

Policy Briefing: Growing Colombia's Sustainable Bioeconomy

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