Síntesis

Boletín Informativo de la Fundación INESAD

N° 39- Septiembre- 2024

Balancing Agricultural Productivity and Nature Conservation in Bolivia

Andrea Baudoin Farah

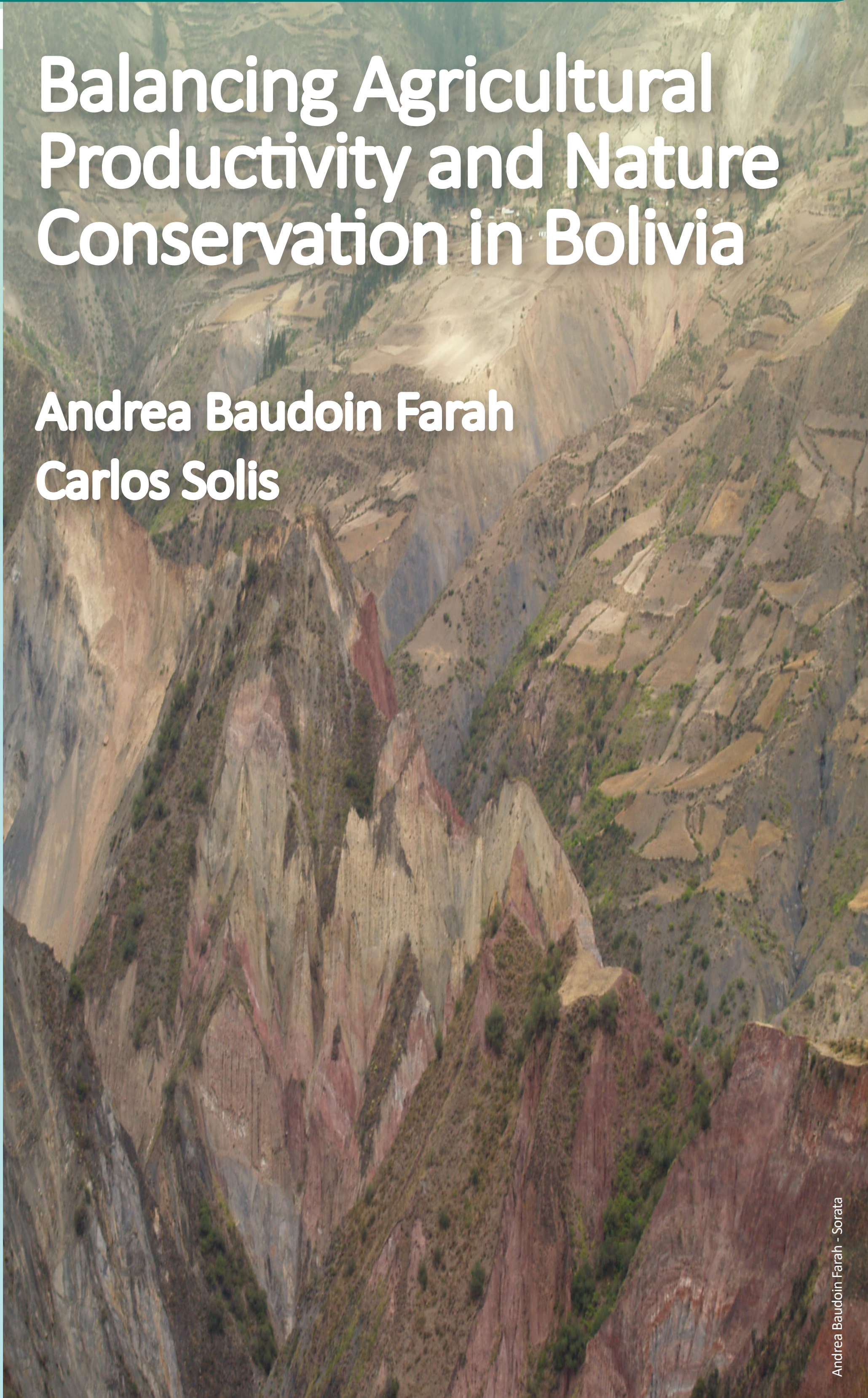
Carlos Solis

CONTENIDO

inesad
INSTITUTO DE ESTUDIOS AVANZADOS EN DESARROLLO

IDRC · CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada



Andrea Baudoin Farah - Sorata

In response to the urgent call for action on climate change and the multiple socio-ecological crises, the recent Conference of the Parties of the United Nations Framework Convention on Climate Change (CoP) in Dubai launched the Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action[1]. This landmark declaration underscores the critical need to adapt and transform agriculture and food systems to mitigate their impacts on climate change. Central to this declaration is the recognition of the vulnerability of food producers to climate impacts and the potential of agriculture to drive innovative responses. Key actions outlined in the declaration include scaling up adaptation and resilience efforts, promoting food security and nutrition, supporting threatened livelihoods, managing water sustainably, and maximizing environmental benefits while minimizing harmful impacts.

The Declaration underscores that agriculture and nature conservation share intricate connections. Agriculture, while essential for economic growth and food security, poses significant environmental challenges, particularly in tropical countries like Bolivia. Deforestation, biodiversity loss, and drought impact are among the pressing environmental issues exacerbated by agricultural expansion (Bossio et al., 2021). Moreover, biodiversity loss and the declining fertility of soils due to erosion and salinization, attributed to various factors including deforestation and excessive use of chemical inputs, threaten the ecological functions essential for agricultural productivity (Bossio et al., 2021).

However, these challenges also show the potential for a synergistic relationship between agriculture and nature conservation. Sustainable agricultural practices, such as agroforestry and integrated pest management, offer pathways to mitigate environmental impacts while ensuring food security. They do so because preserving ecosystems and safeguarding habitats supports agricultural productivity by maintaining essential ecological services, including pollination and pest control. Nature-based solutions (NbS) further demonstrate the potential to address agricultural and environmental challenges simultaneously, offering triple benefits of supporting agricultural resilience, mitigating climate change, and enhancing biodiversity (Iseman and Miralles-Wilhelm, 2021).

Agriculture, environment, and their intimate connection

Food systems in their entirety – from production, to transport, storage, retailing, and consumption – have environmental impacts. However, agricultural production has the most direct effect on environmental degradation among these processes, while directly depending on the health of the surrounding environment. Indeed, agricultural production relies on key ecosystem functions and services, including biodiversity, nutrient cycling, pollination, water provision, soil fertility, and many others.

- Healthy soil is the foundation of a productive agricultural system. It allows farmers to work with the land to reduce erosion, maximize water infiltration, improve nutrient cycling, and ultimately improve the resiliency of their working land. Soil health is directly linked to food quality and quantity (FAO, 2014).

- Pollinators like bees, butterflies, birds,

Sustainable agricultural practices, such as agroforestry and integrated pest management, offer pathways to mitigate environmental impacts while ensuring food

1 https://www.cop28.com/en/food-and-agriculture

bats, and other insects play a crucial role in agriculture. They are responsible for the pollination of approximately 75% of the world's crops producing fruits and seeds for human consumption. This includes crops directly consumed by humans or used for animal feed and plant-based industrial products. Without pollinators, these plants would not be able to successfully reproduce (Reilly et al., 2020).

- Water is a critical input for agricultural production and plays an important role in food security. Over 70% of freshwater withdrawals are connected to agriculture (UN Water, 2023). Given that irrigated agriculture is much more productive than that which is rain-fed, a reduction in the availability of this resource would mean less and more expensive food in any affected area.

Limits and threats of conventional industrial agricultural production

The environmental impacts of food production largely depend on the interactions between the type of productive system and biophysical and ecological conditions. However, beyond the specificities of agrarian systems around the world, there is widespread agreement that the current conventional and dominant agricultural model – based on the tenets of the Green Revolution – has multiple negative environmental impacts.

- One of the major impacts is deforestation, which is primarily driven by agricultural expansion. According to the Food and Agriculture Organization of the United Nations (FAO), agricultural expansion drives almost 90 % of global deforestation. This loss of natural habitat has been the main driver for reducing the world's biodiversity (FAO, 2022a).

- Another impact of agriculture on the environment is soil erosion. Agricultural activities, such as tilling of fields and planting of crops, disturb the ground and lead to soil erosion. About 75% of the terrestrial surface of the globe is considered degraded (IPBES, 2018), and agriculture is one of the biggest contributors to these processes. The U.S. Midwest alone has suffered erosion processes in the order of 57 billion tons of soil in the last 150 years (Thaler et al., 2022).

- Pesticides used in agriculture also contribute to environmental pollution. As much as 80 to 90% of applied pesticides hit non-target vegetation and stay as pesticide residue in the environment (Sun et al., 2018). These residues can contaminate local streams, rivers, and groundwater, posing potential risks to ecosystems and human health. They also threaten pollinators and generate pest resistance to agrochemicals (which in turn results in more pesticide applications).

- Agriculture also contributes significantly to global greenhouse gas emissions. Agriculture, Forestry and Other Land Use (AFOLU) activities accounted for around 28% (12.0 ± 2.9 GtCO2eq/yr) of total net anthropogenic emissions of GHGs in the 2007-2016 period (IPCC, 2019). These emissions come from various agricultural activities, including the use of nitrogen fertilizers, rice production, livestock rearing, and land use change, but do not include pre- and post-production processes.

- The specialization that has accompanied conventional agriculture has also led to losses in agrobiodiversity and genetic resources (e.g. Pingali, 2019). Local crop varieties, historically selected by farmers, have been progressively replaced by seeds produced by breeding programs and purchased by farmers (Pingali, 2019).

The aforementioned impacts are mostly due to the incorporation of inputs and technologies in production systems. While these changes have often resulted in productivity gains, they have also jeopardized the long-term viability of production systems by degrading ecosystem functions and services that support agricultural production like pollination, water, biodiversity, and healthy soils. Conventional production models have also exacerbated land and income concentration and socio-environmental conflict (e.g. Ndi and Batterbury, 2017), that in turn increase pressures on land and ecosystems, exacerbating environmental degradation.

The challenges facing the agricultural sector in Bolivia

The challenges of Bolivia's agricultural sector are multiple and complex. Bolivia has some of the lowest yields in the region (Crespo, 2020). Productivity challenges stem from the fragility of landscapes and soils, and lack of infrastructure and investment, but also from the widespread unsustainable practices that the agricultural sector employs: it is an issue of both lack and excess that requires a differentiated approximation to production systems.

While agricultural production in Bolivia is undertaken by a very diverse mosaic of actors, a dichotomy is recognized between peasant and indigenous economies, based on family labor and combinations of crop and husbandry production systems, hunting, fishing, and gathering; and large-scale agribusinesses, centered around a small number of commodities (mainly soy, beef, sugar cane, poultry, and rice) (Baudoin Farah, Calvo and Wanderley, 2021). Each of these groups face differentiated challenges. The first, while contributing the most to the supply of fresh food to local and national markets and generating the most employment, suffers from the lack of access to fertile soils and irrigation (as it is often confined to marginal soils in steep areas), marginal market access, soil degradation, loss of genetic resources, and vulnerability to the effects of climate change (Baudoin Farah, Calvo and Wanderley, 2021). The agribusiness sector, for its part, is tangled in the crisis of the conventional Green Revolution production model (dependency on synthetic inputs, increasing pest resistance, water and soil pollution, soil erosion and compaction, agrobiodiversity loss, biodiversity loss, etc.) (Crespo, 2020), with the added problem of its expansive character which leads to widespread land use change. Soy alone occupies 40% of the 4.5 million hectares cultivated in the country (data from the National Statistics Institute for 2023).[2]

Several of Bolivia's most pressing environmental challenges are related

2 https://www.ine.gob.bo/index.php/estadisticas-economicas/agropecuaria/agricultura-cuadros-estadisticos/

to the agricultural sector – and the agribusiness sector in particular (although not exclusively):

- Bolivia has the third highest deforestation rate in the world, driven mostly by the expansion of the agricultural frontier (Czaplicki Cabezas, 2023).

- It is also one of the most vulnerable countries in the world to the effects of climate change due to its high rates of poverty and inequality, its fragile ecosystems and its location in a region of climate extremes. Some of the effects of climate change that most affect the agricultural sector in Bolivia are changes in rainfall patterns, drought, and an increased incidence of pests and diseases (Calvo and Baudoin Farah, 2021). At the same time, AFOLU activities account for 80% of Bolivia's GHG emissions (with an estimated 76 MtCO2eq/yr for forestry and land use change, and another 30 MtCO2eq/yr for agriculture)[3] .

- Between 35 and 50% of agricultural soils are degraded (MMAyA, n.d.) and about 40% of the country's surface area is in a desertification process (CBF, 2015) – especially in the highlands and the Chaco plains – resulting in stagnant or decreasing yields and an ever-increasing dependency of food imports (Baudoin Farah, Calvo and Wanderley, 2021).

- Pesticide imports increased five-fold between 2001 and 2017 (from 33 to 167 thousand metric tons); during the same period, pesticide use per hectare and per ton of food produced increased 150% (Crespo, 2020). It is also worrisome that pesticides are often used without proper safety measures and that highly toxic pesticides – prohibited in other countries – are widely used Bolivia (Bickel, 2018; Villalobos, 2021). The use of pesticides also threatens the pollinators on which 62% of the 32 main crops for small, medium and large farms in Bolivia directly depend (MMAyA, 2020).

3 Our World in Data. https://ourworldindata.org/co2/country/bolivia

Food systems need to shift towards more sustainable production models and value chains to respond to the multiple environmental, socioeconomic, and equity crises that humanity is facing.

In Bolivia, agricultural production has historically relied on farmers' deep ecological knowledge and the management of multiple ecosystems across altitudinal gradients. The shift towards simplification and specialization – and subsequently monocultures and reliance on external inputs – started with the colonial economy and the hacienda regime but was exacerbated with the 1953 Agrarian Reform, the efforts to expand the agricultural frontier in the lowlands ("marcha hacia el Oriente") and the policies aimed to substitute imports and liberalize Bolivia's economy in the mid-1980s. In the face of the country's current challenges in terms of the sustainability of the agricultural sector, efforts need to be dedicated to both recover the ecological, social, knowledge, and human capital necessary to produce in Bolivia's complex geography while innovating to face the new conditions posed by demographic and climate change.

Frameworks to reconcile agricultural production and conservation

Food systems need to shift towards more sustainable production models and value chains to respond to the multiple environmental, socioeconomic, and equity crises that humanity is facing. These transformations will provide an opportunity to achieve positive environmental, social, and economic outcomes if properly designed and implemented. Different approaches are being advanced across scales by diverse stakeholders. Some of them are:

- Organic agriculture is a method of farming that focuses on restricting the use of synthetic fertilizers and pesticides to prevent pollution and negative health impacts on consumers. While the area under organic agriculture in the world has steadily increased (almost seven-fold since 1999), it only represented 1.6% of global croplands in 2021 (Willer et al., 2023). More than 70 countries have adopted regulations for organic agriculture and many others have policies that promote the expansion of organic agriculture (e.g. the creation of the National Directorate of Agroecology in Argentina) (Willer et al., 2023).

- Going beyond organic farming, agroecology encourages various agricultural and ecological practices, with an emphasis on nutrient cycling, diversity, resilience, and building synergies across food systems to simultaneously support production and multiple ecosystem services (FAO, 2018). This results in vital benefits such as the preservation of the soil's organic composition and more carbon storage, and increases in biodiversity (Brito et al., 2024). Agroecology is not only a technical approach to production, but also a field of study and a social movement that encompasses food systems in their entirety from an integrated perspective (e.g. centering on food sovereignty, equity, and resilience) (FAO, n.d.).

- Nature-based Solutions (NbS) in agriculture seek to maximize the ability of nature to provide ecosystem services that help address a human challenge, such as climate change adaptation, disaster-risk reduction or, in this case, food production. NbS can deliver a triple benefit when deployed properly, supporting agricultural production and resilience, mitigating climate change, and enhancing biodiversity (Hallstein and Iseman, 2021). NbS encompass a range of practices or elements to improve ecosystem functions of landscapes affected by agricultural production (Simelton et al., 2021).

- Regenerative agriculture is a conservation and rehabilitation approach to food and farming systems. While there is no single definition for regenerative agriculture, most definitions focus either on practices

or outcomes. From an outcomes-based perspective, regenerative agriculture focuses on topsoil regeneration, increasing biodiversity, improving the water cycle, enhancing ecosystem services, supporting biosequestration, increasing resilience to climate change, and strengthening the health and vitality of farm soil (Newton et al., 2020).

The proportion of organic agriculture in Bolivia is relatively low (0.5%); it spans about 180,000 hectares and involves about 14,000 producers (Willer et al., 2023). Most of those producers are small-scale farmers dedicated to diversified production (fruits, vegetables, grains, etc.) or export crops like quinoa, cacao and coffee. Some of these farmers are organized in the Association of Ecological Farmers Organizations (Asociación de Organizaciones de Productores Ecológicos de Bolivia – AOPEB). While some are not certified, others have third party certifications or are engaged in participatory guarantee systems (PGS). In the agribusiness sector, the Association of Oilseeds and Wheat Producers (Asociación de Productores de Oleaginosas y Trigo – ANAPO) has been promoting conservation agriculture among soy producers with recommendations of no tilling, crop rotations, and cover crops. However, the introduction of genetically modified soy – which progressively replaced conventional soy entirely – has been accompanied with a sharp increase in pesticide use (Crespo, 2020). Organic soy production is extremely limited. There are interesting new interinstitutional initiatives to promote sustainable practices in the agribusiness sector, including the reduction of pesticide use, centered on the demonstration of potential economic gains with increased input efficiency[4].

Agro-environmental policies around the world

The recognition of the severe limitations of conventional agriculture has led to policy efforts to regulate the sector and generate incentives to shift agricultural production towards more sustainable practices. There are thousands of agro-environmental policies around the globe aiming to improve environmental sustainability in agriculture. The scale of implementation (from local to supranational), scope (biodiversity, soils, fertilizer use, etc.) and approach (legislation, monitoring, regulation, etc.) of these policies varies greatly. In a revision of over 6,000 policies established between 1960 and 2022 in about 200 countries, Wuepper et al. (2024a) found that the number of policies implemented has been increasing over time with over 70% of them enacted since 2000 (and 40% since 2010). The researchers found that about 50% of policies consist of new legislation and another 25% of new regulations, while payments for environmental services, frameworks, and monitoring instruments are significantly less common. The agro-environmental policies they reviewed are mostly concerned with fertilizer management (33%), forests (15%), soils (14%), biodiversity (12%), pesticide use (11%), and land use (10%)[5] . The geographic distribution of the policies is not homogeneous either. There is a correlation between gross domestic product (GDP) and number of policies, with the caveat that variance increases at higher GDP levels (Wuepper et al., 2024). The European Union (EU) concentrates the highest number of agro-environmental policies, and the African continent the lowest (Wuepper et al., 2024a; Ritchie, 2024). Enforcement also tends to be higher in countries with higher GDP and lower corruption levels (Wuepper et al., 2024a). It is worth noting though, that given that most agro-environmental policies are centered around fertilizer management, countries with high fertilizer use have more reasons to enact policies than countries with low fertilizer use (such as most countries in Africa) (Ritchie, 2024).

While there is still a need for comprehensive analysis on the effectiveness of these different instruments, there is some evidence that, when carefully designed, the adoption of agri-environmental policies leads to better environmental outcomes. Studies of discontinuities in environmental indicators between

4 https://www.landinnovation.fund/es/biblioteca-de-proyectos-es-paol/practicas-regenerativas-este-bolivia

5 Some if not most policies address more than one of these issues.

neighboring countries which control for other factors have shown that agro-environmental policy adoption does have an impact: about 43% of the differences in soil erosion rates can be attributed to soil-related agro-environmental policies (Wuepper et al., 2024a), and a third of differences in pesticide use can also be traced back to policies (Wuepper et al., 2023), as well as about 22% of tree cover loss risk (Wuepper et al., 2024b). In China, for example, the adoption in 2015 of "zero-growth" policies for chemical fertilizers and pesticides has led to rapid decreases in chemical fertilizer use per hectare and overall decreases in pesticide use (Ritchie, 2024). For fertilizers, the "zero-growth" policy focuses on soil-testing to adjust fertilizer quantity, prioritizing the use of improved or organic fertilizers, and managing cropland to improve soil fertility over time (Jin and Zhou, 2018). For pesticides, the policy focuses on pest monitoring and early warning systems, scientific use of pesticides, replacement of high toxicity products with lower toxicity ones, and integrated pest control (Jin and Zhou, 2018).

However, agro-environmental policies can have negative impacts – environmental and otherwise – if they do not consider trade-offs with other sectors or goals, or if they fail to account for spill-over effects (Ritchie, 2024). Some agro-environmental policies can lead to decreased yields and production, jeopardizing food security and livelihoods (e.g. the abrupt and strict ban on chemical fertilizer imports in Sri-Lanka in 2021 led to massive declines in food production and exports), or lead to the displacement of food production to countries with less stringent regulations, leading to overall increases in pollution or GHG emissions at the global scale (Ritchie, 2024; Smith et al., 2019). Thus, agro-environmental policies need to be carefully designed with a systems perspective that considers interactions between context, multiple goals and sectors (e.g. energy production, water management, poverty reduction, equity, etc.), and scale.

Trade agreements and regulations are also policy tools that are increasingly incorporating environment-related provisions for agricultural commodities. Indeed, a significant portion of all

agricultural production in the world is embedded in international trade and importing countries are increasingly recognizing their role in reducing the environmental externalities of their consumption. Of the 318 regional trade agreements established between 1957 and 2019, 131 included at least one environment-related provision, of which 71 (or 22% of all the agreements) explicitly targeted interactions between the environment and agriculture (Matoo et al., 2020). For example, the Common Market for Eastern and Southern Africa (COMESA) includes provisions for the reduction of transboundary air and water pollution arising from agricultural activities and the use of chemical fertilizers and pesticides (FAO, 2022b). As with jurisdiction focused agro-environmental policies, there is incipient evidence that environment-related provisions in trade agreements can have positive effects on environmental outcomes if they are equipped with a robust political and legal framework addressing environmental externalities (FAO, 2022b). However, attention should be given to evaluating and preventing potential spill-over effects to countries not included in the agreements (FAO, 2022b).

Similarly, voluntary third-party "green" certification schemes (e.g. organic agriculture standards, Rainforest Alliance's Roundtable on Sustainable Palm Oil) are increasingly being encouraged – and occasionally adopted – by trade agreements (FAO, 2022b). The most ambitious example so far is the enactment in 2023 of the European Union's regulation on deforestation-free products (EUDR; 2023/1115) which will require that all cattle, cocoa, coffee, oil palm, rubber, soy, and timber products that make it to the EU's market be guaranteed deforestation-free (compared to a 2020 baseline) by the end of 2024. While this regulation is expected to have significant positive impact on environmental outcomes in supplier countries, it also raises significant challenges for traceability and compliance, especially for small-scale producers (RECOFTC, 2024). The exclusive focus on forests has also raised concerns about the potential displacement of harmful agricultural expansion to savannas, fragile grasslands, and wetlands – all critical for biodiversity and other ecosystem services worldwide (FSC, 2022; Bergau et al., 2023).

In this context, monitoring and measuring advances in the sustainable transformation of agriculture is key. In that sense, frameworks and platforms have been created, which do not necessarily propose specific practices, but set principles, generate dialogue to advance the agenda, and introduce recommendations on monitoring and reporting mechanisms.

- Regen 10 is a collective action plan designed to scale regenerative food production systems worldwide within a decade. The initiative aims to transform agricultural systems so that by 2030, over 50% of the world's food can be produced in a way that drives positive outcomes for people, nature and climate. Regen 10 is based on 10 principles that include farmer-centricity, resilience, landscape-alignment, equity, fairness, rights, diversity, healthy climate, collaboration, partnership, inclusivity, transparency, innovation, and ongoing learning [6].

- The Task Force on Nature-related Financial Disclosures (TNFD) has developed a set of disclosure recommendations and guidance that encourage and enable businesses and finance to assess, report, and act on their nature-related dependencies, impacts, risks, and opportunities. The recommendations are structured around four pillars: governance, strategy, risk and impact management, and metrics and targets[7] . This framework is essential for companies in the food sector or those with supply chains rooted in agricultural lands, as it provides a road map for ensuring that the private sector can support producers appropriately in the systemic transformation towards sustainability.

- Natural capital accounting (NCA) is the process of calculating the total stocks and flows of natural resources and ecosystem services provided by nature's different ecosystems (Lars Hein et al., 2020). Because agriculture relies heavily on natural capital, quantifying and understanding the relationship between production and the ecosystem is important, and this method provides the necessary data to do so (FAO, 2015). If properly applied, it can be an approach to understanding farming that puts nature on the balance sheet alongside the sales from produce.

Agro-environmental policy landscape in Bolivia

Bolivia has a complex regulatory landscape that simultaneously fosters and hinders sustainable agro-environmental practices. Bolivian society has been discussing environmental policy aimed at achieving sustainable development since the 1990s (e.g. Environmental Law 1333 of 1992, Forestry Law 1700 of 1996, land-use and territorial plans, National Biodiversity Management Strategy, watershed management plans, etc.) (Calvo and Baudoin Farah, 2021). The 2009 Constitution cemented provisions

for environmental management in general (e.g. articles 9, 33, 342, and 345) but also for agroecological practices specifically (articles 405, 406, 407, 408, and 409) alongside enshrining the right to food (article 16) (Calvo and Baudoin Farah, 2021; Rivero Lobo, n.d.). Other legislation has more specifically advanced the framework of the rights of nature (Law 71 of the Rights of Mother Earth and Framework Law of Mother Earth and Integral Development for Living Well or Law 300, both from 2012); the promotion and regulation of agroecological products, including the creation of the Nacional Council of Ecological Production (Consejo Nacional de Producción Ecológica – CNAPE) and the "ecological product" national label (Law 3525 of 2006); the promotion of sustainable agriculture based on family farming and food sovereignty (Law 144 of 2011); the promotion of associativity in family farming in the framework of food sovereignty (Law 338 of 2013); and planning mechanisms at the national level that include territorial planning, comprehensive development conceptions, and climate change management (Law 777 of 2016) (Calvo and Baudoin Farah, 2021; Rivero Lobo, n.d.). According to the database compiled by Wuepper et al. (2024), Bolivia has about 18 agro-environmental policies[8] .

However, these policies not only lack institutional frameworks and financing to be effectively implemented, but they are also undermined by a series of other policies that concurrently promote unsustainable practices in agriculture and the expansion of the agricultural frontier (Rivero Lobo, n.d.), such as:

- Laws that establish exceptions to Forestry Law 1700 and condone deforestation and the use of fire to clear land in exchange for a small infraction fee and the registration of burnt or deforested areas in the "program of food production and forest restitution" (Laws 337 of 2013, 502 of 2014, 739 of 2015, 952 of 2017, and 1171 of 2019) (Villalobos, 2020).

- Laws that allow the expansion of the agricultural frontier over forests with increases in the allowances for deforestation for smallholders (Law 741 of 2015), extensions in the verification period of the socio-economic function of land use (which encourages land speculation) (Law 740 of 2015), and the promotion of the expansion of the area dedicated to biofuels (Law 1098 de 2018) (Villalobos, 2020).

- The authorization, despite their prohibition in the 2009 Constitution, of genetically modified seeds (GMO). The use of GMO seeds is particularly problematic because the authorized varieties are resistant to glyphosate and thus imply the use of highly toxic pesticides (Decree 3874 of 2019).

- New land use plans in Santa Cruz and Beni that allow the expansion of the agricultural frontier in forested areas, natural savannas, and wetlands.

6 https://regen10.org/
7 https://tnfd.global/publication/recommendations-of-the-task-force-on-nature-related-financial-disclosures/

8 Compared to over 90 in the EU

Recommendations for Bolivia

In Bolivia, addressing the environmental challenges posed by agriculture requires concerted efforts to promote sustainable land management practices and support diversified farming systems. Given that about 25% of the population depends on the sector for their livelihoods (Colque, 2020), the country faces a significant challenge in curtailing deforestation and environmental degradation while safeguarding livelihoods and food security for its population. This means adjusting, designing and implementing public policies centered around land governance and stewardship for sustainable development. Given international experience and the country's context, for Bolivia to achieve the sustainable transformation of its agricultural sector, we recommend that:

- Agro-environmental regulations are reviewed and organized to guarantee their coherence with the Constitution and Environmental Law 1333. This will mean that some laws and decrees will need to be revoked, while others are adjusted or strengthened. Provisions for agroecological production should be centered on public policy instruments, while responsibilities and sanctions for environmental damages from the agricultural sector should be defined and enforced (Calvo and Baudoin Farah, 2021). Policy incentives for the expansion of the agricultural frontier should be eliminated.

- Establish an independent and rigorous monitoring system of the performance of the agricultural sector – including in environmental terms – in conjunction with academia, NGOs, and producers.

- Generate scientific information to guide planning, zoning, and land use from an integrated and sustainable perspective that concurrently analyzes needs for food production, energy generation, water management, and conservation.

- Regulate the import and use of pesticides, prohibiting highly toxic substances and promoting the implementation of integrated pest control.

Given the differentiated challenges of family farming and the agribusiness sector, specific recommendations also need to be differentiated. For small-scale producers and family farming we recommend to:

- Center agro-environmental and food production policy on the promotion of (i) fresh agroecological products for local and national markets, (ii) highly demanded organic products for export, (iii) aggregated value and transformation.

- Invest in and strengthen organizational capacity for small producers to access markets under better conditions.

- Promote and support territorial and climate change management through: (i) integrated watershed management and reforestation, (ii) optimization of water management and irrigation systems (rain harvesting, water storage, etc.), (iii) soil management and gully control, and (iv) strengthening of risk management systems including local climate prediction systems (Calvo and Baudoin Farah, 2021).

- Support the transition to organic or agroecological production through specialized credit programs and innovative certification mechanisms (like participatory guarantee systems).

- Support the conservation and recovery of agrobiodiversity through the establishment of locally managed seed banks.

- Promote the development of knowledge and skills through conventional, alternative and adult education processes that rescue and strengthen traditional ecological knowledge and complement it with approaches related to agroecological production, territorial and watershed management, soil management, business organization, and marketing (Calvo and Baudoin Farah, 2021).

For the agribusiness sector specifically, we consider that the concept of "sustainable intensification" is useful (Friedrich, 2020). It is not merely an intensification in capital or technology, but in management practices that allow recovering the productive potential of soils (Friedrich, 2020). In that sense, we recommend to:

- Stop the expansion of the agricultural frontier in forested areas, natural savannas, and wetlands. Bolivia does not need more cultivated areas (Calvo and Baudoin Farah, 2021). The amount of agricultural land per capita in Bolivia is 3.61 ha/hab compared to 0.61 ha/hab in the world (1.23 ha/hab in South America and 0.99 ha/hab in high-income countries)[9] . An implication of the above recommendation is the need to better regulate the concentration of land to reduce socioenvironmental conflict and enhance social justice, which is also a pillar of sustainability.

- Develop environmental responsibility policies for agribusinesses. Public policies should be aimed at generating incentives for sustainable production and regulating practices that deteriorate the country's productive and natural capital (Calvo and Baudoin Farah, 2021). The private sector should be involved in the design of sustainability standards based on efficiency gains through the preservation of the ecosystems that sustain agricultural production (e.g. through integrated water, soil, and pest management, as well as diversification).

Finally, in addition to the policy-oriented actions described above, the State should also pilot programs that can provide guidance to the whole sector and decision makers in key areas that can advance the agricultural sustainability agenda. One of these areas is concerted support for the different stakeholders in the value chain of priority crops to implement sustainability measures. Because producers make decisions based on the requirements and opportunities presented by off-takers, and these in turn consider wholesalers and ultimately retailers, the only way to aspire to a sustainable sector is working with the whole value chain. Some initial actions that could be implemented in a pilot program include:

- Empower farmer organizations and cooperatives to collectively bargain for better prices and to access markets. This process should include providing organizational development support, facilitating knowledge-sharing and peer-to-peer learning among farmer groups, and training smallholder farmers on sustainable farming techniques, such as nutrient cycling, diversification, and integrated pest management, to improve productivity and resilience.

- Implement traceability and certification systems, to support the adoption of organic, Participatory Guarantee Systems (PGS), or other relevant certification schemes to verify the sustainability claims of agricultural products. The pilot certification should include or develop robust traceability systems to ensure the integrity and authenticity of sustainable agricultural products, building consumer trust and demand. There is probably an opportunity to leverage the cultural and nutritional value of traditional Andean crops to develop niche market opportunities that preserve indigenous knowledge and promote food sovereignty.

9 Includes grazing areas. Our World in Data: https://ourworldindata.org/grapher/agricultural-area-per-capita?country=BOL~OWID_WRL~OWID_SAM~High-income+countries

References

Baudoin Farah, A., Calvo, L. M., and Wanderley, F. (2021). Seguridad alimentaria y producción de alimentos. Bolivia debate: un futuro sustentable, pgs. 25-31. La Paz: Página Siete

Bergau, et al. (2023). Why the new EU Deforestation Regulation should include 'Other wooded land'. Rainforest Foundation Norway. Available at: https://dv719tqmsuwvb.cloudfront.net/documents/EUDR-and-other-wooded-land.pdf

Bickel, U. (2018). Uso de plaguicidas por productores familiares en Bolivia. Impactos en la salud, los ecosistemas y la economía campesina. Alternativas agroecológicas y conclusiones para lograr una orientación hacía una mayor sostenibilidad. Rostock University (master's thesis), Germany

Bossio D., Obersteiner M., Wironen M., Jung M., Wood S., Folberth C., Boucher T., Alleway H., Simons R., Bucien K., Dowell L., Cleary D., Jones R. 2021. Foodscapes: Toward Food System Transition, The Nature Conservancy, International Institute for Applied Systems Analysis, and SYSTEMIQ, ISBN: 978-0-578-31122-7

Brito, T.P., de Souza-Esquerdo, V.F. and Tasca, L.H.C. Agrobiodiversity in Participatory Guarantee Systems (PGS). Org. Agr. (2024). https://doi.org/10.1007/s13165-024-00468-3

Calvo, L. M. and Baudoin Farah, A. (2021). Desafíos de la gestión ambiental en Bolivia. Bolivia debate: un futuro sustentable, pgs. 32-38. La Paz: Página Siete

CBF. (2015). 38% del territorio boliviano sufre una alta desertificación. Cámara Forestal de Bolivia, 21 de octubre de 2015

Crespo, M. A. (2020). Contexto global de la agricultura. In Friedrich et al.: Memoria. Situación, perspectivas y desafíos económicos y socioambientales de la agroindustria en Bolivia. Serie Bolivia Debate: un futuro sustentable, No. 2. La Paz: Instituto Socioambiental ISA Bolivia, Universidad Católica Boliviana "San Pablo" UCB, Fundación Jubileo, Plataforma Digital "La Pública", Organización de Naciones Unidas en Bolivia. Available at: http://ftierra.org/index.php?option=com_mtree&task=att_download&link_id=200&cf_id=52

Czaplicki Cabezas, S. (2023). The hidden crisis of deforestation in Bolivia. Global Canopy, August 23rd, 2023. Available at: https://globalcanopy.org/insights/insight/the-hidden-crisis-of-deforestation-in-bolivia/

FAO. (2014). Healthy soils are the basis for healthy food production. Available at: https://openknowledge.fao.org/server/api/core/bitstreams/4fb89216-b131-4809-bbed-b91850738fa1/content

FAO. (2015). Natural Capital Impacts in Agriculture. Supporting better business decision-making. Retrieved from: Final_Natural_Capital_Impacts_in_Agriculture_-_Supporting_Better_Business_Descision-Making_v5.0.pdf (fao.org)

FAO. (2018). The 10 elements of Agroecology. Available at: https://www.fao.org/agroecology/overview/overview10elements/en/

FAO. (2022a). FRA 2020 Remote Sensing Survey. FAO Forestry Paper, No. 186. Rome

FAO. (2022b). The State of Agricultural Commodity Markets 2022. The geography of food and agricultural trade: Policy approaches for sustainable development. Rome, FAO. https://doi.org/10.4060/cc0471en

FAO. (n.d.). What is agroecology? Available at: https://www.fao.org/agroecology/overview/en/

Friedrich, T. (2020). Modelos agroindustriales y de producción de alimentos sustentables. In Friedrich et al.: Memoria. Situación, perspectivas y desafíos económicos y socioambientales de la agroindustria en Bolivia. Serie Bolivia Debate: un futuro sustentable, No. 2. La Paz: Instituto Socioambiental ISA Bolivia, Universidad Católica Boliviana "San Pablo" UCB, Fundación Jubileo, Plataforma Digital "La Pública", Organización de Naciones Unidas en Bolivia. Available at: http://ftierra.org/index.php?option=com_mtree&task=att_download&link_id=200&cf_id=52

FSC. (2022). FSC welcomes the new EU Regulation on deforestation-free products – and is ready to work for effective enforcement on the ground. FSC, December 15th, 2022. [Online resource]. Available at: https://fsc.org/en/newscentre/fsc-welcomes-the-new-eu-anti-deforestation-regulation

Hallstein, E. and Iseman, T. (2021). Nature-based solutions in agriculture – Project design for securing investment. Virginia. FAO and The Nature Conservancy

IPBES. (2018). Media Release: Worsening Worldwide Land Degradation Now 'Critical', Undermining Well-Being of 3.2 Billion People. IPBES, March 26th, 2018. Available at: https://www.ipbes.net/news/media-release-worsening-worldwide-land-degradation-now-%E2%80%98critical%E2%80%99-undermining-well-being-32

IPCC. (2019). Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press.

Iseman, T. and Miralles-Wilhelm, F. (2021). Nature-based solutions in agriculture: The case and pathway for adoption. FAO

Jin, S. and Zhou, F. (2018). Zero Growth of Chemical Fertilizer and Pesticide Use: China's Objectives, Progress and Challenges. Journal of Resources and Ecology, 9(1): 50–58. DOI: 10.5814/j.issn.1674-764x.2018.01.006

Lars Hein, Kenneth J. Bagstad, Carl Obst, Bram Edens, Sjoerd Schenau, Gem Castillo, Francois Soulard, Claire Brown, Amanda Driver, Michael Bordt, Anton Steurer, Rocky Harris, and Alejandro Caparrós. (202). Progress in natural capital accounting for ecosystems. Science367, pgs. 514-515 (2020)

Mattoo, A., Rocha, N. and Ruta, M. 2020. Handbook of Deep Trade Agreements. Washington, DC, World Bank

Ministerio de Medio Ambiente y Agua – MMAyA (s.f.) Estrategia Nacional. Neutralidad en la degradación de las tierras (NDT) hacia el 2030 La Paz: MMAtA, pg. 7

MMAyA. (2020). MMAyA presenta la primera colección de abejas polinizadoras de la castaña en Bolivia. Ministerio de Medio Ambiente y Agua, January 31st, 2020. Available at: https://www.mmaya.gob.bo/2020/01/31/mmaya-presenta-la-primera-coleccion-de-abejas-polinizadoras-de-la-castana-en-bolivia/

Ndi, F. A. and Batterbury, S. (2017). Land Grabbing and the Axis of Political Conflicts: Insights from Southwest Cameroon. Africa Spectrum, 52(1), pgs. 33-63. https://doi.org/10.1177/000203971705200102

Newton, P., Civita, N., Frankel-Goldwater, L., Bartel, K., and Johns, C. (2020). What is regenerative agriculture? A review of scholar and practitioner definitions based on processes and outcomes. Frontiers in Sustainable Food Systems, 4, 577723

Pingali, P. L. (2019). The Green Revolution and Crop Biodiversity. In: Dasgupta P, Raven P, McIvor A, eds. Biological Extinction: New Perspectives. Cambridge University Press, pgs. 175-192

RECOFTC. (2024). Potential impacts of the EU Regulation on Deforestation-free Products (EUDR) on smallholders in Thailand and Indonesia – case studies on rubber, timber and coffee. RECOFTC. Available at: https://www.recoftc.org/sites/default/files/publications/resources/recoftc-0000469-0002-en.pdf

Reilly, J. R., Artz, D. R., Biddinger, D., Bobiwash, K., Boyle, N. K., Brittain, C., ... and Winfree, R. (2020). Crop production in the USA is frequently limited by a lack of pollinators. Proceedings of the Royal Society B, 287(1931), 20200922

Ritchie, Hannah (2024) – "How effective are policies in reducing the environmental impacts of agriculture?" Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/effective-policies-reducing-environmental-impacts-agriculture' [Online Resource]

Rivero Lobo, B. Z. (n.d.). Políticas públicas e inversión estatal en el sector agropecuario boliviano. Available at: https://cipca.org.bo/docs/publications/es/264_politicas-publicas-e-inversion-estatal-en-el-sector-agropecuario-boliviano.pdf

Simelton, E., Carew-Reid, J., Coulier, M., Damen, B., Howell, J., Pottinger-Glass, C., ... and Van Der Meiren, M. (2021). NBS framework for agricultural landscapes. Frontiers in Environmental Science, 9, 678367

Smith, L.G., Kirk, G.J.D., Jones, P.J., and Williams, A. G. (2019). The greenhouse gas impacts of converting food production in England and Wales to organic methods. Nature Communications, 10, 4641. https://doi.org/10.1038/s41467-019-12622-7

Sun, S., Sidhu, V., Rong, Y. et al. Pesticide Pollution in Agricultural Soils and Sustainable Remediation Methods: a Review. Curr Pollution Rep 4, pgs. 240-250 (2018). https://doi.org/10.1007/s40726-018-0092-x

Thaler, E. A., Kwang, J. S., Quirk, B. J., Quarrier, C. L., and Larsen, I. J. (2022). Rates of historical anthropogenic soil erosion in the midwestern United States. Earth's Future, 10(3), e2021EF002396

UN Water. (2023). Blueprint for Acceleration: Sustainable Development Goal 6 Synthesis Report on Water and Sanitation 2023

Villalobos, G. (2020). Las leyes incendiarias de Bolivia. Fundación Solón, February 20th, 2020. Available at: https://fundacionsolon.org/2020/02/20/las-leyes-incendiarias-en-bolivia/

Villalobos, G. (2021). Los agroquímicos más usados en Bolivia: entre toxicidad y prohibiciones internacionales. Fundación Solón, May 20th, 2021. Available at: https://fundacionsolon.org/2021/05/20/los-agroquimicos-mas-usados-en-bolivia-entre-toxicidad-y-prohibiciones-internacionales/

Willer, H., Schlatter, B. and Trávníček, J. (2023). The World of Organic Agriculture. Statistics and Emerging Trends 2023. FiBL, IFOAM – Organics International. DOI: 10.5281/zenodo.7572890

Wuepper, D., Crowther, T., Lauber, T., Routh, D., Le Clec'h, S., Garrett, R. D., and Börner, J. (2024). Public policies and global forest conservation: Empirical evidence from national borders. Global Environmental Change, 84, 102770 https://www.sciencedirect.com/science/article/pii/S095937802300136X

Wuepper, D., Tang, F. H. M. and Finger, R. (2023). National leverage points to reduce global pesticide pollution. Global Environmental Change, 78, [102631]. https://doi.org/10.1016/j.gloenvcha.2022.102631

Wuepper, D., Wiebecke, I., Meier, L., Vogelsanger, S., Bramato, S., Fürholz, A., and Finger, R. (2024). Agri-environmental policies from 1960 to 2022. Nature Food 5, 323–331. https://doi.org/10.1038/s43016-

Researchers

Andrea Baudoin Farah - Assistant Professor, Colorado State University.
Carlos Solis - Economist, The Nature Conservancy.

INSTITUTO DE ESTUDIOS AVANZADOS EN DESARROLLO

IDRC · CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

https://mattersoftaste.com.au/wp-content/uploads/2016/09/KIDS-HANDS-WITH-PLANTS.jpg