Growth Lab

Bolivia's Economic Pivot: Agricultural Potential and Challenges

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About the Growth Lab

The Growth Lab at Harvard University's multidisciplinary team, led by Professor Ricardo Hausmann, pushes the frontiers of research on economic growth and development policy. The Lab advances academic research on the nature of economic growth and conducts applied, place-based engagements that aim to understand context-specific growth processes, address key constraints, and identify promising opportunities. Through its research and teaching activities, the Lab has become a global thought leader offering breakthrough ideas, methods, and tools — including Growth Diagnostics, Economic Complexity and Green Growth — that help practitioners, policymakers, and scholars understand how to accelerate economic growth and expand opportunity across the world. Consistent with the mission of the Harvard Kennedy School of Government, in which the program is housed, the Lab works to expand capabilities for improved economic policy-making such that more people and societies can enjoy higher levels of wellbeing through stronger, more sustainable, and more inclusive economic growth processes.

About the Series

The "Bolivia's Economic Pivot" series, produced by the Growth Lab, comprises seven documents: (1) Main findings and reform priorities, which integrates and synthesizes the six thematic studies in the series (Hausmann et al., 2026); (2) The Making of a Macroeconomic Crisis (García et al., 2026); (3) Early Macroeconomic Achievements and Remaining Challenges (Arcay et al., 2026); (4) Reviving the Energy Sector (Lamby et al., 2026); (5) Unlocking the Mining and Lithium Potential (Lamby & Hausmann, 2026); (6) Opportunities and Challenges in Agriculture (Shah et al., 2026); and (7) A Growth Diagnostics of the Tourism Sector (Freeman & Hausmann, 2026). See references.

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We note that the views expressed in this report are solely those of the authors and do not necessarily reflect the views of those acknowledged here.

Data and Information Disclaimer

This report is based exclusively on publicly available information and statistics at the time of writing. Official datasets in Bolivia are often outdated, incomplete, or published with significant lags, which limits the precision of certain estimates and the depth of the analysis. Where possible, these gaps have been addressed through secondary sources, historical trends, or internationally comparable data, though some figures should be interpreted as indicative rather than definitive. Given this, judgment was applied in preparing some of the numbers and calculations contained in this report, and any changes or developments occurring after February 28th, 2026, are not fully accounted for.

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1 Executive Summary

The analysis presented here focuses on pathways to unlock Bolivia's agricultural potential. Agricultural output has sustained high levels of growth in the recent past, exceeding growth rates observed in any other period in Bolivia since 1960, and outpacing most regional peers. This relatively successful dynamic could be improved by generating more growth from productivity gains rather than relying on the expansion of cultivated areas, and re-calibrating the food security policy framework that has left significant export potential unrealized. To make the most of Bolivia's diverse geography, we propose launching a coordinated, region-specific policy approach aimed at enabling each of Bolivia's distinct regions to reach its productive potential. The natural outcome would be accelerated growth and a diversified agricultural export basket that reflects the country's productive diversity.

Unlocking agricultural potential is a macroeconomic imperative. Bolivia is in the midst of a severe macroeconomic crisis driven by the collapse of its natural gas industry, which resulted in a substantial fiscal deficit and foreign exchange scarcity. Growing the agricultural sector and enabling producers to export is among the most immediate avenues available to generate the foreign exchange and fiscal revenues the country urgently needs.

The following sections examine the drivers and limitations of Bolivia's agricultural growth, identify recurring constraints, and conclude with policy recommendations.

1.0.1 Extensification over productivity

Agricultural growth has been driven primarily by expansions in area under cultivation rather than yields. Bolivia recorded the fastest growth in cultivated area since 2001 relative to all peers, and gains in area have far outstripped gains in yields. Agricultural labor productivity remains the lowest among all peers, and yields for key crops continue to underperform. Bolivia already possesses very high levels of agricultural land per capita, including high levels of cropland per capita, relative to peers. Continuing on this extensive growth path would imply additional deforestation, thus imposing large environmental costs, as well as threatening the loss of access to international markets for products related to deforestation. Furthermore, deforestation has mobilized social resistance that has become a constraint to infrastructure projects like the TIPNIS highway through the Amazon basin. Given these facts, policy priorities should instead shift toward policies that facilitate productivity growth and more efficient utilization of existing agricultural land.

1.0.2 Export restrictions and the food security framework

The prevailing policy emphasis on food security has constrained agricultural exports through a permit regime that prioritizes the satisfaction of domestic consumption before granting access to export markets. Export permits for agricultural produce are only granted if the authorities have deemed that there is enough supply to meet domestic demand, which leads to less predictability in the trade regime (World Trade Organization, 2017), in turn reducing producer confidence and therefore potential production growth. For example, in response to high international prices of beef in 2008, Bolivia banned exports in order to secure a larger quantity of domestic supply, with the goal of containing the price increase. However this logic did not take into account the supply-side response: producers reduced total beef production to such an extent that it led to a higher rise in domestic prices than those observed internationally (Garcia-Lembergman, Rossi and Stucchi, 2020). Not only do export quotas dampen the investment environment for producers, in this case they also did not meet their goal of containing price increases. Since then, Bolivia has suspended exports of soybeans, sugar, and beef on several occasions, as in 2021, 2022, and 2025 (Martinez, 2025).

Global trade of agricultural goods is highly regulated, and the state plays a central role in mediating access for its producers to the market. This includes activities ranging from establishing trade agreements which grant producers market access, to providing well-functioning logistics infrastructure and systems, phytosanitary inspection capacity, and more. Given Bolivia's landlocked status, such support plays an outsized role and can have significant impact. However, the particular way in which officials have pursued food security has come into conflict with the opportunity to expand trade agreements and allow Bolivians to provide high quality produce to the rest of the world.

1.0.3 Constraints and Policy Responses

An analysis of land use, productivity and diversification opportunities reveals a recurring set of key constraints that hold back agricultural output growth. These constraints can be organized along two dimensions: whether they primarily affect production, or affect market access, and whether they are the product of immediate policy choices or reflect deeper structural gaps (Figure 1).

Figure 1: Recurring Constraints to Agricultural Production in Bolivia

	Policy-created	Structural
Production	Restrictions on Transgenic Seeds Restrictions on international fertilizer use Weak regulatory framework for machinery registration	Underinvestment in R&D Lack of effective extension programs Irrigation
Market Access	Unpredictable export quotas and bans Limited phytosanitary agreements with key markets Limited trade agreements	Logistics Infrastructure Weak phytosanitary compliance capacity SENASAG inspection bottlenecks Landlocked Geography

Source: Own elaboration.

The policy-created constraints represent the most immediate opportunities for reform. Lifting restrictions on transgenic seeds alone is estimated to improve yields by 28% for soy and 84% for maize (ANAPO, 2024), and improving access to fertilizer and machinery while credibly committing to removing export restrictions would reduce uncertainty and improve the investment environment for producers. Developing phytosanitary agreements with new trading partners will require improving phytosanitary compliance capacity, but it is only in pursuing these relationships that the specific requirements and corresponding know-how can be developed and scaled up. The 2019 agreement with China on beef demonstrated that Bolivian producers can react quickly to supply the additional demand coming from new markets.

The structural constraints take longer to improve, but are critical for longer-term sustained growth. Bolivia has a wide range of geographic and social environments in which agricultural produce is grown, with each geography and crop combination facing its own particular set of constraints. Scaling up funding of more effective public or mixed R&D institutions to help tackle these local problems can push forward the productive frontier across the country — Embrapa in Brazil, which increased agricultural productivity by 110% through decentralized, region-specific public R&D, serves as a particularly useful model. At the same time, investing in an expanded and more effective agriculture extension program will accelerate diffusion solutions and help transfer knowledge of best practices to reduce the widespread productivity gaps between farmers. Bolivia has already committed to expanded irrigation through Law 745's Decade of Irrigation, and building on this foundation while reorienting investment toward commercially export-oriented irrigation can both raise productivity for farmers on existing lands (World Bank, 2019) and unlock the productive potential of underutilized agricultural land. Peru's Chavimochic and Olmos projects were integral to the success of its exports in new, diversified products such as mango, avocado, blueberries and asparagus by opening up land not previously conducive to agricultural use. Logistics infrastructure and phytosanitary compliance capacity require attention, particularly given Bolivia's landlocked geography and current costs imposed by inspection bottlenecks, estimated at up to 23% overruns for land transport (Sánchez and Wilmsmeier, 2014). Because these constraints interact differently across Bolivia's diverse geography, the specific policy package has to be adapted to local conditions.

The specific policy packages must be adapted to local conditions across Bolivia's diverse geography. Because these constraints interact differently across Bolivia's diverse agricultural zones, crop systems, and social arrangements, the specific combination of interventions needed will vary by region. This analysis can highlight recurring constraints for priority attention, but the specific actions to be taken must emerge from sustained engagement between ministries, producers, associations and civil society. Such a sustained, iterative process also crucially enables policy to update and adjust course as implementation proceeds and ground realities change.

We propose that Bolivia launch a National Strategy for Agricultural Potential, aimed at enabling each of Bolivia's distinct agricultural regions to reach its productive frontier. Following the model of Bolivia's National Agroecology Strategy, which organizes sustained policymaking around a clear objective, this strategy would create the institutional mandate to identify and address the particular constraints holding back each region and to assign responsibility for tackling them. The issue is not a lack of potential, but a shortage of the region-specific infrastructure, technology, research, extension, and market access needed to unlock it. A policy framework that is oriented around increasing the productive capabilities of the sector in each region is elaborated in the table at the end of this section. Export diversification — across products, markets, and geographies — is the natural outcome when more of Bolivia's regions are able to connect their distinct endowments to global demand.

The analysis of deforestation dynamics points to a distinct set of land governance reforms. Credible enforcement of the existing land use plan — and a clear commitment not to repeat the retroactive legalization of illegal clearing — is the most immediate priority. The FES (Funcion Economico Social) regime should be clarified so that landholders who keep forested land in its natural state are not at risk of expropriation, removing the preemptive clearing dynamic this fear creates. The regulatory framework governing smallholder and community forestry should be redesigned to enable genuine participation in legal forestry, raising the returns to keeping land forested. And investments in pasture productivity can decouple cattle herd growth from land expansion, easing pressure on the frontier. Together, these reforms would shift Bolivia's land use trajectory toward deliberate, planned management of the agricultural frontier — one that allows agricultural land expansion to maximize production gains and minimize environmental loss.

Policy Framework for a National Strategy for Agricultural Potential

Policy Priority	Description	Potential Action Areas
Improve Access to Markets	End unpredictable export bans and negotiate phytosanitary market access.	• Establish a rules-based, predictable trade framework with a credible commitment not to ban exports • Reform or eliminate the domestic supply certification requirement for export permits • Negotiate phytosanitary agreements with new trading partners together with producer associations • Invest in SENASAG capacity and turnaround times • Develop phytosanitary roadmaps for priority export products and destination markets
Improve Access to Inputs	Streamline agrochemical registration and legalize and regulate GM seeds.	• Conduct a targeted review of SENASAG's agrochemical registration process • Streamline the prior authorization process by supreme decree under Andean Community Decision 804 • Streamline the GMO approval process via supreme decree to enable faster, rules-based authorization • Legalize and regulate the GM varieties already in widespread informal use • Consider a zone-specific framework to balance social pressures
Improve Access to Infrastructure	Invest in logistics and transport, and scale irrigation for commercial agriculture.	• Invest in transport and logistics infrastructure • Reduce inspection and certification delays • Address bottlenecks at border crossings and transit corridors • Continue scaling up irrigation coverage • Reorient project design to match system scale with farm structure in highland and inter-Andean regions • Identify strategically located land suitable for large-scale, export-oriented irrigation investment
Improve Access to Knowledge	Build zone-specific R&D capacity and deploy extension networks.	• Increase INIAF funding and operational capacity • Build out an agricultural extension network across Bolivia's diverse geographic zones • Establish decentralized research capacity across distinct agroecological zones, drawing on Embrapa's model
Develop Sustainable Land Governance	Enforce the land use plan and protect forests; plan frontier expansion to maximize	• Credibly enforce the existing land use plan; stop retroactive legalization of illegal clearing • Clarify the FES regime so keeping land forested does not trigger expropriation risk

	productive value and minimize ecological loss.	• Redesign smallholder and community forestry regulation to enable participation in legal forestry • Facilitate investments in pasture productivity to decouple cattle growth from land expansion

2 Introduction

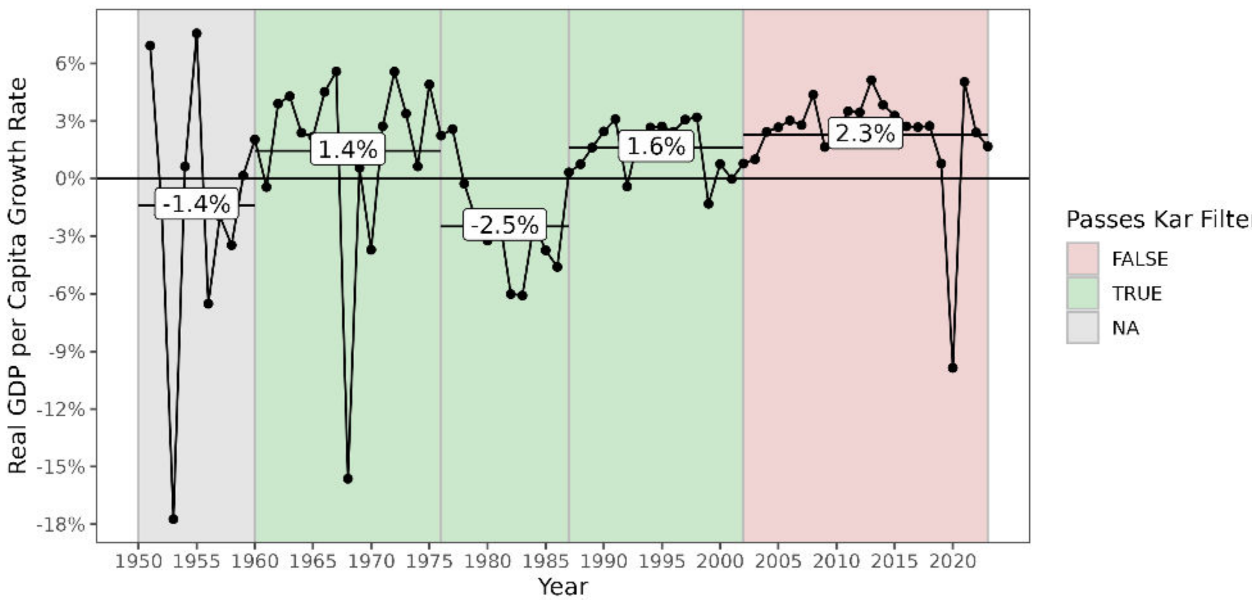
The analysis of Bolivia's agricultural sector is situated within the broader context of an ongoing macroeconomic growth diagnostic conducted by the Growth Lab. Bolivia is in the midst of a severe economic crisis, driven by an unsustainable policy mix that has produced an acute shortage of foreign exchange. Natural gas, a key source of foreign exchange and state revenue contracted significantly, while fiscal and monetary policies have failed to adjust accordingly. In light of this, the growth diagnostic emphasizes that policy should prioritize the generation of additional foreign exchange.

The agricultural analysis presented here therefore focuses on pathways to increase agricultural production and, in particular, to expand agricultural exports. The analysis begins by examining the growth dynamics of the agricultural sector, both across time within Bolivia and in comparison to regional peers. It then examines Bolivia's land use patterns to assess whether expansion of the agricultural frontier should remain a policy priority, including the dynamics of deforestation and the role of the land rights regime (see Appendix A.1). The analysis then turns to productivity, examining both crops that Bolivia currently produces at scale and extensive-margin products that Bolivia might plausibly develop, drawing on the example of Peru. These analyses surface a recurring set of constraints, which are collected and then organized into a framework for policy responses in the final section.

3 Context and Patterns of Growth

Bolivia has experienced five distinct economic growth regimes since 1950. We take a historical time series of Bolivia's real GDP per capita and statistically identify years in which patterns of growth change in order to demarcate specific 'eras' of growth, visualized in Figure 2. The test identifies the five distinct periods: from 1950-1960, 1960-1976, 1976-1986, 1986-2003, and 2003-2023. All but the last period pass the 'Kar filter' (Kar *et al.*, 2013) which is an additional test to check whether the difference in growth rates is significant enough to signify a real difference in the growth regime or not. The final period does not pass the Kar filter after incorporating post-2019 data, which includes the Covid-19 slowdown. We nontheless treat it as a distinct growth acceleration. The chart shows five different economic regimes. In the 1950s, Bolivia experienced negative GDP per capita growth on average of -1.4%. This was followed by a significant acceleration from 1960 to 1976, in which Bolivia experienced an average growth rate of 1.4%, immediately followed by a sharp deceleration to -2.5% between 1976 and 1986. Post 1986, the two periods are both growth accelerations, with average growth transitioning to 1.6% between 1986 and 2003, followed by another acceleration to 2.3% after 2003.

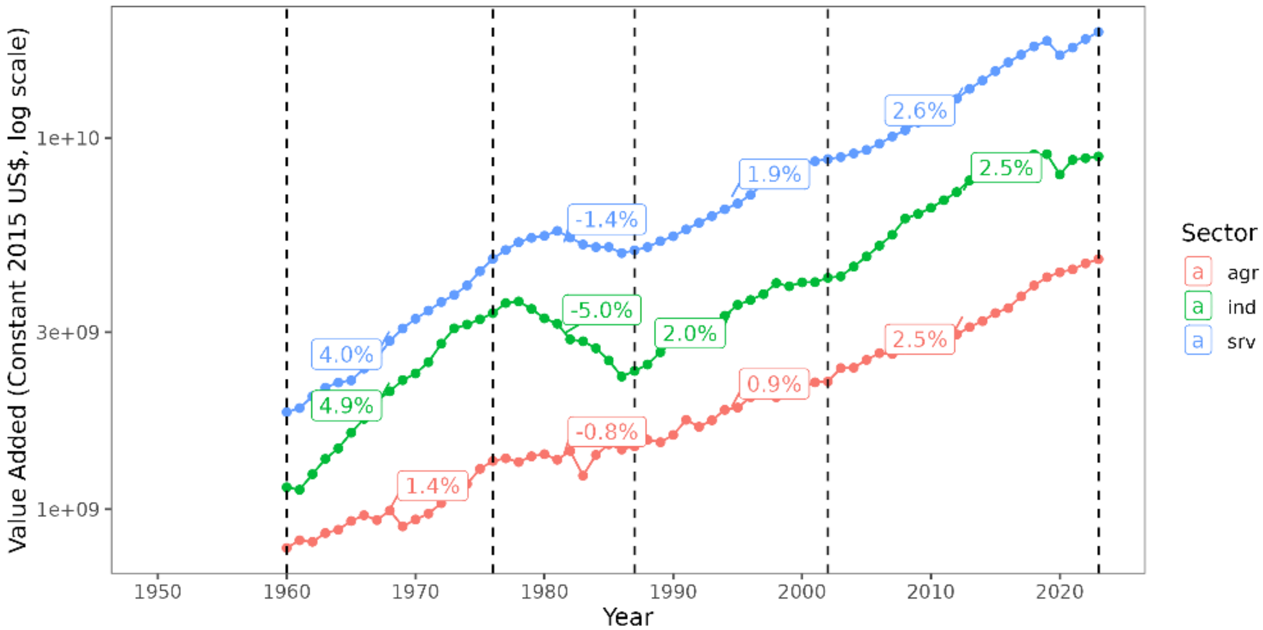
Figure 2: Growth Breaks



Source: Own calculations from Penn World Tables 11.0

The rate of growth of agriculture is highest in the most recent period. From 2003 until 2023, the average rate of growth of Agricultural value added in real terms per capita was 2.5% (Figure 3) This is the highest rate of growth in the agricultural sector across all of Bolivia's growth periods for which we have data, going back to 1960. The rest of this section examines the drivers of this growth.

Figure 3: Per Capita Sectoral Value Added over Time

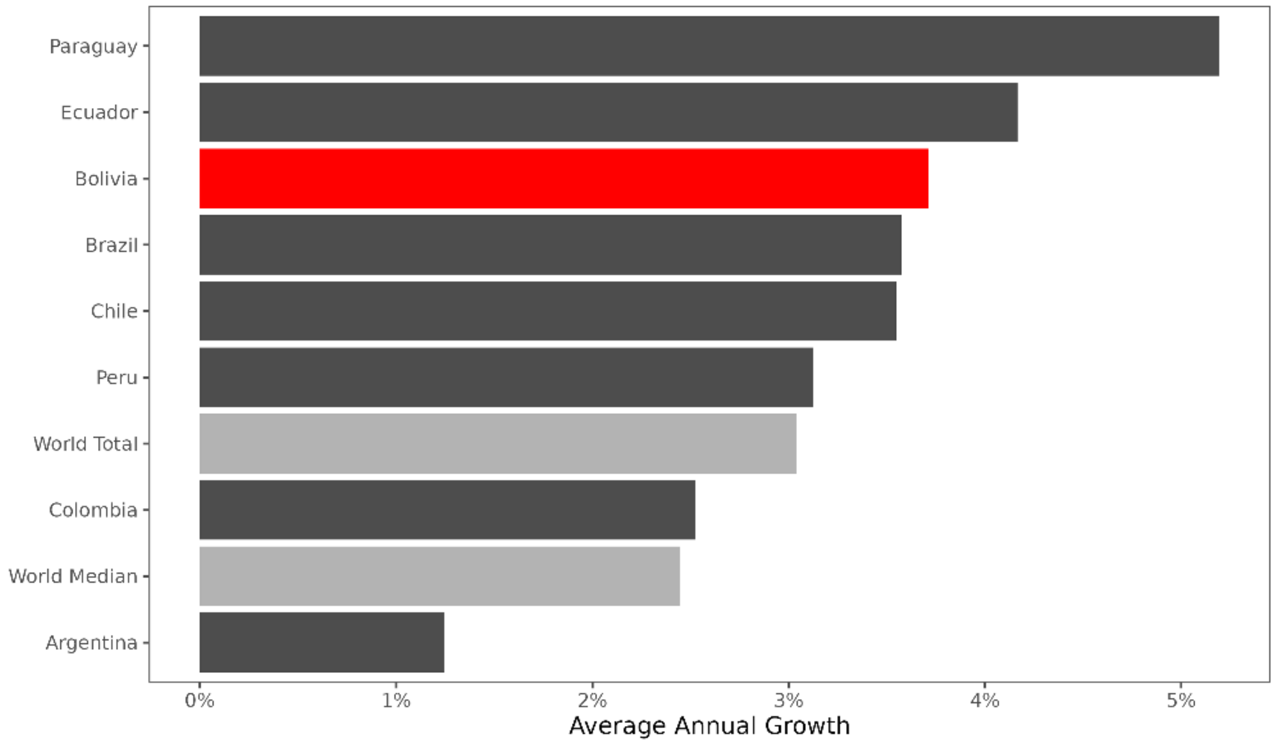


Source: Own elaboration using World Bank WDI

The recent rate of growth in agricultural value added is higher than the world average and comparable to peers. Figure 4 plots the average annual growth of value added in agriculture from 2003 to 2023 for Bolivia, Latin American peers, and both the world total and the world median country.[1] Bolivia grew faster than the world average while tracking broadly in line with Latin American peers.

[1] The world total represents the sum of all value added in agriculture across all countries, whereas the world median represents the median value of average annual growth across all countries.

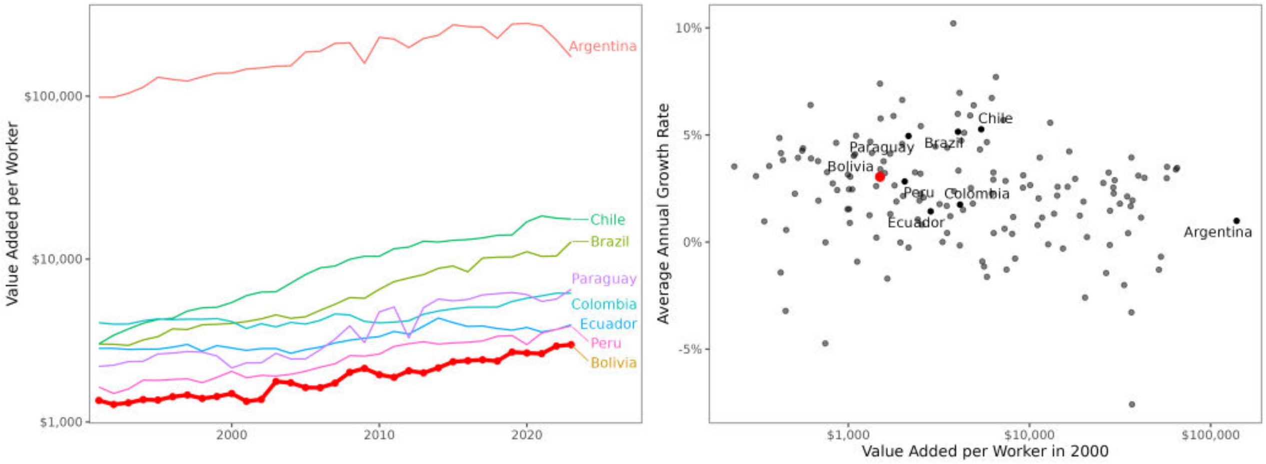
Figure 4: Agricultural Value Added Growth: Average Annual Growth 2003-2023



Source: Own elaboration using World Bank WDI

Bolivia's value added per worker in agriculture remains below all peers. Although Bolivia starts and ends the period with value added per worker lower than its peers, the growth rates of value added per worker were comparable. Figure 5 illustrates this below, as the line graph on the left shows how the levels of value added per worker have evolved over time, and the scatter to the right compares the average annual growth rates of value added per worker to peers and the rest of the world. By this metric, Argentina is one of the most productive agriculture economies in the world. Chile, Brazil and Paraguay started at a higher base and grew faster than Bolivia, leading to a widening gap in productivity levels. Peru is closest to Bolivia in terms of starting level, and grew at roughly the same pace. Ecuador's productivity per worker declined from 2014 onward, driven by a sharp influx of labor into the agricultural sector, while conversely, Colombia's value added per worker began growing quickly after 2012 following stagnation since 2000.

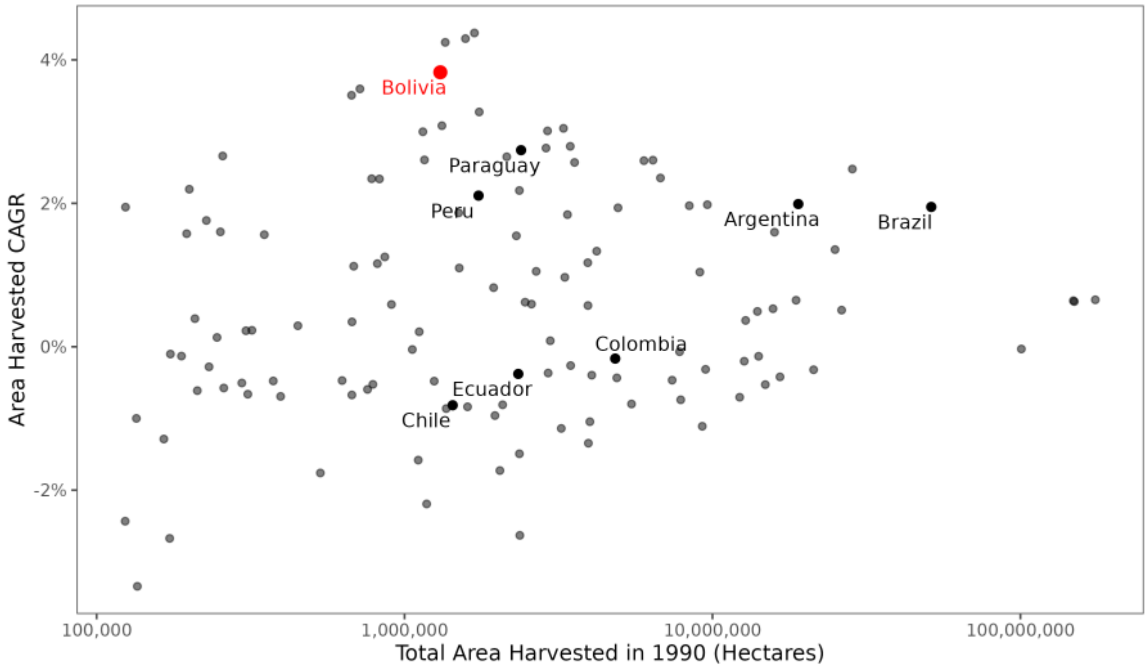
Figure 5: Value Added per Worker in Agriculture; Starting Level vs Growth



Source: Own elaboration using World Bank WDI

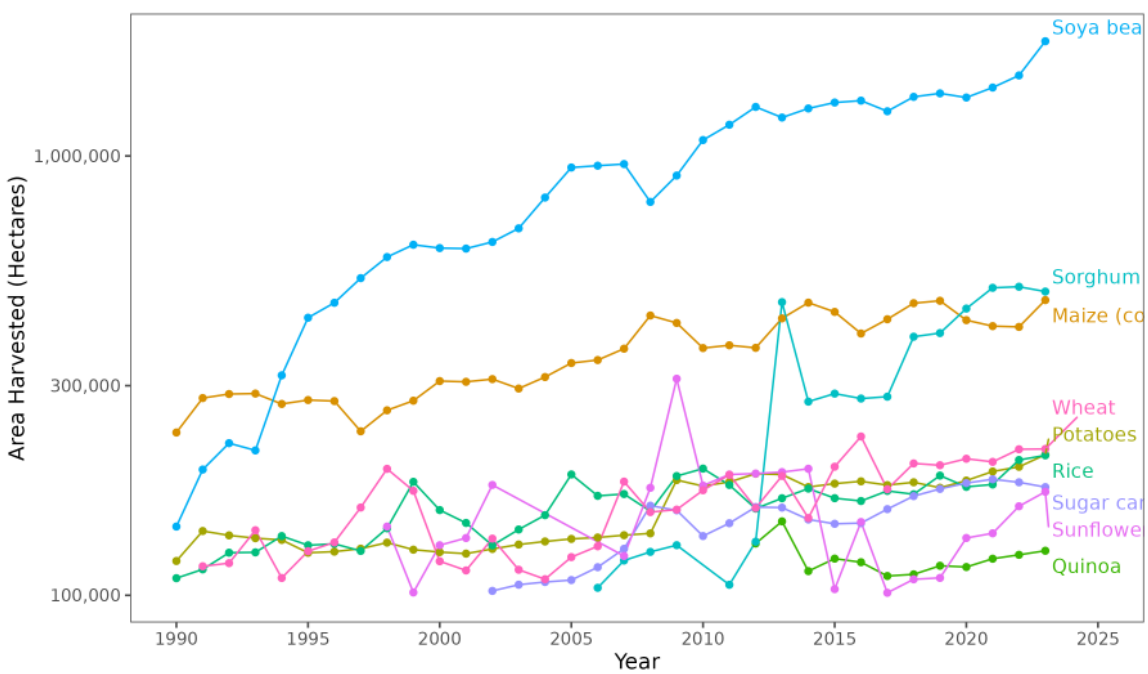
The total area under cultivation has expanded significantly. Figure 6 shows a scatter plot of the total area harvested in 1990 on the x axis, and the cumulative average annual growth of the total area harvested on the y axis. Bolivia's total area harvested growth is among the fastest in the world, including its peers. Figure 7 disaggregates this metric and shows the total area dedicated to each of the major crops of Bolivia and their evolution since 1990 using data from FAOSTAT. This figure first highlights the dominance of Soy relative to all other crops in terms of area dedicated to it. The area under soy cultivation increased some 12.5x since 1990, with the vast majority of this expansion taking place in the Santa Cruz region. Sorghum made a notable appearance in 2013, growing quickly to become the second most planted crop after Soy, closely followed by Maize. Sunflower seeds have also been growing in significant quantities, with the area dedicated to it fluctuating over this time period.

Figure 6: Total Area Harvested Growth by Country



Source: Own elaboration using FAOSTAT

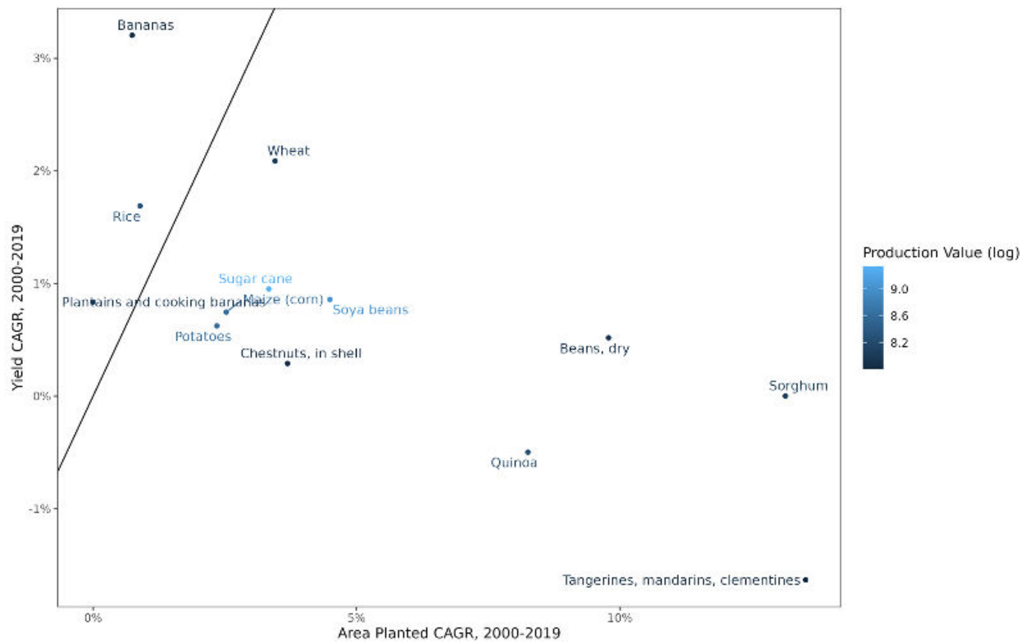
Figure 7: Bolivia Crop Areas over Time: Area Harvested by Crop



Source: Own elaboration using FAOSTAT

Agricultural production growth since 2000 has been driven by increases in the area under cultivation rather than yield growth. The total amount of a crop produced in kilograms is a function of the area under cultivation and the yield on that area. Figure 8 shows the cumulative average growth rate of the yield and the area planted since 2000 in Bolivia, as well as the 45 degree line to show the relationship between productivity growth and area growth. The majority of major crops have seen areas under cultivation expand far more significantly than yields. In line with the figure above, the area dedicated to soya beans has expanded almost 5% per year on average while yields have grown less than 1%. Quinoa has seen declining productivity while the area dedicated to it has expanded rapidly, and similarly for Sorghum. On the other end of the spectrum, Bananas and Rice have seen productivity gains outpace area growth.

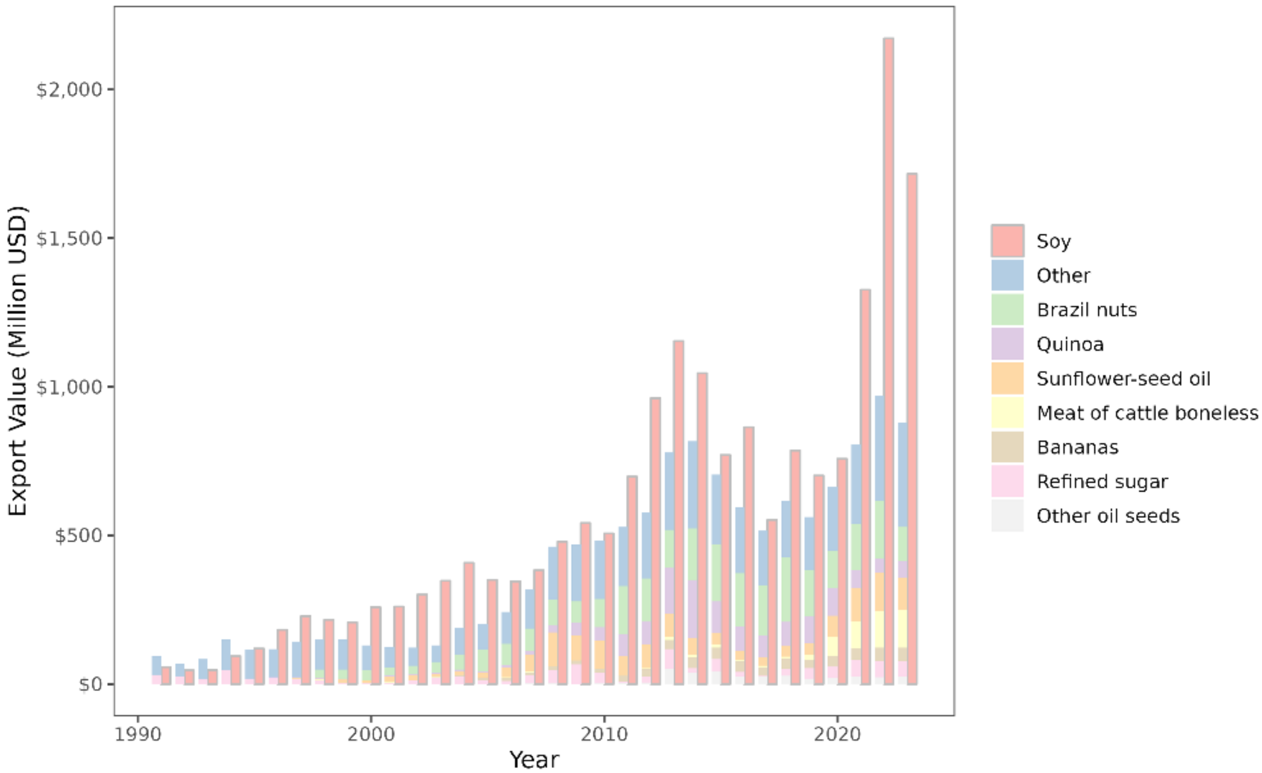
Figure 8: Decomposing Contribution to Crop Production Growth



Source: Own elaboration using FAOSTAT based on 5 year rolling averages

As the area under cultivation expanded, so did agricultural export value. Total export value as measured by FAOSTAT increased steadily from the 1990s, and then saw an acceleration in 2003 coinciding with Bolivia's growth break. The vast majority of the increase in land under cultivation was for soya beans, and this too is reflected in the export composition. Figure 9 illustrates that Soy-derived products - soy beans, soy oil, and soy meal cakes - grew to become more than half of the overall agricultural export basket in 1994, and continues to dominate the composition of agricultural exports until today. The rates of growth for all other agricultural products for export began to accelerate after 2003, with significant contributions from Sunflower-seed oil, a Quinoa boom post 2013, and a significant expansion of Brazil nuts for export. In 2019, meat from cattle begins to be exported, growing quickly to become the second-most exported product after soybeans in 2023.

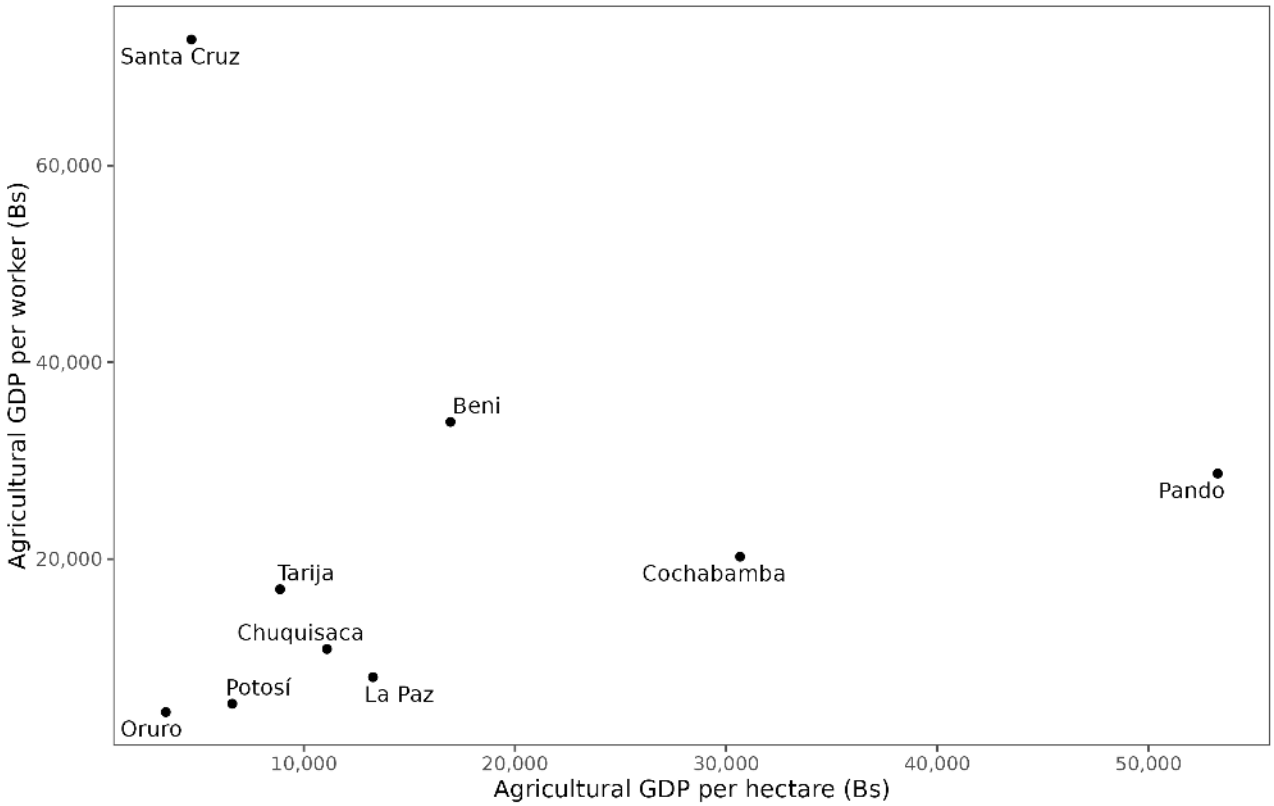
Figure 9: Bolivia Agricultural Exports



Source: Own elaboration using FAOSTAT

As Bolivia's output became increasingly dominated by Soy, agricultural production became increasingly concentrated in Santa Cruz. Santa Cruz, which is the largest of Bolivia's nine departments and occupies roughly one-third of the country's area, generates approximately 50% of total agricultural GDP and is home to the vast majority of Bolivia's soy production. The department is dominated by modern commercial agribusiness, with relatively developed input and capital markets (World Bank, 2019). This dominance is the product of a major expansion of land under cultivation over the past several decades, coinciding with mass migration into the department: in the 1950s, Santa Cruz represented only 9% of cropped area, growing to 60% by 2013 (World Bank, 2019). The flat land, rich soils, and weather patterns in Santa Cruz were well suited for extensive soy farming after the area had been cleared of forest. This agricultural model is significantly different from what takes place throughout the rest of Bolivia. Figure 10 shows land productivity (proxied here by the Agricultural GDP divided by the cultivated area in hectares) versus labor productivity, demonstrating that the agricultural model in Santa Cruz has led to the highest level of labor productivity in Bolivia, but the lowest level of land productivity. The departments of Cochabamba and La Paz, which have more agricultural workers than Santa Cruz, exhibit much higher land productivity, but much lower labor productivity. Santa Cruz outputs 3.6x more GDP per worker than Cochabamba, and 9.1x more than La Paz. The flat terrain and soy's suitability to Santa Cruz soils enabled mechanization, allowing fewer farmers to manage far more land, thus driving the productivity patterns observed.

Figure 10: Labor vs Land productivity by Department, 2024

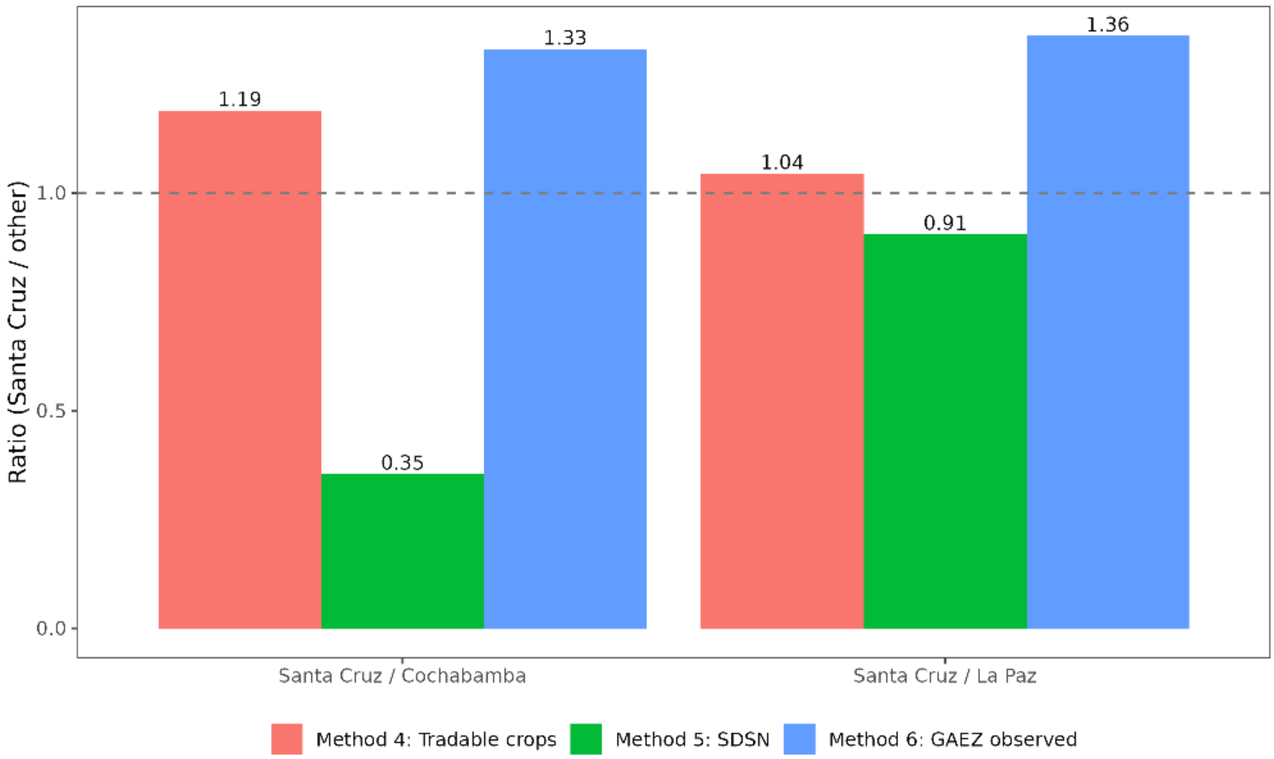


Source: Own analysis with data from INE

The differences in land productivity are larger than what the underlying land quality would predict. Figure 11 illustrates that across multiple land valuation models, the implied land productivity gaps are far smaller than observed [2]. These findings indicate that Santa Cruz should in theory be able to raise its land productivity significantly, and closer to parity with Cochabamba and La Paz, if all departments were operating at their maximum land productivity. The fact that we do not observe this in practice indicates that there are strong forces which instead incentivize the current low land productivity outcome in Santa Cruz. The specific technologies and infrastructure available to farmers has meant that the most profitable farming models in Santa Cruz today are not very productive per hectare of land.

[2] We estimate potential land value per hectare at the department level using three approaches: (i) a tradable-crops model that assigns each ~9km pixel its highest-value exportable crop at regional international prices using FAO GAEZ v4 rainfed potential yields; (ii) an integrated agro-economic model from Andersen et al. (2023) that incorporates production costs, terrain, and legal land-use restrictions at 30m resolution; and (iii) GAEZ v4 observed crop production values in purchasing-power-parity adjusted dollars.

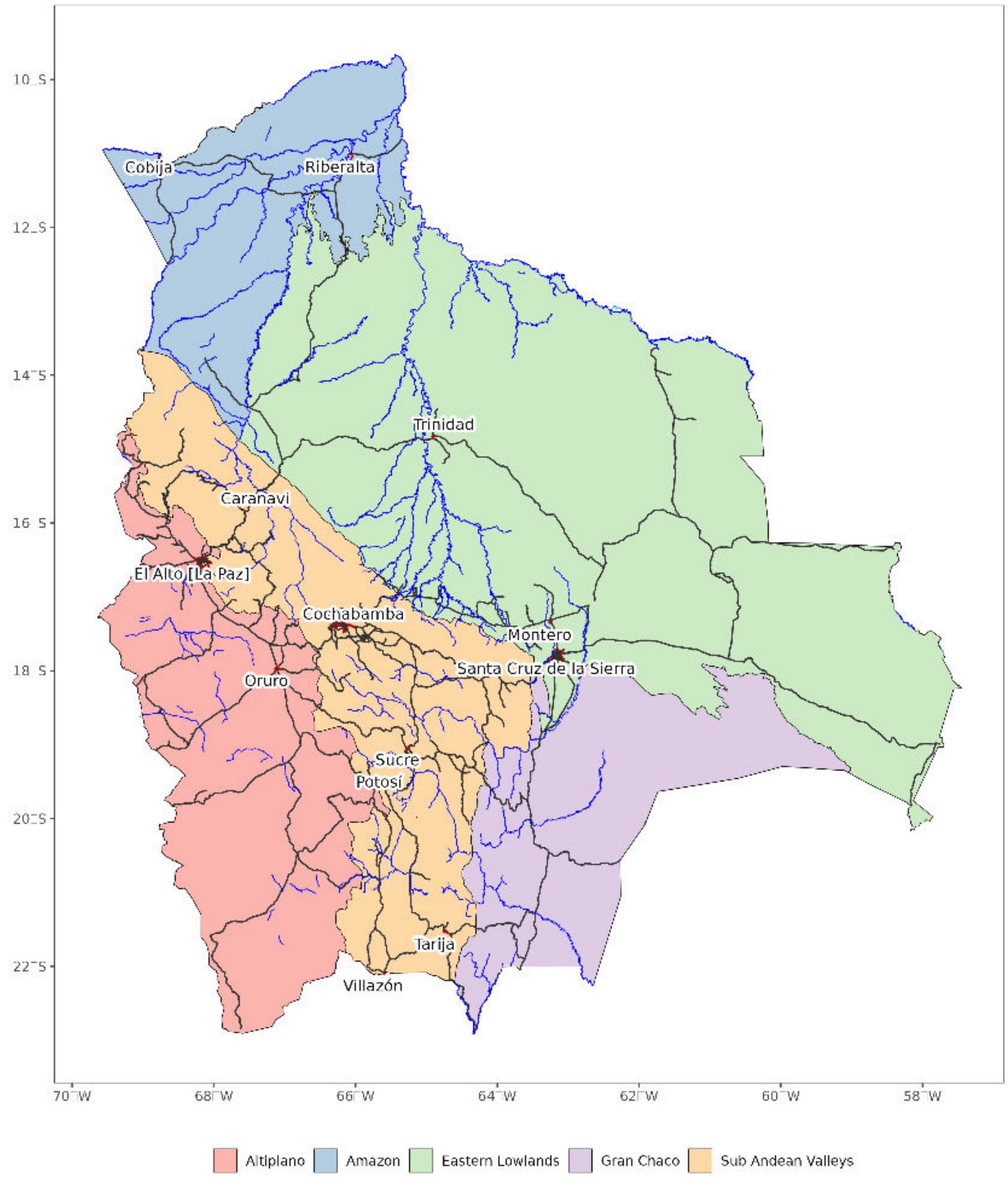
Figure 11: Land Quality Estimates in Santa Cruz



Source: Calculations from FAO GAEZ v4 and Anderson et al. (2023)

Bolivia's geographic diversity has given rise to distinct agricultural systems, each facing different constraints. The country encompasses at least four distinct agricultural zones, illustrated in Figure 12. The Altiplano to the southwest, home to roughly 40% of the population, is characterized by small-scale farming of quinoa, potatoes, and livestock, and is the center of origin for a wide range of crop species. Land is abundant, but water is scarce and a natural constraint on expanding production and productivity (World Bank, 2019). The Sub-Andean Valleys to the east (in orange) feature conditions suitable for fruits, vegetables, and coffee, though farmers face challenges from erratic rainfall and erosion (World Bank, 2019). The Eastern Lowlands beyond Santa Cruz consist of tropical grasslands well suited to extensive livestock production. Each of these zones possesses distinct endowments which will generate particular governance needs.

Figure 12: Map of Bolivia



Source: Own construction from GeoBolivia

In sum, Bolivia's agricultural sector has experienced a period of historically strong growth, but this growth model has been remarkably land intensive. Agricultural output gains have been driven primarily by the expansion of area under cultivation rather than improvements in yields. The remainder of this analysis examines whether further expansion of the agricultural frontier should remain a policy priority, assesses productivity patterns across key crops, and identifies the binding constraints that policy should address.

Analytical Note

At the most basic level, primary agricultural output is a function of two factors: the area under cultivation and the yield on that area.* Having established that recent growth has been driven overwhelmingly by the former, the remainder of the analysis examines each factor in turn. The land use analysis asks whether Bolivia faces a shortage of agricultural land that would justify deforestation to expand the agricultural frontier, and whether existing land is being allocated efficiently across uses. Appendix A.1 shows that Bolivia has done very well with the expansion of titles, and that private property rights are unlikely to be a binding constraint to output growth, although there remain areas for improvement within the structure of property rights. The Deforestation section examines this dynamic in detail, highlighting how the agricultural frontier has been expanding in practice. The productivity analysis examines yields for key crops relative to regional peers, and then looks at extensive-margin opportunities where Bolivia might develop new export products by drawing on the experience of Peru. Together, these analyses identify recurring constraints that a productivity-oriented agricultural policy should prioritize. *

**One could add 'prices' here as well as a proxy for quality, particularly for traded produce*

4 Examining Land-Use Patterns

Policy should prioritize improving land productivity over expanding the agricultural frontier. The expansion of the agricultural frontier has been a policy priority for Bolivia in the recent past, and continues to be a topic of debate within Bolivia. Law 337 of 2013[3], the 2014 Agenda Patriótica targets to expand cultivated land by 2.5 times (Erkenswick Watsa, 2014b), and the 2019 amendment to Supreme Decree 26075[4] have all directly facilitated the expansion of the agricultural frontier. From one perspective, vast expanses of under-utilized forested land can be converted for agricultural use relatively easily, especially for growing soy and raising cattle. These products can then contribute to foreign exchange earnings and export growth. Arguments against expanding the agricultural frontier tend to be environmental in nature, as Bolivia has experienced significant deforestation and biodiversity loss already. At the same time from an economic perspective, further deforestation also risks the marketability of Bolivia's existing agricultural exports, as EU regulation (EU) 2023/1115 prohibits deforestation-linked products from entering the European Union, and commodity giants like Cargill have stated policies against purchasing such products. The following analysis focuses on a cross-country comparison of land-use patterns both today and over time, to examine questions of whether Bolivia has "too much forest" or "too little agricultural land" to support its population. The data shows that Bolivia has the 12th most agricultural land per capita in the world already[5]; that cropland per capita is high by global standards; and that increasing cropland per capita to levels of Paraguay or Argentina would be an expansion of agricultural land that is historically unprecedented. These facts indicate that increasing land productivity, especially on land classified as 'permanent meadows and pastures' as well as cropland, should take policy priority over expansion of the agricultural frontier.

We use the FAO's land classification scheme to understand land use patterns across the world. A diagram of this scheme is presented below. The FAO classifies land at the top level as Forest land, Agricultural land and "Other land", which includes urban land, and land that is not usable as agricultural land like glaciers, deserts, etc. Within agricultural land, there are two subdivisions - land designated as permanent meadows and pastures, and cropland[6]. Cropland is further subdivided into arable land, and permanent crops, where arable land is even further subdivided into temporary meadows and pastures, temporary fallow land, and temporary crops. Examples of permanent crops are fruit trees, which are the same plant which yields new fruit periodically, or grape vines, etc, while temporary crops need to be replanted each season. The treemap in Figure 14 shows the division of land via this classification in Bolivia. Permanent meadows and pastures are shown in red and cropland types in green, while non-agricultural land appears in blue. In 2022 by this classification, Bolivia had some 50 million hectares of forest, 33 million hectares of permanent meadows and pastures, 19 million hectares of 'other' land, some 4 million hectares of temporary cropland and 1.6 million hectares of land lying temporarily fallow.

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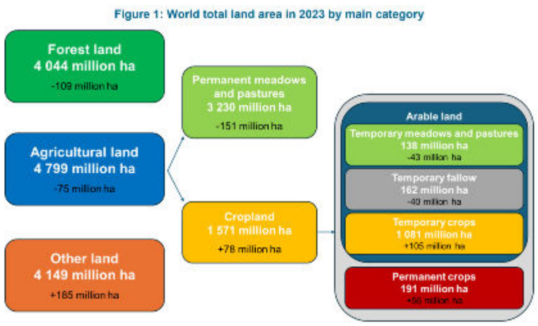
[3] which retroactively legalized illegal forest clearing between 1996 and 2011

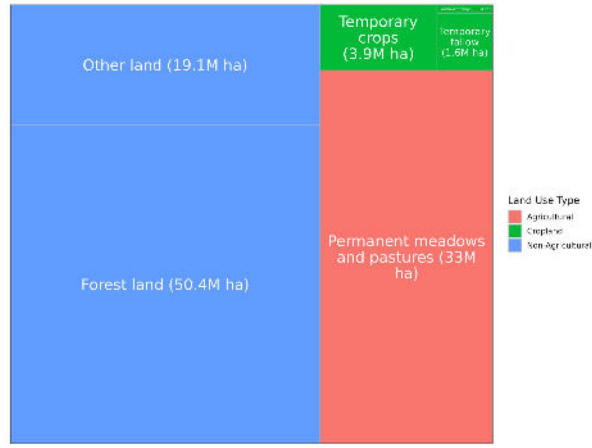
[4] which expanded land demarcated for livestock and agribusiness in Beni and Santa Cruz, including Permanent Forest Production lands

[5] According to FAO, in 2022, when considering countries with at least 1M hectares of land.

[6] Permanent meadows and pastures are areas used permanently (five years or more) for herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land) (FAO)

Figure 13: Fao Land Use Classification (left); Figure 14: Land Use in Bolivia in 2022 (right)

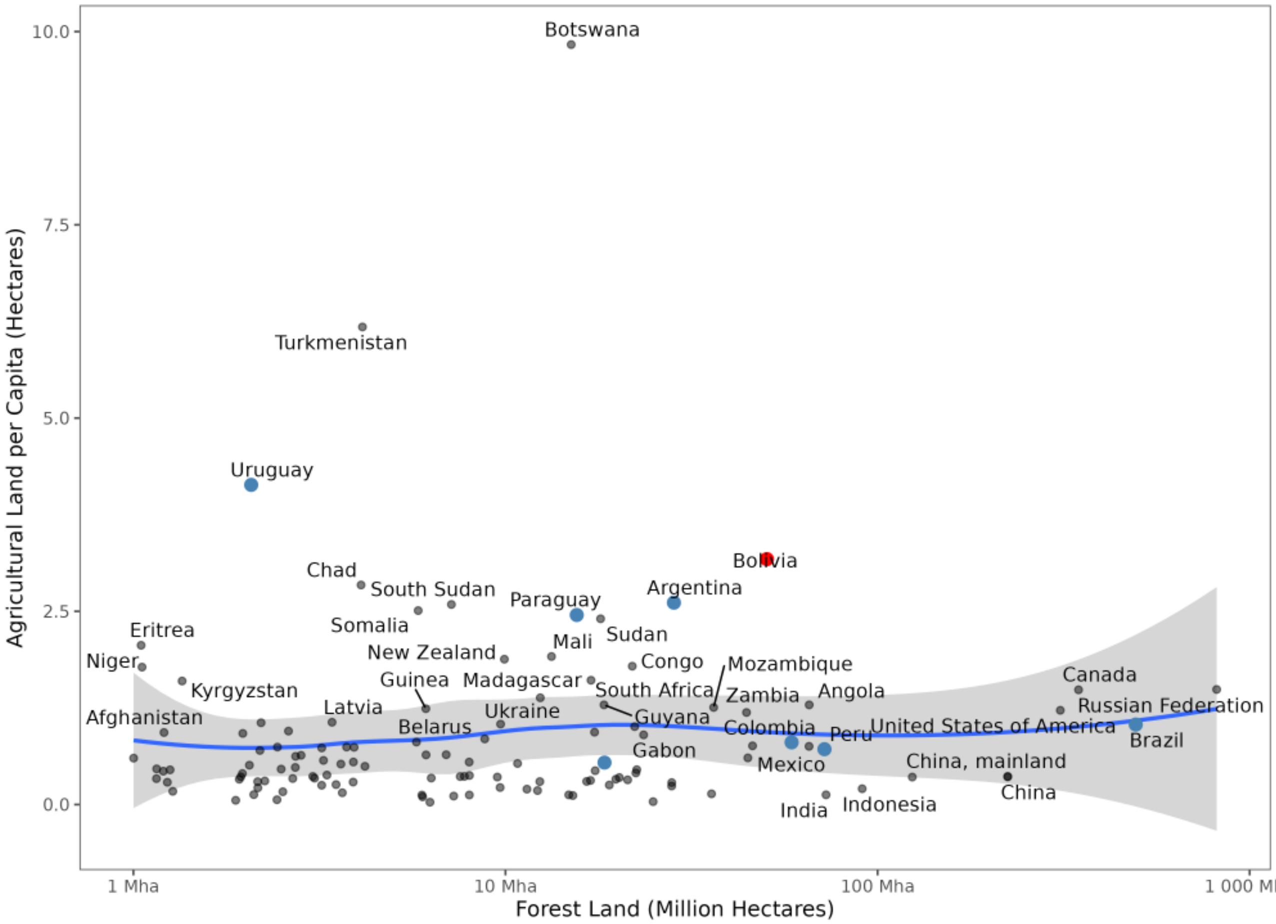




Source: Own elaboration using FAOSTAT

Bolivia has the 12th most agricultural land per capita in the world. When considering whether the agricultural frontier should be expanded, one question to ask is whether there is enough agricultural land to support both the domestic population and generate an exportable surplus. In per capita terms, Bolivia has more agricultural land than almost any other country, suggesting that agricultural land scarcity is not the binding constraint on agricultural output. This fact argues against any urgent need to expand the agricultural frontier.

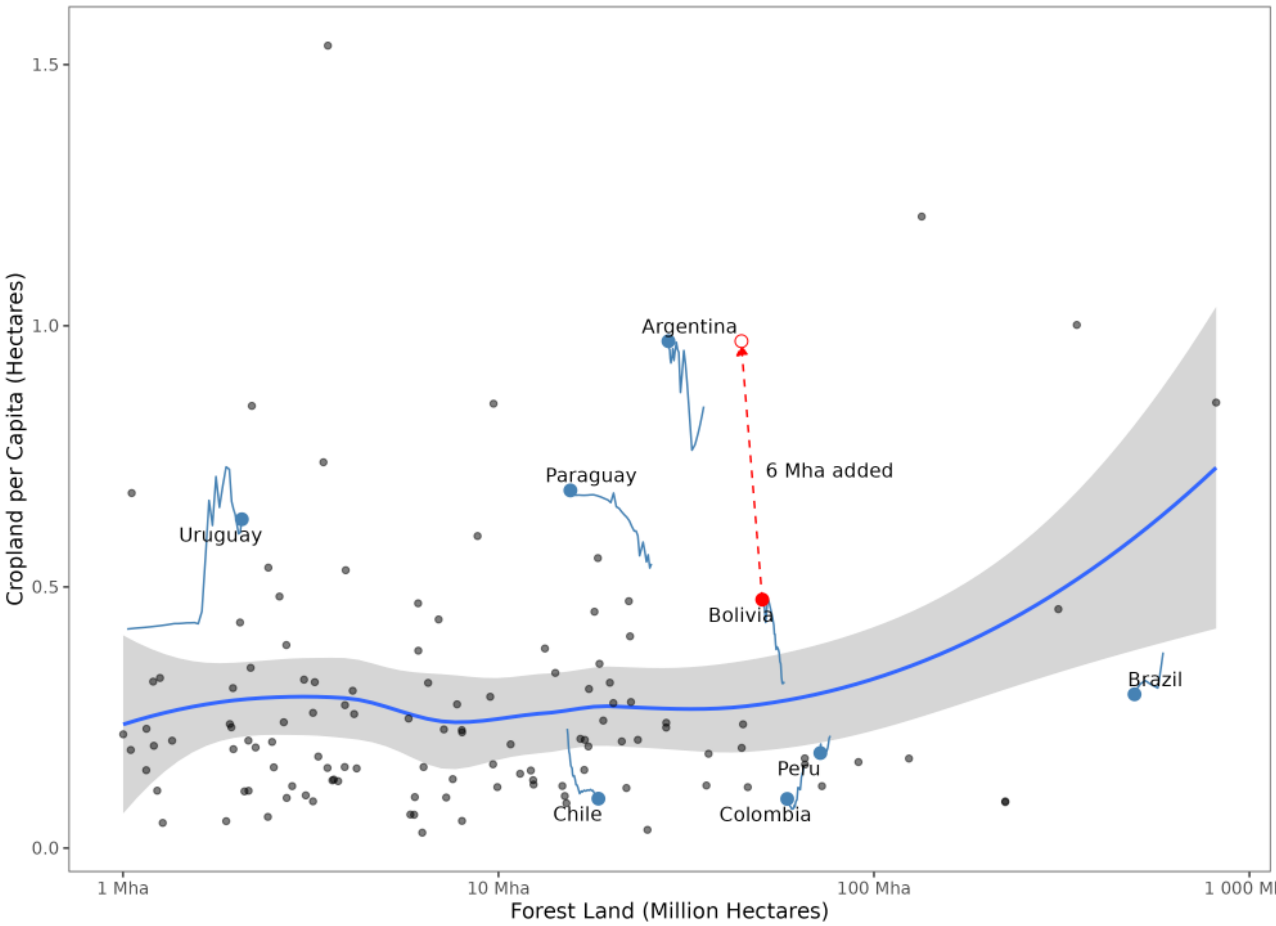
Figure 15: Agricultural Land per Capita vs Forest Land in 2022



Source: Own elaboration using FAOSTAT

Cropland per capita, a subset of agricultural land, is still high by global standards but lower than many peers. As shown in Figure 13, agricultural land consists of both cropland and permanent meadows and pastures. While Bolivia has less cropland per capita than peers like Argentina, Paraguay and Uruguay, it still has more cropland per capita than most countries in the world, even when taking into account its large quantity of forested land. This implies that the scarcity of cropland is not likely to be the constraint to agricultural output. Furthermore, its expansion to the levels of Argentina or Paraguay would be historically unprecedented in per capita terms. Figure 16 shows forested land on the x axis, with cropland per capita on the y axis. In most cases, land cannot be created, and can simply be re-allocated from one type to another. Most countries have deforested in order to create agricultural land. Latin American peer countries are labelled, and for each of these peers the figure shows a blue line which traces the relationship of cropland per capita and forested land over time, culminating in its current position as of 2022. There are marked differences in these trajectories for different countries. Bolivia, like Argentina and Paraguay, has lost forest land over time while cropland per capita has risen. However, Brazil, Peru and Colombia have lost forest land while cropland per capita has decreased over time. Chile has gained forest land while cropland per capita has decreased, and Uruguay has gained forest land while cropland per capita increased. Against this historical backdrop, we project what would need to take place if Bolivia was to reach the same level of cropland per capita as Argentina, indicated in the red dashed line. Assuming that new cropland comes from the conversion of forested land, as has been the case in Bolivia, this would require the conversion of 6 million hectares of forest land to cropland, which is a conservative estimate because it assumes current population levels. This figure demonstrates that such a goal has no historical precedent, at least among peer countries.

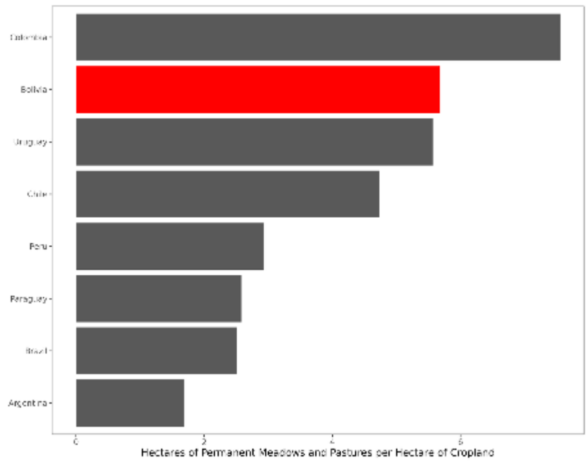
Figure 16: Cropland per Capita vs Forest Land in 2022

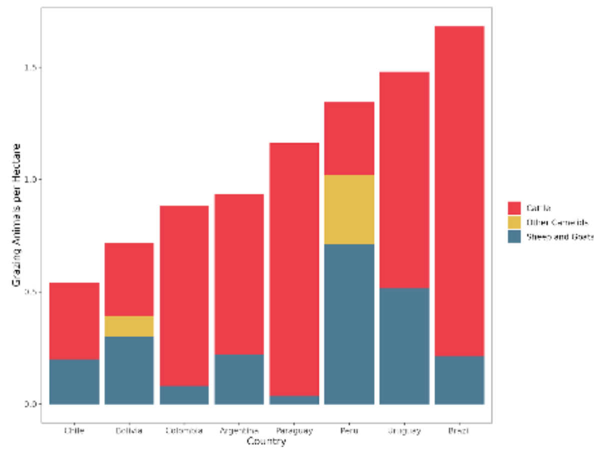


Source: Own elaboration using FAOSTAT

Out of total agricultural land, Bolivia dedicates a relatively high amount to permanent meadows and pastures. Having analyzed previously the conversion of forest land into cropland, we now turn to an analysis of the allocation of land which is already classified as agricultural, namely the difference between cropland and meadows and pastures. Bolivia has a relatively high share of permanent meadows and pastures given its total amount of agricultural land, compared to Latin American peers (Figure 17, left). Is this a good use of its agricultural land? To get a sense of the productivity of this land, we take the total stock of grazing animals - cattle, sheep, goats, and other camelids (llamas, for example) - and divide it by the total permanent meadows and pastures, which is visualized in the right box of Figure 17. These facts together suggest that Bolivia allocates a large share of its agricultural land to meadows and pastures, and then does not use that land to its potential.

Figure 17: Ratio of Permanent Meadows and Pastures to Cropland in 2022 (left); Figure 18: Grazing Animals per Hectare in 2022 (right)





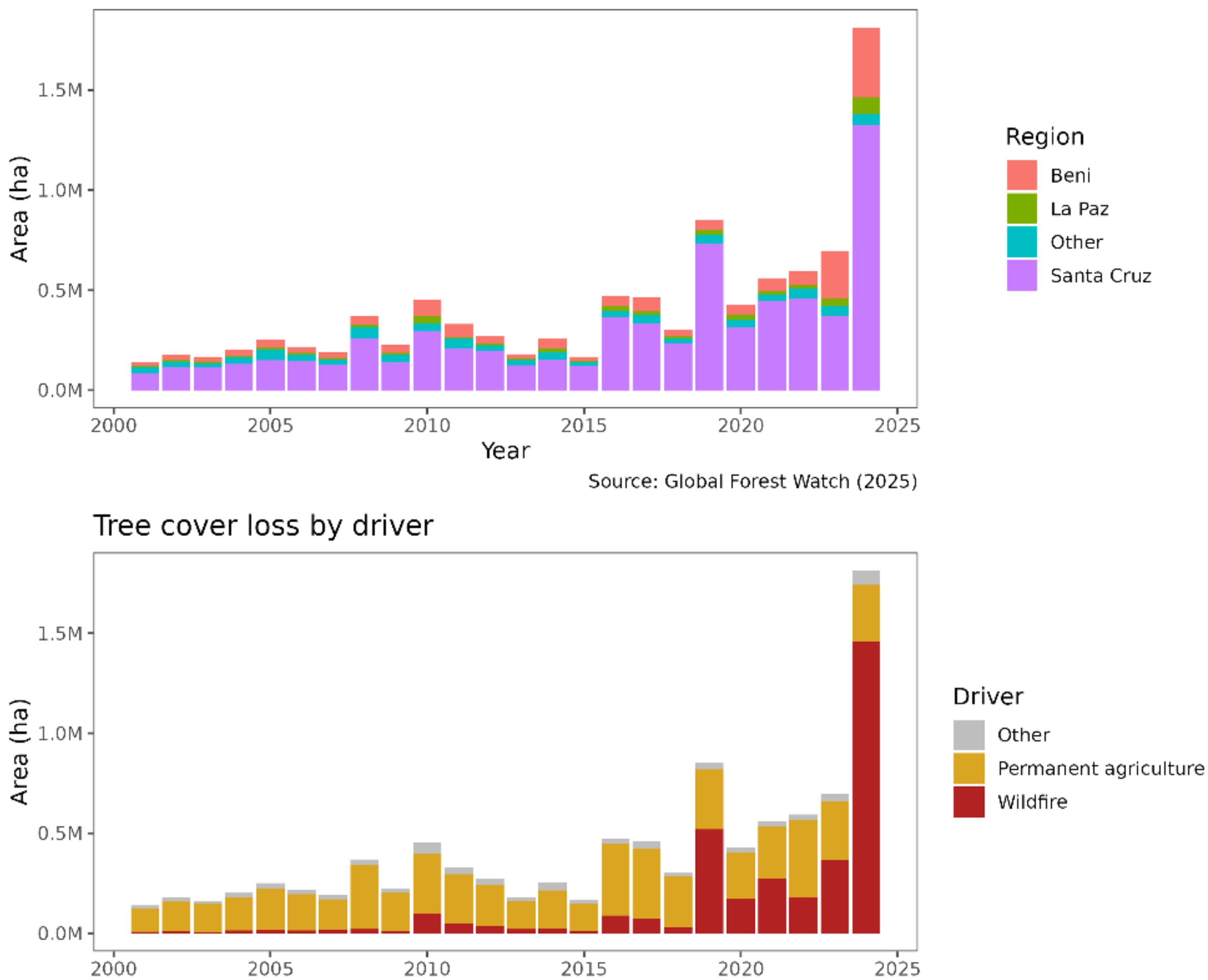
Source: Own elaboration using FAOSTAT

This comparative analysis of land usage patterns indicates that Bolivia faces no shortage of agricultural land. In terms of quantities, agricultural land per capita ranks very high by global standards, and although Bolivia dedicates a relatively large share of this land towards permanent meadows and pastures, cropland per capita remains high by global levels. Therefore, policies promoting the expansion of the agricultural frontier at the expense of forested land are at the very least not addressing the core of Bolivia's agricultural output issue, and could even threaten the marketability of Bolivia's existing agricultural exports as consumers take stronger stances against promoting deforestation. EU regulation (EU) 2023/1115, known as the EU Deforestation Regulation (EUDR), does not allow products related to deforestation to cross into the European Union, and commodity giants like Cargill have stated policies to not interact with products related to deforestation. On the other hand, Bolivia has 33 million hectares of permanent meadows and pastures that appear to be underutilized. Further analysis should look into possibilities to improve the productivity of this land, either by supporting more livestock, or by converting it into cropland.

5 Deforestation

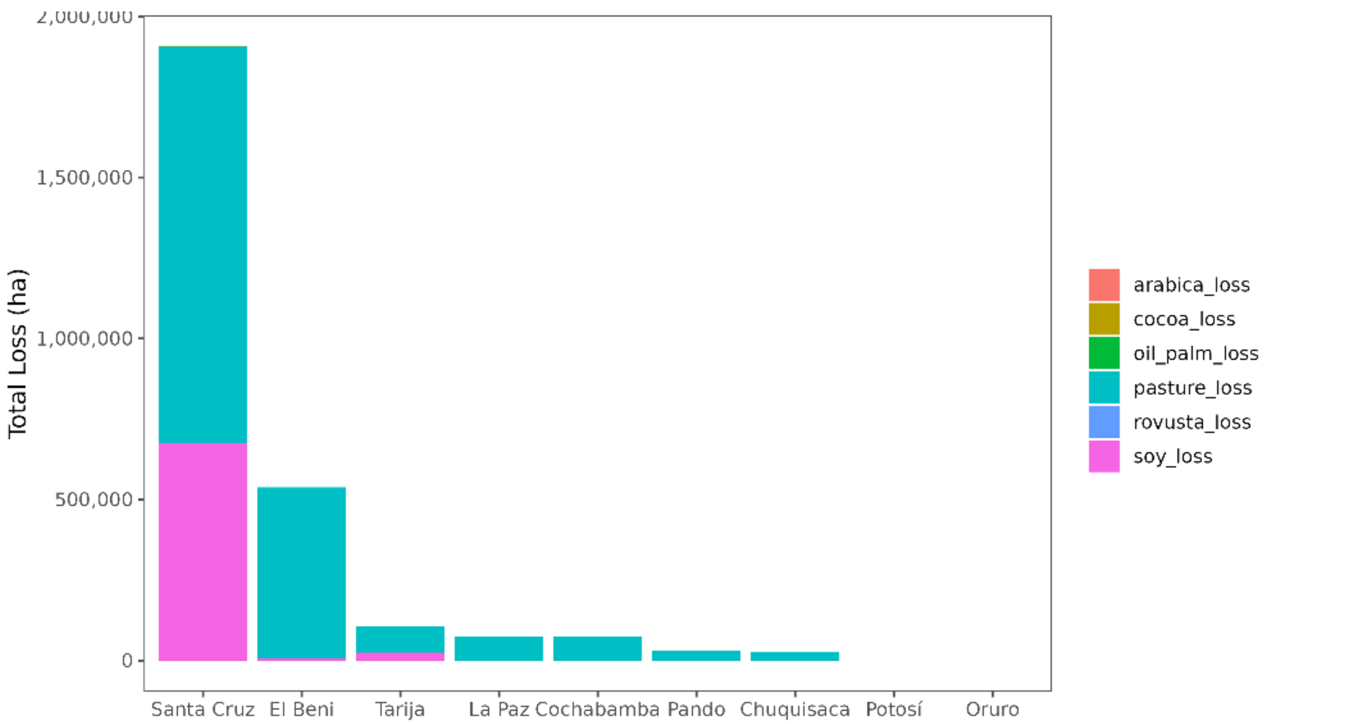
The expansion of area under cultivation was enabled by extensive deforestation. From 2001 to 2024, Bolivia lost 9.78 Mha of tree cover, equivalent to 15% of the 2000 tree cover area and 3.78 Gt of additional CO_2e emissions (Global Forest Watch, 2025). This deforestation is largely related to clearing land to be used for agricultural activities, in particular pasture for cattle ranching and soy. Analysis by Global Forest Watch shows that 71% of all tree loss from 2001-2024 has taken place in Santa Cruz, followed by Beni at 15%, La Paz at 4%, and Cochabamba and Pando at 3% each. Deforestation due to wildfires has become a more significant problem since 2019, and especially in 2024 (Figure 19 and Figure 20).

Figure 19: Tree Cover Loss by Region (top); Tree Cover Loss by Driver (bottom)



Source: Global Forest Watch (2025)

Figure 20: Bolivia Forest Loss to Agriculture



Source: Global Forest Watch, 2022

Deforestation in Bolivia is a complex dynamic which is driven by a number of interrelated factors. Prominent among these factors is the relative productivity of agriculture versus forestry, institutional distortions related to private property and land use, and weak capacity and low political will to enforce regulations related to deforestation. This section summarizes and builds upon the work of He *et al.* (2019) and Müller, Pacheco and Montero (2014; 2024), among others, to address a subset of prominent factors which drive much of the dynamic.

Land clearing is used as an investment in securing property rights. The Agrarian Reform Law (INRA Law) of 1996 established the National Institute of Agrarian Reform (INRA) which is responsible for the titling of rural lands. While this law recognized the historic land rights of indigenous people, and significant progress has been made on this issue over time, the processing of conflicting land claims and allocation of titles has been slow and reportedly skewed, resulting in large swathes of land being contested, and according to INRA, some 12 percent of all land in Bolivia still lacks a clear title in 2024 (U.S. Department of State, 2024). In the case of the Guarayos Indigenous Territory, the indigenous community received only a partial allocation of titles to their claimed land - mostly to a remote and unused subset - while some 23% were distributed to third parties and 19% remained yet to be assigned as of 2014 (He *et al.*, 2019). The INRA Law also requires land to demonstrate "functional and economic use" in order to receive a title. Whether or not land is in productive use is a determination made at the discretion of the government, but in practice, it is "dominated by agricultural-use criteria as a justification for recognition of rights" (Pacheco, 2006; Müller, Pacheco and Montero, 2014). Since agriculture and cattle ranching tend to demonstrate clear examples of land being put to use, "the easiest, fastest and cheapest way to justify land-ownership and thus compliance with FES, was by clearing" (Pacheco, 2006; Müller, Pacheco and Montero, 2014). This results in an incentive to clear forested land for agricultural use in order to strengthen the claim on the land and receive a title in the future, which in turn fuels land speculation that is described as "the main distortion in the regularization process that has contributed to deforestation" (Müller, Pacheco and Montero, 2014).

The economic returns to forestry relative to agriculture have declined, raising the incentives to deforest. Agents who have access to forested land make an economic decision on how to maximize their returns. These decisions are affected by the institutional concerns discussed above related to land titling. However these decisions will also be affected by the relative ability to extract monetary value from forested land compared to beef or soy farming - the major drivers of deforestation. For example, declining prices of timber, or rising prices of soy and beef, would incentivize deforestation, and this is largely what has happened since the 1990s. While both commodities have seen cycles, international lumber prices have risen at most some 1.6x since 1990, while soybean prices at their 2022 peak were roughly 2.8x their 1990 level (calculations from FRED data), illustrating the increasing economic pressure to convert forest into agricultural land. Müller, Pacheco and Montero (2014) carefully studied the opportunity cost of a hectare of forested land and reports that the gross production net present value of mechanized and small-scale agriculture are significantly higher than logging (see Figure 21). It is worth noting that in a scenario without diesel subsidies, the NPV of mechanized agriculture declines by up to 50% (Müller, Pacheco and Montero, 2014). In the case of Guarayos, the community depended on timber and saw declining prices - from US $25-30 per cubic meter of tropical wood, down to $8-10, and consequently debated the conversion of the land for agricultural use (He *et al.*, 2019). More recently, a phytosanitary agreement was reached with China in 2019 which led to a boom in beef exports. Cattle ranchers have responded by making investments to increase the total herd size. The average "stocking rate", or the amount of land used per head of cattle is between 0.5-1 hectare per head (Müller, Montero and Mariaca, 2024), and the herd has grown by 3.2% per year on average since the agreement was reached in 2019, putting severe pressure on forest land (Müller, Montero and Mariaca, 2024). Improvements in the stocking rate through improved cattle and pasture management techniques, allowing cattle farmers to use more cows on less land, could help to alleviate this pressure while still facilitating beef exports. In some cases, such improvements may be economically infeasible today, if input and capital costs are high and there are constraints to lending. However, Müller, Pacheco and Montero (2014) argues the potential to increase the rate is high through the adoption of "relatively simple technologies, such as grazing rotations". Additional study should diagnose the constraints to better pasture management in practice across Bolivia.

Figure 21: Average NPV of Gross Production per hectare for different land-uses in Santa Cruz

Table 8. Average NPV per hectare for different land-uses in the Department of Santa Cruz (8% discount rate)

Land-use	Details	Average NVP per hectare (30 years)
Mechanized agriculture	Soybean (two harvests per year or in combination with sunflower), rice or sugarcane	1000–2500 USD/ha
Small scale agriculture	rice + corn (manual)	approx. 500 USD/ha
Cattle ranching on sown pasture	In Santa Cruz (around the city of Santa Cruz or Chiquitania)	50–400 USD/ha
Logging	Different regions in Santa Cruz department	100–400 USD/ha

Source: Müller et al. (2013)

Source: Müller et al. (2014).

The returns to forestry are suppressed, as regulatory hurdles make it relatively difficult for smallholders and communities to extract value from forestry activities versus agriculture. The Forest Law of 1996 imposes stringent requirements before timber can be extracted commercially, including the completion of a tree inventory and an annual forest management plan approved by the Autoridad de Fiscalizacion y Control Social de Bosques y Tierra (ABT). These requirements were originally intended for large scale commercial forest operations, however they were also applied to small-scale community operations who often find the requirements 'overwhelming', creating barriers to entry and incentivizing informal operations (Pokorny and Johnson, 2008; Müller, Pacheco and Montero, 2014; He *et al.*, 2019). Informal operations may then face additional constraints to raising productivity, further skewing the decisions toward using forest for agricultural use.

The costs of deforestation are low, as the relevant oversight authorities lack capacity and resources, and previously illegal clearing has been legalized retroactively multiple times. The ABT is responsible for land use regulation, especially in forested areas. It oversees the enforcement of land use plans and monitors deforestation. However, the authority is understaffed and under-resourced. In 2021, 98% of the 4.1 million hectares burned were from illegal fires, but the forest agency issued only 248 sanctions for unauthorized burns (He *et al.*, 2025). In Guarayos, the regional ABT director reported that they had "13 staff, 3 of whom are monitoring more than 2 million hectares of forest with two trucks" (He *et al.*, 2019). In addition to the low capacity of ABT, the Law of Support to Food Production and Forest Restitution (Law 337) was passed in 2013, and allowed farmers to legalize illegal clearing between 1996 and 2011 (Müller, Pacheco and Montero, 2014). The law was motivated by improving food security, and despite its commitments to partially reforest previously cleared land, it is functionally an instrument to facilitate the expansion of the agricultural frontier (Müller, Pacheco and Montero, 2014).

Recent policies have explicitly prioritized the expansion of the agricultural frontier, at the cost of a significant acceleration of deforestation. In 2014, Vice President Alvaro Garcia Linera announced that Bolivia would expand cultivated land by 2.5 times and triple food production (Vicepresidencia de Bolivia, 2014). This was predicted to "increase the deforestation rate - which is among the highest in the world already - by a factor of 4 or 5" (Erkenswick Watsa, 2014a). Satellite data confirms that 2016 and 2017 became the most deforested years since 2000, coinciding with this drive to expand agricultural land. Then, in 2019, President Evo Morales approved an amendment to supreme decree 26075 which expanded the land demarcated for livestock and agribusiness production in Beni and Santa Cruz. The expanded areas included Permanent Forest Production lands, and authorized the clearing of forest, including via controlled burning (Mercado and Méndez, 2019). Consequently, there was a further acceleration in deforestation in 2019, with wildfires contributing a significantly larger proportion of deforestation.

Taken together, these factors form a self-reinforcing cycle rather than a set of independent problems. Historically, insecure property rights created strong incentives to clear forest as a means of securing land claims — though as discussed in Appendix A.1, Bolivia's titling program has advanced to the point where this dynamic is likely less acute today than it once was. What persist are the structural features that suppress the returns to keeping land forested: regulatory barriers that make formal forestry activity burdensome for smallholders, weak enforcement capacity within ABT, retroactive legalization that has repeatedly confirmed clearing carries little downside risk, and a FES regime that creates a residual fear that forested land left uncleared may be deemed unproductive and subject to expropriation. Explicit policy has then accelerated the process further. Together, these conditions have produced a pattern of chaotic, decentralized, and largely unplanned frontier expansion — driven more by individual incentives and institutional distortions than by any deliberate assessment of where agricultural development would be most productive while minimizing environmental costs.

The policy implication is a shift from passive, incentive-driven clearing to deliberate, planned land use management. The immediate priority is credible enforcement of the existing land use plan: an environment where illegal clearing is consistently sanctioned rather than periodically legalized would substantially change the calculus for frontier farmers. The retroactive legalization of cleared land should not be repeated, as it has consistently signaled that the rules governing forest use are not binding. At the same time, the FES regime should be clarified so that landholders who choose to leave forested land in its natural state are not at risk of expropriation; the fear of losing land by keeping it forested creates a preemptive clearing dynamic that undermines the intent of the regulation. The regulatory regime governing forestry activities should also be redesigned with smallholders and communities in mind. The current framework, built around the requirements of large commercial operators, is too complex for small-scale actors to navigate, and this effectively tilts the calculus toward clearing rather than sustainable forestry use. A workable regulatory framework for these actors that preserves the intent of forest protection without imposing compliance costs that only large operators can absorb would raise the returns to keeping forest standing and provide a livelihood alternative to conversion. Finally, facilitating growth in pasture productivity through grazing rotation, better herd management, and other improvements, can allow the cattle sector to expand output without a commensurate expansion of land, releasing pressure on the frontier. Taken together, these reforms would shift Bolivia's land use trajectory from one characterized by ecological attrition toward one in which the agricultural frontier expands selectively, deliberately, and in ways that maximize the productive and environmental return on each hectare converted.

6 Productivity

The analysis of agricultural productivity will focus on crop yields, as there is limited micro data to assess other metrics of productivity, such as total factor productivity. Yields can also be readily compared to other countries around the world using the FAO data, allowing us to contextualize Bolivia's performance. We will first assess productivity on the "intensive" margin of Bolivia's production basket, and then turn to potential "extensive" margin opportunities, drawing on recent success in diversification in Peru.

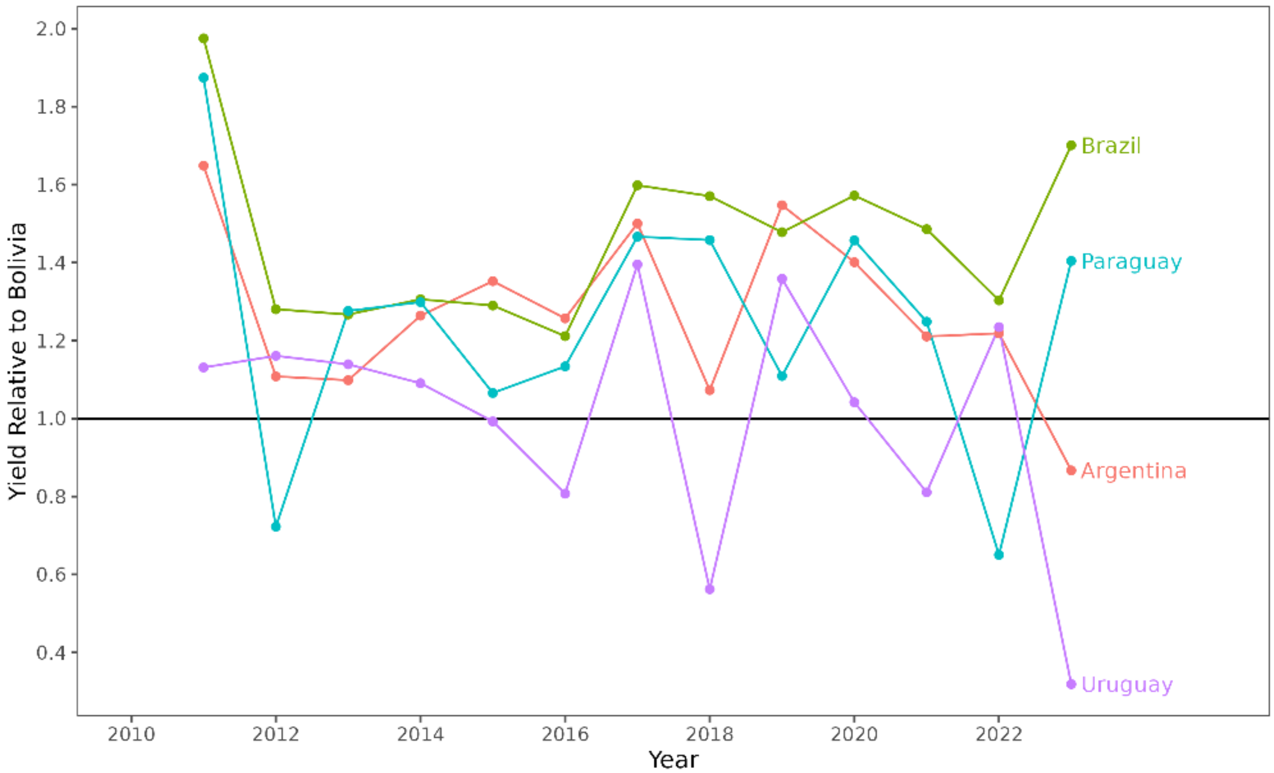
6.1 Intensive Margin Activities

This subsection looks into a subset of the major produce of Bolivia today. It begins by examining soy, maize and beef, which are related to one another in the production of proteins. This is because soy and maize are the major components of animal feed, and are therefore an input in industrial beef, chicken and pork production. The report focuses on beef, given its recent relevance in the export basket, its rapid growth, and its significant potential. We then introduces a model which seeks to illustrate the potential output and growth path for the industrial beef sector. The section on intensive margin activities then concludes with a comparison of Quinoa growing patterns in Bolivia versus Peru, a comparable quinoa producer and exporter.

6.1.1 The Protein Production System

Soy is a central export for Bolivia, predominantly produced in the Santa Cruz region. Export of the raw soybean is restricted in most years, which channels production towards processing plants that convert it into soy meal and soy oil. Estimates based on the USDA Foreign Agricultural Service indicate that by weight, 68% of soy production is processed into meal, 17% into oil and the rest for other use. Roughly 70% of this processed product is then sent for exports, primarily transported by rail to river ports by the Brazilian border and then shipped via the Paraná–Paraguay waterway to Rosario, Argentina (World Bank, 2019). Soy yields at the country level are typically between 20-60% lower than peers like Brazil, Paraguay, Argentina and Uruguay (illustrated below in Figure 22), and even the "best yields achieved in Bolivia are 80-90 percent of the yields obtained by other producers in the LAC Region, which limits competitiveness" (World Bank, 2019). Much of this difference might be explained by the reluctance to allow Genetically Modified (GM) crops, which ANAPO estimates would improve yields by some 28% (ANAPO, 2024).

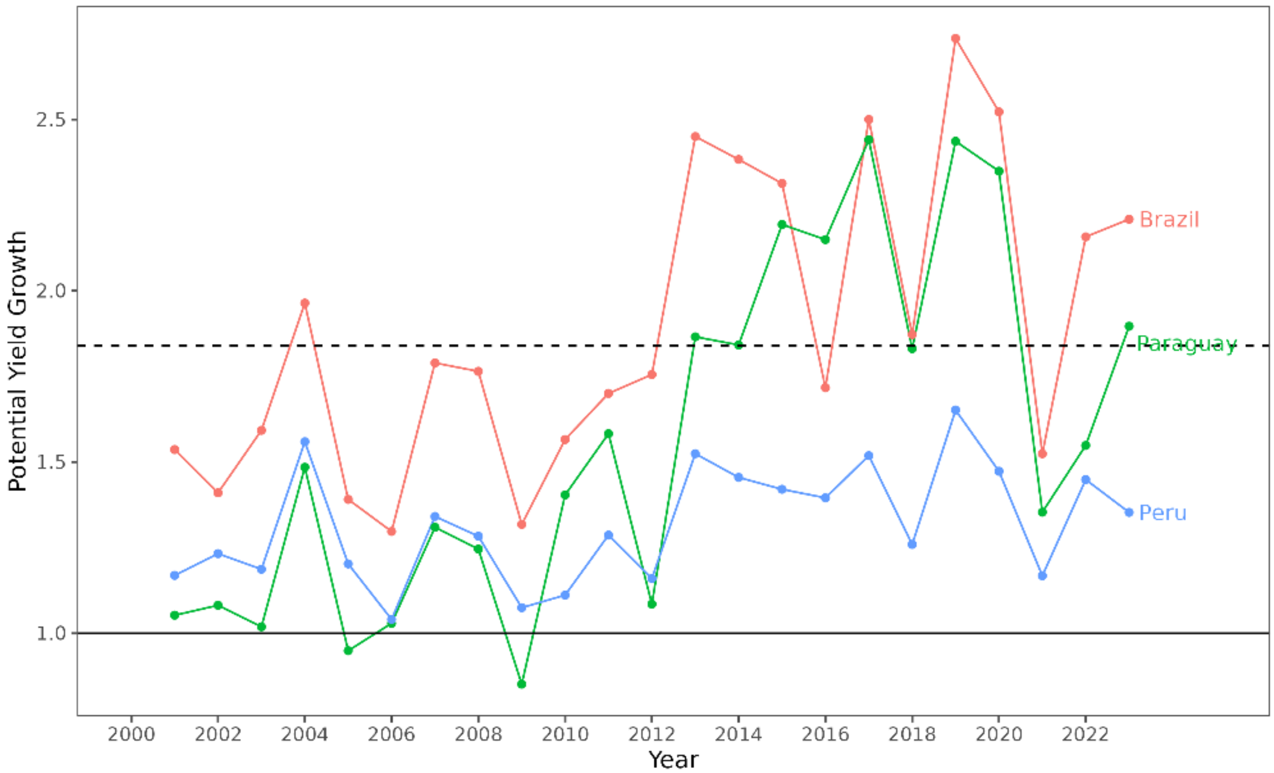
Figure 22: Soya Bean Yields Relative to Bolivia



Source: Own elaboration using FAOSTAT

Maize is deeply embedded in Bolivian culture, economy, and cuisine. Bolivia is recognized as one of the global centers of origin for maize, and the country's remarkable diversity of native varieties reflects thousands of years of selective breeding by Indigenous farmers. Yet despite this long relationship with the crop, Bolivia has struggled to meet domestic demand in recent years: since 2015, the country has been a net maize importer in six of eight years, according to FAO data. Yields remain well below those of regional peers, as Brazilian yields are more than double Bolivia's, and Paraguay and Peru consistently outperform Bolivian producers. This productivity gap sits at the heart of a politically sensitive debate. Strong social opposition to transgenic maize reflects concerns about protecting native varieties, farmer seed sovereignty, and ecological risks associated with gene flow in a center-of-origin country, which are concerns echoed in countries like Mexico and Peru. At the same time, producer groups such as ANAPO argue that access to transgenic technologies could substantially raise yields, estimating potential gains of 84%. If realized, such gains could move Bolivia closer to regional productivity levels, with implications for food security, farmer incomes, and reduced reliance on imports (see Figure 23). One way to navigate the tension between these potential gains and the legitimate concerns around gene flow and native variety protection would be a regionally differentiated approach — permitting transgenic adoption in districts where commercial production dominates while maintaining restrictions elsewhere, with appropriate measures to monitor and mitigate spillovers across those boundaries.

Figure 23: Maize Yields Relative to Bolivia

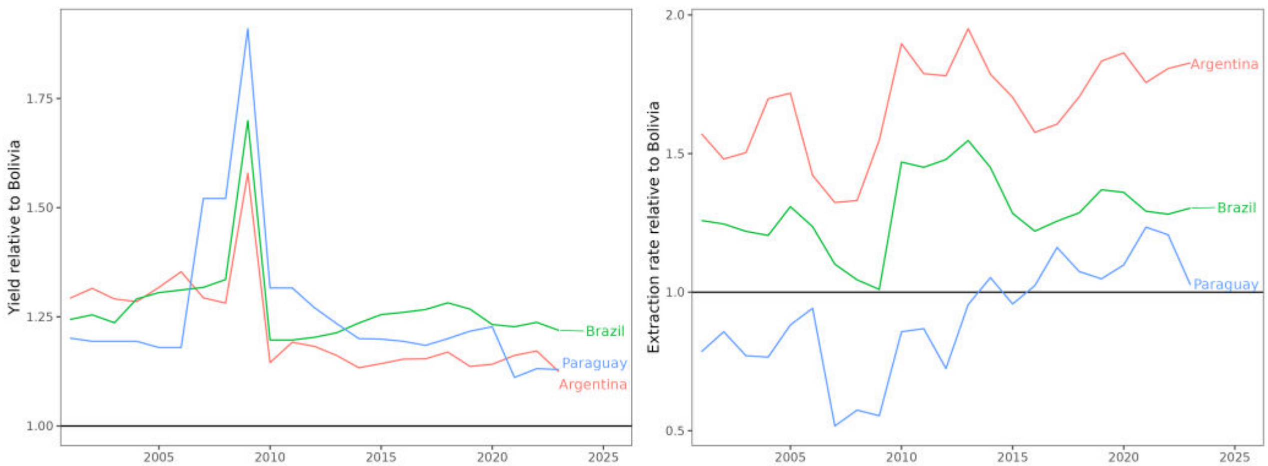


Source: Own elaboration using FAOSTAT

Productivity gains and spillovers from improved access to modern transgenics may be even larger for maize than for soy because of their different roles in Bolivia's livestock system. Both crops are key inputs into industrial meat production, where they are used for animal feed. However, Bolivia already produces a significant exportable surplus of soy, and soy availability does not appear to constrain the expansion of industrial livestock. Maize is different: a substantial scale-up of industrial beef and poultry production would require far larger volumes of feed maize than the country currently produces. If domestic maize production could expand to meet this demand, Bolivia could support growth in higher–value livestock sectors without increasing reliance on imported feed. In this sense, maize productivity gains would have important downstream spillovers into meat production, foreign exchange earnings, and agro-industrial development.

Beef production illustrates the scale of these potential spillovers. Following a 2019 phytosanitary agreement with China, Bolivian beef exports expanded rapidly, becoming the country's second-most valuable agricultural export after soy-derived products. This growth demonstrates both external demand and Bolivia's capacity to participate in higher-value meat markets when market access barriers are reduced. At the same time, there remains substantial room to improve production efficiency. Compared with peers such as Brazil, Paraguay, and Argentina, Bolivia exhibits lower beef yields and lower cattle extraction rates, which is the share of slaughtered animals relative to total herd size (Figure 24). These indicators suggest that the sector remains less industrialized and less productive than regional competitors, pointing to significant scope for intensification and modernization.

Figure 24: Cattle Yields; Extraction Rates

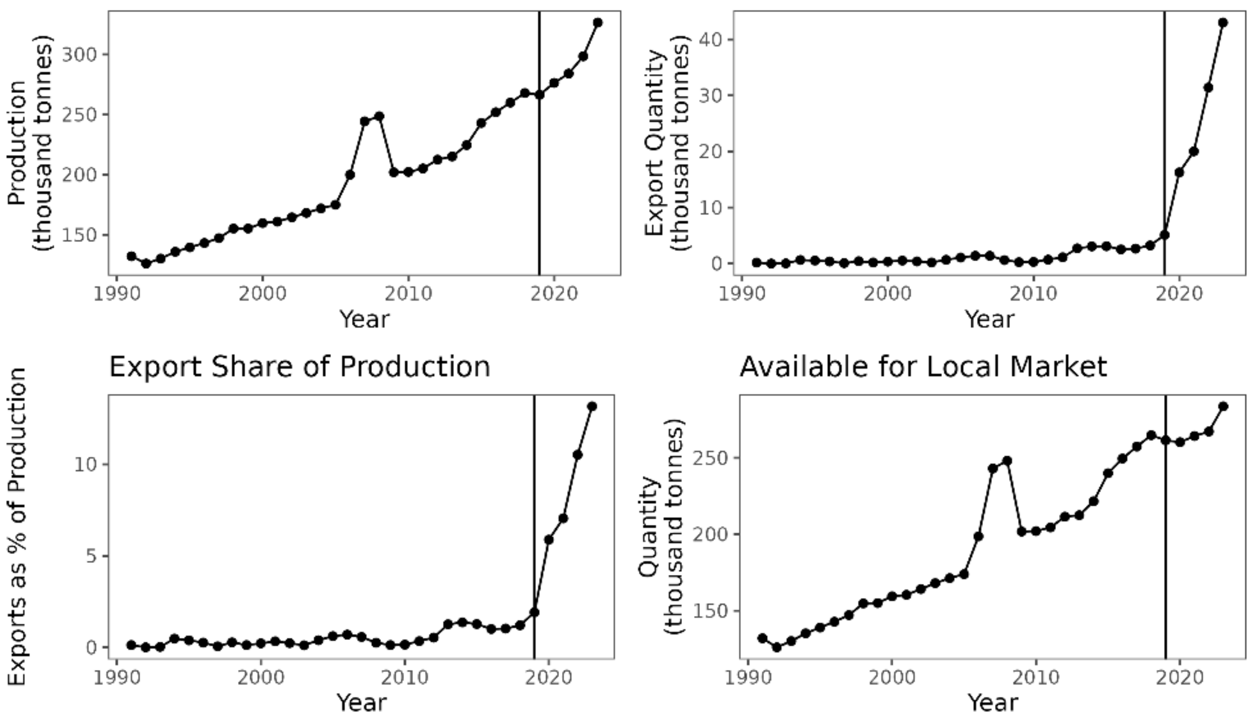


Source: Own elaboration using FAOSTAT, 2025

The beef sector's rapid response to the China agreement also reveals that phytosanitary capacity and trade agreements are likely binding constraints on export expansion. The fact that Bolivia currently exports beef primarily to China, and not to neighboring countries, suggests that limited market access continues to restrict growth. Strengthening sanitary and phytosanitary (SPS) systems and negotiating additional export protocols could therefore unlock further expansion in livestock exports.

The boom in beef exports appears to have stimulated an acceleration in production, mitigating losses of beef availability for the local market. Figure 25 below shows Bolivian beef production, exports, exports as a share of production, and the inferred amount of beef available for the local market over time using data from the FAO. A vertical line marks 2019, the year that the agreement was reached with China. Even though exports have rapidly grown since then, the amount of meat available for the local market has not decreased much, and in 2023 began to tick upwards again. The implication here is that opening more markets for export is compatible with the food security objective.

Figure 25: Bolivia: Beef - Production, Exports, Export Share, Available for Local Market



Source: Own elaboration using FAOSTAT. Note: Exports include boneless, bone-in, salted/dried, offal, and preparations.

Beyond market access, logistics pose a broader structural constraint on Bolivia's agricultural export competitiveness. As a landlocked and topographically rugged country, Bolivia's main production areas are distant from deep-water ports, raising transport costs and delivery times. In this context, efficient domestic logistics and border procedures are especially critical. Yet current systems appear to amplify rather than mitigate these disadvantages. Bolivia ranked 121st out of 139 countries in the World Bank's 2023 Logistics Performance Index. A 2014 World Bank study noted that "routine delays associated with SENASAG inspection and certification create long turnaround times that are incompatible with business and trade realities." Similarly, the Economic Commission for Latin America and the Caribbean estimates that logistics-related cost overruns can reach 21% for river shipments and more than 23% for land transport (Sánchez and Wilmsmeier, 2014).

Addressing these bottlenecks would have economy-wide benefits, but they are particularly important for perishable, SPS-sensitive products such as beef. As Bolivia seeks to expand export-oriented agro-industry, improvements in logistics and certification systems will be essential complements to productivity gains in primary agriculture.

6.1.1.1 Potential Growth of the Protein Ecosystem

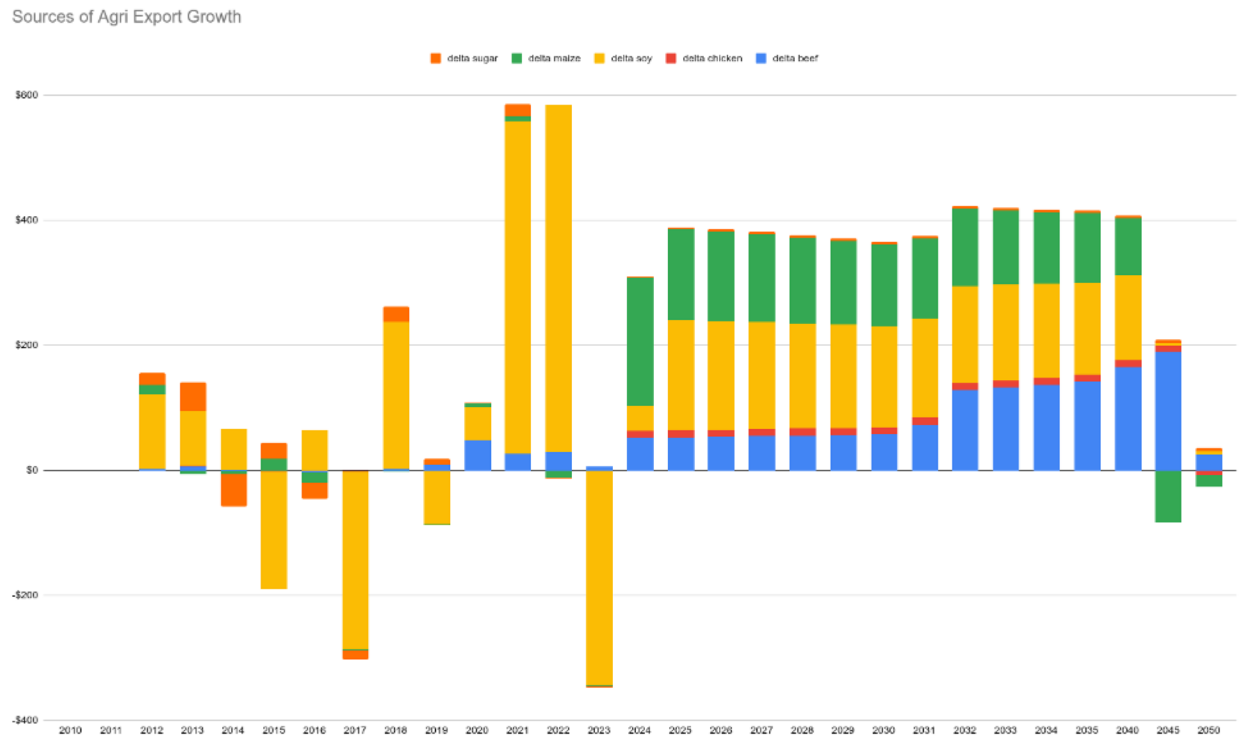
The yield gaps and structural inefficiencies documented above represent not only constraints but also a measure of unrealized potential. To illustrate the scale of what closing these gaps could deliver, we construct a simple projection model for Bolivia's protein ecosystem, consisting of soy, maize and beef, under a reform scenario in which productivity converges toward regional benchmarks over the next 25 years.

The model assumes that a combination of policy reforms and sustained investment gradually brings Bolivia's productivity in 2050 closer to that of Brazil today. For soy and maize, yields converge to within 10% of current Brazilian levels[7], driven primarily by the lifting of restrictions on transgenic seeds and an improvement in the investment environment. For beef, the cattle herd doubles over 25 years as improved policy stability - including the credible removal of export restrictions and expansion of phytosanitary agreements with new trade partners - spurs continued investment. Beef yields converge toward Brazilian levels through the gradual adoption of improved techniques, and the extraction rate rises from 15% to 25%, allowing a larger share of the herd to be slaughtered while the stock continues to grow. For chicken, where Bolivian yields are already competitive, the model assumes growth slightly above the rate of population increase with improvements in extraction rates as poultry production industrializes. In each case domestic consumption is accounted for before the surplus is allocated to exports. For beef, per capita consumption grows linearly from 25 kg to 32 kg by 2050. For chicken, per capita consumption is held constant at current levels of 45 kg per capita, so all additional output from productivity and stock growth is exported. Maize is treated primarily as a feedstock: 95% of domestic consumption is absorbed by the beef and poultry production chain, with any surplus exported. For soy, a share is consumed domestically as meal and oil at existing conversion ratios, with the remainder exported. Biodiesel production and consumption is not modeled here.

Under these assumptions, total agricultural exports for these products grow from approximately $750 million in 2019 to over $4 billion by 2030, and approach $10 billion by 2050 (Figure 26). Beef is the single largest driver of this growth, reflecting both the current low base of productivity and the scale of the opportunity that improved extraction rates and expanded market access would unlock. Soy remains the largest export category in absolute terms, with gains driven by both area expansion - as underutilized pastureland is converted to cropland - and yield improvements from transgenic adoption. Maize shifts from a net import to a contributor to exports as productivity gains generate a surplus beyond domestic feed requirements. These projections are illustrative rather than precise forecasts, but they demonstrate that convergence toward achievable regional productivity benchmarks, combined with a more supportive policy environment, could transform the scale of Bolivia's agricultural export earnings.

[7] Year-to-year assumptions are that almost all values grow linearly, with the exception of soy and maize yields, which asymptotically approach the target yield, modeling a rapid increase in yields through the lifting of GMO restrictions which tapers off over time.

Figure 26: Model: Bolivia's Potential Exports by 2050



Source: Own Elaboration

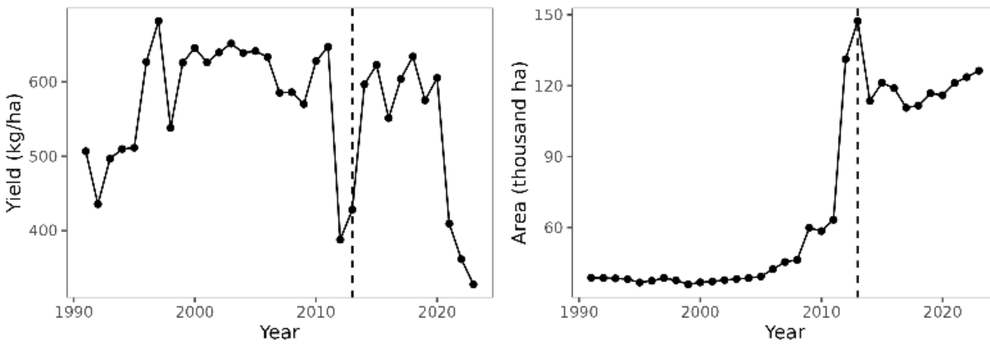
6.1.2 Quinoa

Quinoa is an Andean grain crop of global significance, and Bolivia is one of its centers of origin. An estimated 70,000 small-scale highland farms produce quinoa in Bolivia, predominantly in the southern Altiplano (World Bank, 2019). The crop is highly nutritious and naturally resistant to perishability, a critical attribute that allows Bolivia to export it despite its landlocked geography and logistics challenges, in contrast to perishable products where these constraints are more binding.

The United Nations' declaration of the International Year of Quinoa in 2013 triggered a surge in global demand, creating a major opportunity for Andean producers. Global awareness of quinoa as a nutritious "superfood" rose sharply, and international prices increased significantly. Both Bolivia and Peru, the world's two leading quinoa producers, experienced a boom in export demand.

Bolivia's response to this demand shock followed a familiar pattern: rapid expansion of area under cultivation, with stagnant and declining yields. Figure 27 shows production indicators for Bolivian quinoa over time. The area harvested expanded rapidly following the 2013 boom, while yields failed to improve and in fact declined - echoing the extensification pattern observed across Bolivian agriculture more broadly. This suggests that the same structural constraints limiting productivity growth in other crops, such as underinvestment in research and extension, limited access to improved inputs, and weak support for agronomic intensification, are also operative in quinoa.

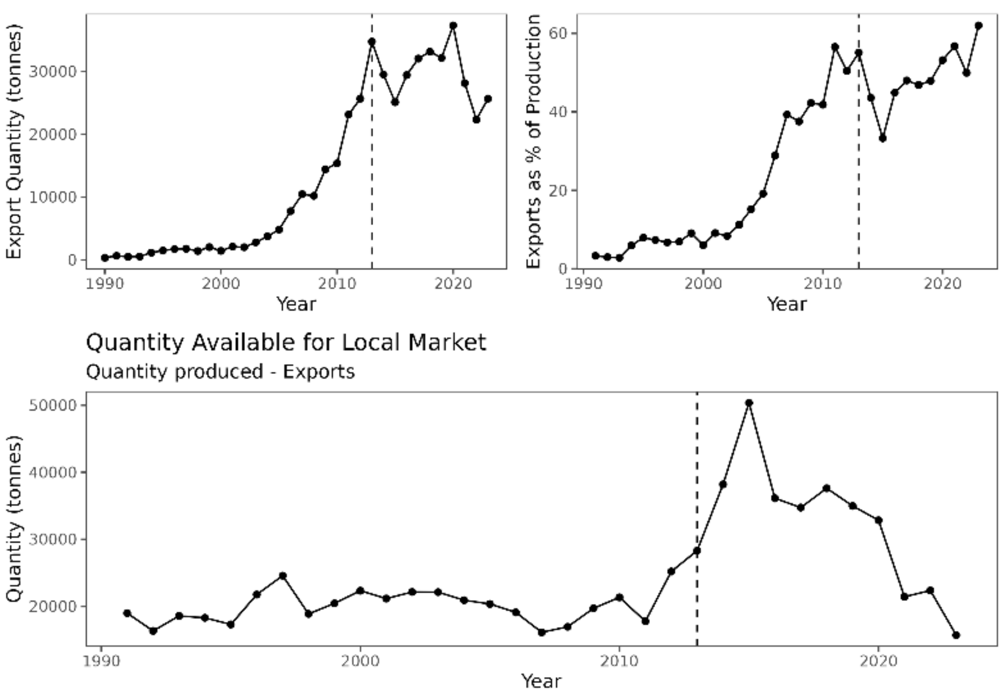
Figure 27: Quinoa Production in Bolivia



Source: Own elaboration using FAOSTAT

Critically, the export boom did not come at the expense of domestic supply. Figure 28 shows export dynamics: total quinoa exports, exports as a share of production, and the quantity remaining for the local market. Although exports rose to nearly 50% of total production following the 2013 boom, the supply response from Bolivian producers was strong enough that the quantity of quinoa available for domestic consumption actually increased relative to pre-boom levels. This is a direct finding for the food security debate: expanding international market access did not produce a local shortage, but instead stimulated additional production that benefited both export and domestic markets.

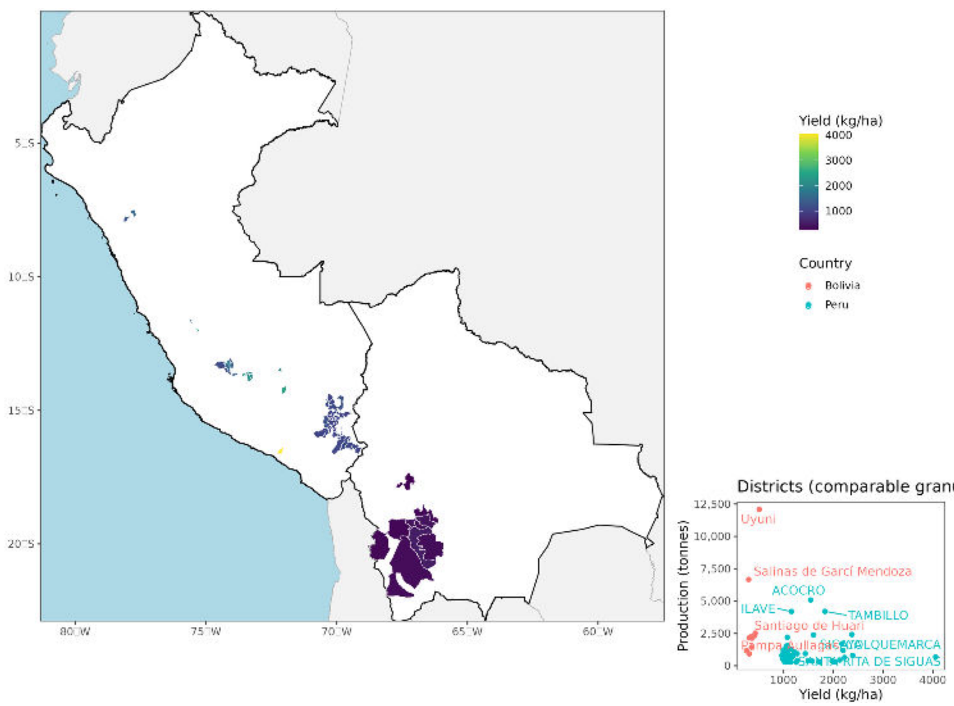
Figure 28: Quinoa Export Dynamics in Bolivia



Source: Own elaboration using FAOSTAT

Peru, by contrast, responded to the same demand shock through geographic expansion and intensification. Quinoa production spread beyond traditional highland zones into lower-altitude coastal and inter-Andean valleys, where more favorable growing conditions allowed the use of irrigation, improved seed varieties, fertilizers, and crop protection chemicals. This facilitated a rapid increase in both yields and total output. Figure 29 visualizes the difference in district-level production patterns. Major quinoa-producing districts in Peru exhibit substantially higher yields than those in Bolivia, with the most productive Peruvian districts reaching nearly 4,000 kg per hectare - more than four times the yield of Bolivia's highest-performing districts. At the same time, Peruvian districts also tend to have larger production volumes, indicating that yield improvements have been accompanied by scale expansion. Bolivia's production, in contrast, remains concentrated in lower-yield, environmentally constrained regions.

Figure 29: Quinoa Yield at District Level - Bolivia and Peru



Source: Own elaboration based on Peru MIDAGRI, Bolivia INE

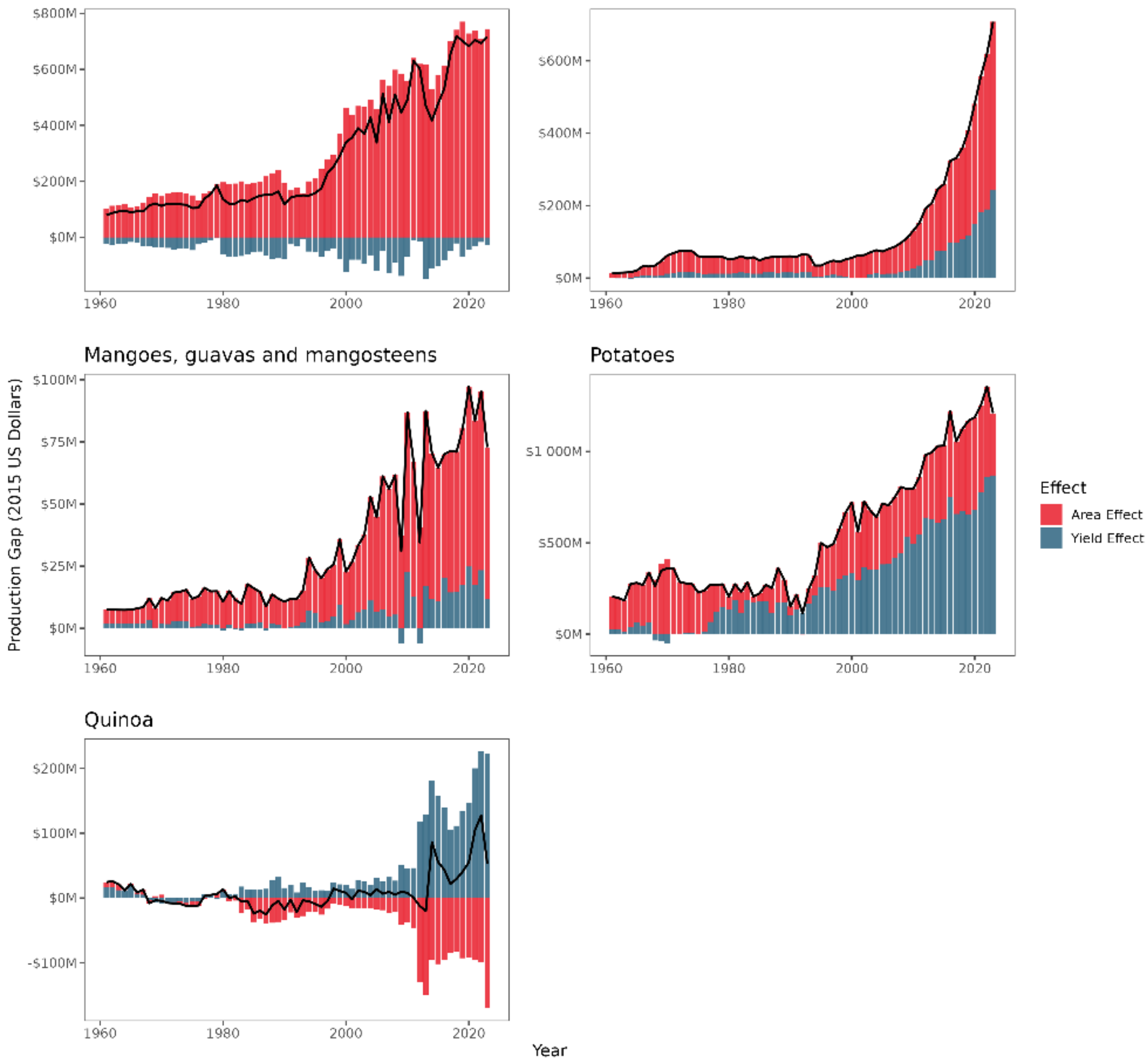
6.2 Extensive Margin Opportunities: Lessons from Peruvian Diversification

Bolivia and Peru share many structural and geographic similarities: both are Andean countries with high-altitude production systems, significant Indigenous agricultural traditions, and ecological diversity ranging from mountains to tropical lowlands. These similarities make Peru a useful benchmark for understanding how agricultural production structures can evolve under comparable natural conditions.

Over the past two decades, Peru has experienced a rapid expansion and diversification of agricultural production, particularly in non-traditional and high-value crops. Products such as avocados, mangoes, and coffee have become major export earners, while traditional Andean crops such as quinoa and potatoes have also seen significant productivity gains. This transformation stands in contrast to Bolivia, where agricultural export growth has been more concentrated and less diversified. To better understand the drivers of this divergence, Figure 30 decomposes differences in agricultural production between Peru and Bolivia into a yield effect and an area effect across a set of crops: avocados, mangoes, coffee, potatoes, and quinoa. The black line shows the net effect. Potatoes are included despite their limited export role because of their central importance to food security and agricultural livelihoods in both countries, and because the Andes are a global center of origin for the crop. For many of these products, Bolivia and Peru exhibited broadly similar production levels through the 1990s and early 2000s. From the mid-2000s onward, however, Peru's production began to diverge sharply, with the sources of this divergence differing across crops. The decomposition allows us to examine three separate types of divergence: divergence driven by yield improvements, expansions of area under cultivation, or a combination of both.

This section analyses the factors that enabled the scale-up of production across key export crops. We first identify if divergence was driven by increases in yields, area under cultivation, or a combination of both. These are the *proximate* factors driving divergence, and the remainder of this section focuses on partially unpacking the primary proximate factor identified for a particular crop in order to highlight areas of policy attention that are necessary to scaling success for these products. The factors enabling scaling production differ from those enabling its birth, the latter being a complex bundle of social and policy factors, inevitably including the establishment of phytosanitary inspection regimes and compliance with the phytosanitary standards required by other countries in order to access their markets. This analysis focuses on what allowed the industry to scale, after these entry conditions had already been met.

Figure 30: Decomposing Production Differences: Peru vs Bolivia for Selected Crops



Source: Own elaboration using FAOSTAT

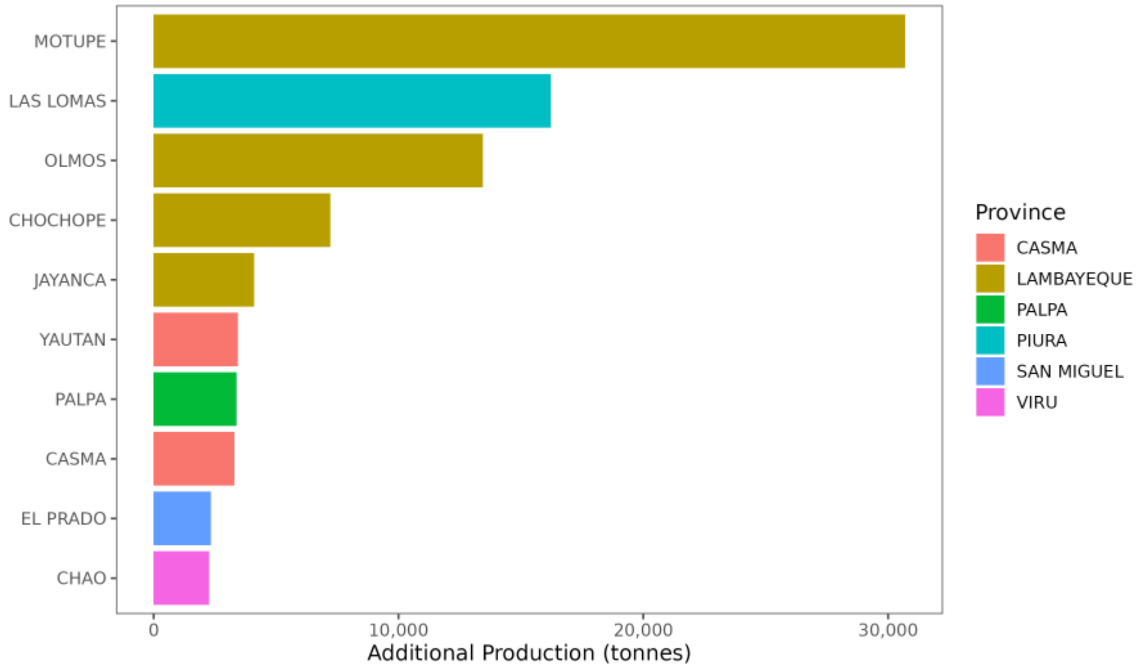
The divergence in total potato and quinoa production were driven by rapidly improving yields in Peru relative to Bolivia. The quinoa section in this report shows that the two countries pursued different strategies in quinoa production. Where Bolivia concentrated on organic production of Quinoa Real in the altiplano, Peru experimented with different varieties of Quinoa in different geographies, finding success in producing at scale using more input intensive processes in less ecologically constrained geographies. A similar dynamic may be taking place in Potato production, but data limitations do not allow a similar analysis. Principally, improvements in yield in Peru suggest improvements in seeds, agronomic practices, irrigation, and research and extension that raised land productivity without requiring large expansions in cultivated area. Many of these areas reflect gaps in public investment and support.

The divergence in coffee and mango production is driven largely by differences in area under cultivation, while yield gaps are relatively small, or are even negative in the case of coffee. We infer from this that a major factor in the success is the ability to facilitate the spread of these crops to new farmers and farming systems, potentially through improved market access, infrastructure and producer incentives. At the same time, both of these crops are notable for being quality-differentiated in the market, as opposed to bulk commodities like soy, and therefore yield gaps may not be the best metric to compare technologies for production. Given the significant differences in production and post-harvest processing dynamics, we examine the crops separately.

Recent increases in Peruvian mango production have come from Lambayeque province, and was enabled by expansions in irrigation. The majority of mango production takes place in Piura province, in particular Tambo Grande district, which produced an average of 250,000 tonnes of mangoes at a yield of about 15,000 kilograms per hectare from 2015-2025 (visualized in Figure 31 below). Peru first established the phytosanitary capacity and agreements required for participating in mango exports, which implicitly require sophisticated cold-chain logistics operations. Using data available from MIDAGRI, we examine the district level sources of increases in mango production in Peru to infer additional key enabling characteristics that continue to drive the divergence with Bolivia. The analysis finds that the expansion occurs mostly in Lambayeque, especially in Motupe, Olmos and Chochope districts (Figure 31). Although data on the 'area harvested' per district is not available, a 2021 report by the US department of agriculture confirms that "additional acreage has mostly been added in the Lambayeque region". This expansion in area under cultivation coincides with the completion of the Olmos Tinajones irrigation project in 2014[8], which provided irrigation to an additional 40,000 hectares, indicating the fundamental role that expansions in irrigation play in diverging mango production between Bolivia and Peru.

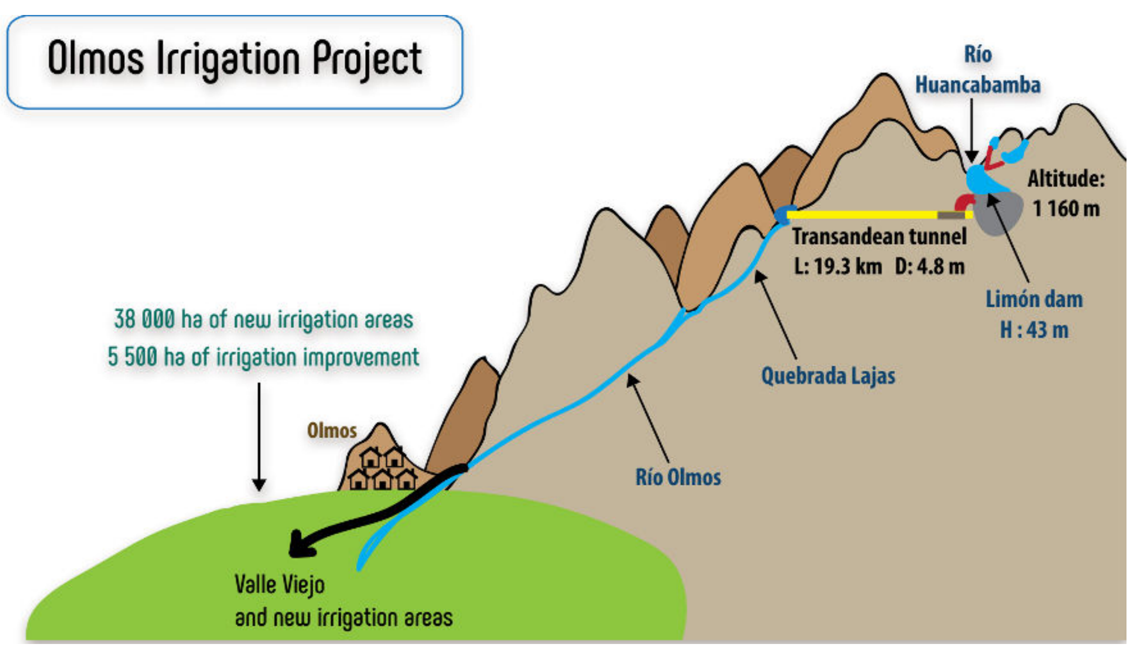
[8] Oxford Business Group

Figure 31: Peru: Contribution to Increase in Mango Production by District



Source: Own elaboration using data from MIDAGRI, Peru

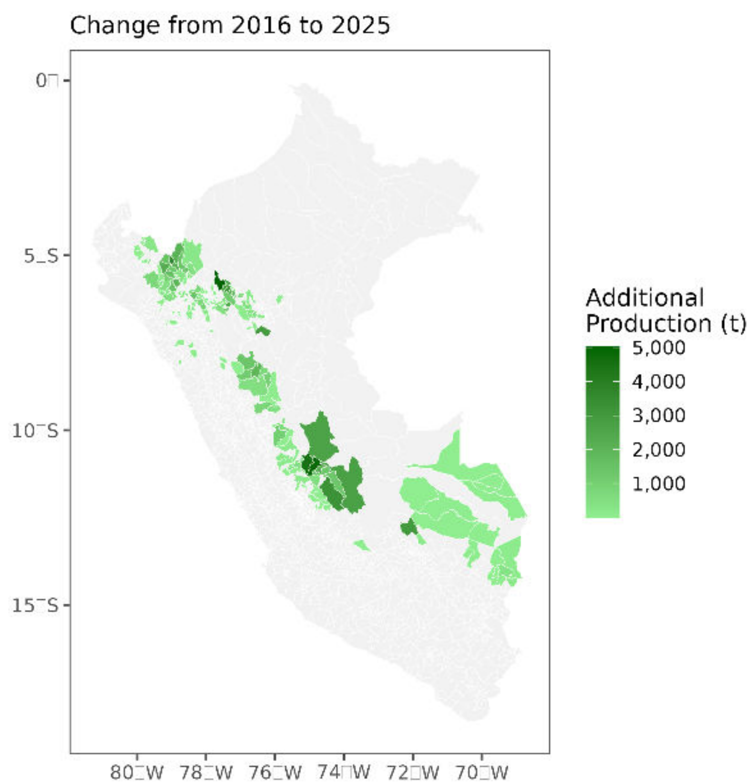
Olmos Irrigation Project



Source: CIRAD (2019)

Alternatively, the expansion in Peruvian coffee production has been more geographically diverse, and has been enabled by strong producer cooperatives and associations. Figure 32 below uses district level data from the ministry of agriculture in Peru to map the districts that have increased production from 2016 to 2025, the years for which there is this level of disaggregation in the data. It shows that the increase in coffee production has happened throughout the country, along the spine of the Andes mountain range, suggesting that the underlying forces driving adoption are widespread and broad based. Over 90 percent of Peruvian coffee is grown on smallholder farmers less than 5 hectares in size and many participate in strong cooperatives and associations which help farmholders "secure better prices, enhance post-harvest processing, and implement more effective marketing strategies" (Nolte, 2025). While historically coffee has been produced in the center of Peru, now more than 50% of total coffee production comes from the North, and this expansion has been associated with the proliferation of new cooperatives which provide technical assistance and training to producers, along with a number of new mills opening in the area to combat remoteness constraints in post-harvest processing (Sucafina, no date). At the same time, a 2019 World Bank report cites Bolivian coffee production as being undermined by "low yields, weak producer organizations, poor training, degraded soils, limited input supplies, and limited infrastructure" (World Bank, 2019). The Peruvian experience suggests that many of these constraints may be alleviated with stronger support for cooperatives.

Figure 32: Peru: Contribution to Increase in Coffee Production by District

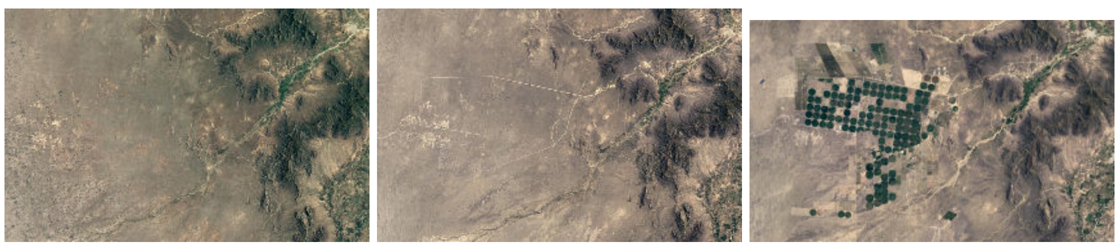


Source: Own elaboration using data from MIDAGRI, Peru

The trajectory of coffee production in the Andes is also closely linked to the policy and economic environment surrounding coca cultivation. In both Bolivia and Peru, coffee often competes with coca for adoption by farmers. The Peruvian approach of pairing manual eradication of illegal coca plots, with support for alternative development through coffee and other crops (UNODC) may offer lessons for Bolivian policymakers seeking to strengthen conditions for coffee producers. Bolivia's less aggressive stance against coca cultivation may reduce the relative incentives for farmers to transition into coffee, particularly where market access and technical support for coffee remain limited.

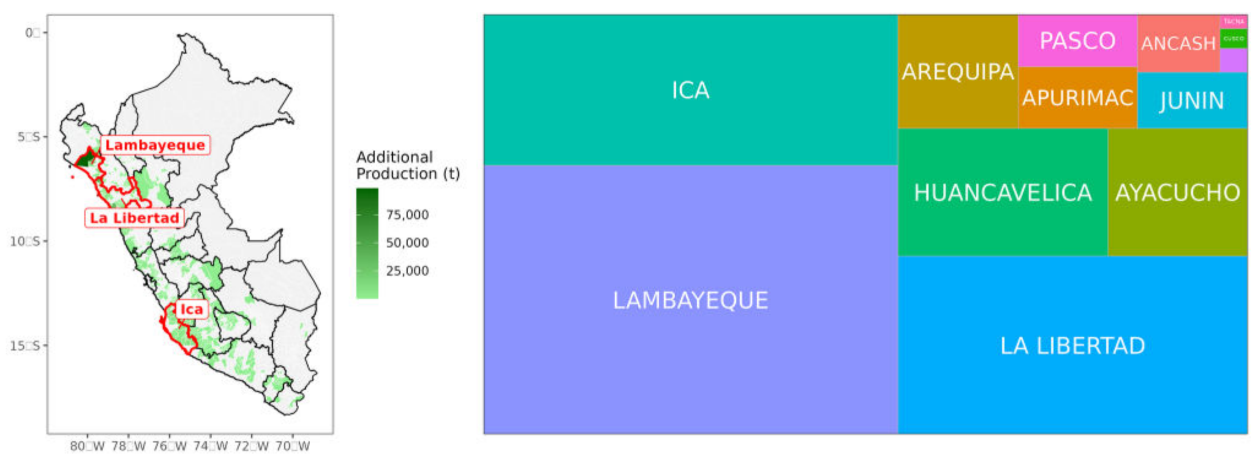
Divergence in avocado production was driven by both yield and area growth, fueled by capital intensive export-oriented firms with large land holdings that were made productive through massive irrigation projects. Avocado production for export in Peru is extremely concentrated and capital intensive. In 2018, 60% of exports came from 10 companies, with the top 4 companies responsible for 39% (CIRAD, 2019). Expansion in the area under cultivation was largely driven by irrigation projects which raised the productivity of land. The major Avocado producing districts are Viru and Chao, which were beneficiaries of the Chavimochic irrigation project that extends throughout the western coast in the La Libertad region[9], which is described as the "cradle of the Peruvian Hass industry" (CIRAD, 2019). This irrigation megaproject brings waters from the Andes to these areas, improving irrigation in 78,310 hectares (World Bank). Figure 34 analyzes production growth from 2016 to 2025, showing that the largest increase in avocado production came from Lambayeque region, in particular Olmos and Motupe districts. These regions were recently brought under cultivation through the completion of the Olmos Irrigation Project, and satellite imagery in Figure 33 shows the difference in land usage patterns before and after the project was completed, which followed a similar pattern to that seen in Chavimochic. La Libertad region continues to account for significant increase in the production of avocados, as well as the Ica department.

Figure 33: Olmos Irrigation Project, Satellite 2012-2023



Source: Satellite images from 2012, 2013 and 2023 via Google Earth

Figure 34: Peru: Contribution to Increase in Avocado Production

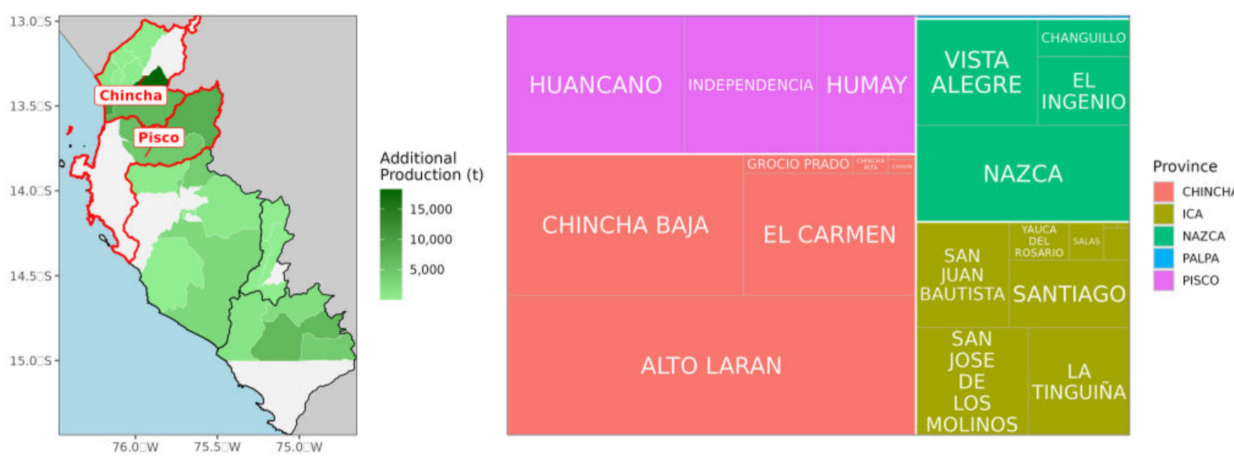


Source: Own elaboration using data from MIDAGRI, Peru, 2025

[9] Chavimochic is an acronym formed partly by the names of the valleys it crosses: CHao, VIru, MOche and CHICama.

Avocado production in the Ica department demonstrates how capital-intensive avocado production in the north has had positive productivity effects on more traditional producers. Much of Ica is part of the coastal river valleys that represent the traditional agricultural zones, which have smaller landholdings and are now partially switching towards export crops (CIRAD, 2019). Ica is an example of how the work of capital-intensive export firms in the north can spillover to improved productivity for existing farmers engaged in more typical agricultural activities. Within Ica, much of the growth comes from Chincha and Pisco provinces between 2016-2025 (Figure 35), towards the north of the department. The growing conditions are similar to those in Olmos and Chavimochic (CIRAD, 2019), which makes it a natural location to apply techniques, technologies and know-how gained in those regions. Here too, investments in irrigation have enabled the production of avocado, while water stress continues to be a limiting factor in avocado production (ibid). There are several potential mechanisms by which know-how from La Libertad and Lambayeque would make their way to Ica. One mechanism is through associations. The Hass Avocado Producers of Peru (ProHass) is an active association of producers which conducts a wide variety of activities from marketing programs, efforts to diversify export markets, technical support for farmers and even R&D exercises with the National Agricultural University (La Molina) (Camacho, 2025). Approximately 60% of the production of avocado comes from ProHass members (CIRAD, 2019), and the association plays an important role in intermediating between the industry and the government. Another mechanism is through productive policies from local governments. The Hass Avocado Board report of 2019 writes "producers are entitled to incentives and technical support from local governments and some exporters specialising in the 'acopio' system (packers/exporters bundling together the harvests of a large number of small producers based in the same geographic zone)". These mechanisms are non-trivial - the USDA reports that some 94 percent of Hass avocado producers are farmers with less than 5 hectares, representing 30 percent of total area in production (Camacho, 2025), demonstrating that despite market concentration among large export-oriented companies, conducive policies and know-how transfer have meant that many small-holders are still able to participate in production.

Figure 35: ICA: Contribution to Increase in Avocado Production



Source: Own elaboration using data from MIDAGRI, Peru, 2025

7 Constraints

The analysis of productivity examines both crops that Bolivia currently produces at scale - including soy, maize, beef, and quinoa - and extensive-margin products that Bolivia might plausibly develop, drawing on the example of Peru, which successfully diversified into high-value crops for export. These studies reveal a recurring set of constraints, which we argue policymakers should prioritize in order to accelerate agricultural growth and exports. These constraints fall into several categories: agricultural innovation and extension; restrictions on key inputs such as fertilizer, machinery, and transgenic seeds; infrastructure and logistics; market access and trade agreements; phytosanitary capacity and compliance; and the provision of irrigation.

Innovation and productivity constraints continue to be a major obstacle despite the potential for significant yield gains. Bolivia faces policy and structural obstacles related to innovation, including restrictions on transgenic seeds (estimated to improve yields by 28% for soy and 84% for maize (ANAPO, 2024)), which maintains a wide productivity gap with regional peers. Furthermore, underinvestment in research and development limits the creation of local solutions to local challenges, and a lack of effective agriculture extension programs contributes to a wide dispersion of productivity among farmers. A 2019 World Bank report found the INIAF, which is the governing and coordinating body of the national agricultural and forestry innovation system, to have "virtually no operating budget to take on agricultural research and transfer technology to producers" (World Bank (2019)). Given Bolivia's geographic diversity and wide range of operating environments, the binding constraints to growth will be different in different regions. Without a locally embedded institution that is continuously developing and disseminating relevant solutions to local problems, productivity improvements will be much slower than what is possible. Furthermore, regulatory frameworks for agricultural inputs are also weak, contributing to low fertilizer use and virtually non-existent processes for registering machinery.

The Embrapa model

Embrapa provides a useful model of how agricultural research could be set up effectively in Bolivia. Embrapa (Empresa Brasileira de Pesquisa Agropecuaria) was established in 1973 as a public corporation focusing on agriculture research and development. At the time of its founding, its designers had identified two main challenges constraining Brazilian agricultural productivity growth - geographic centralization of the research structure, and the lack of trained and specialized personnel to carry out the research (Akerman et al., 2025). One of Embrapa's founders, Eliseu Alves, said

The designers of Embrapa countered these issues by establishing a large public corporation with an explicit goal to study and serve all regions and ecosystems of Brazil. At its peak, Embrapa cost 1% of agricultural GDP and employed over 2,000 researchers, with research centers deliberately established in remote, ecologically distinct areas that had limited pre-existing R&D — including the Northeast, the Cerrado, and the Amazon. Its autonomous legal framework as a public company enabled flexible interactions with the private sector, universities, and other organizations, allowing it to develop technologies that could be widely marketed to farmers, directly participate in the commercialization of seed varieties, and conduct extensive interviews with farmers across all regions to tailor its research investments to their specific constraints and production threats (Akerman et al., 2025).

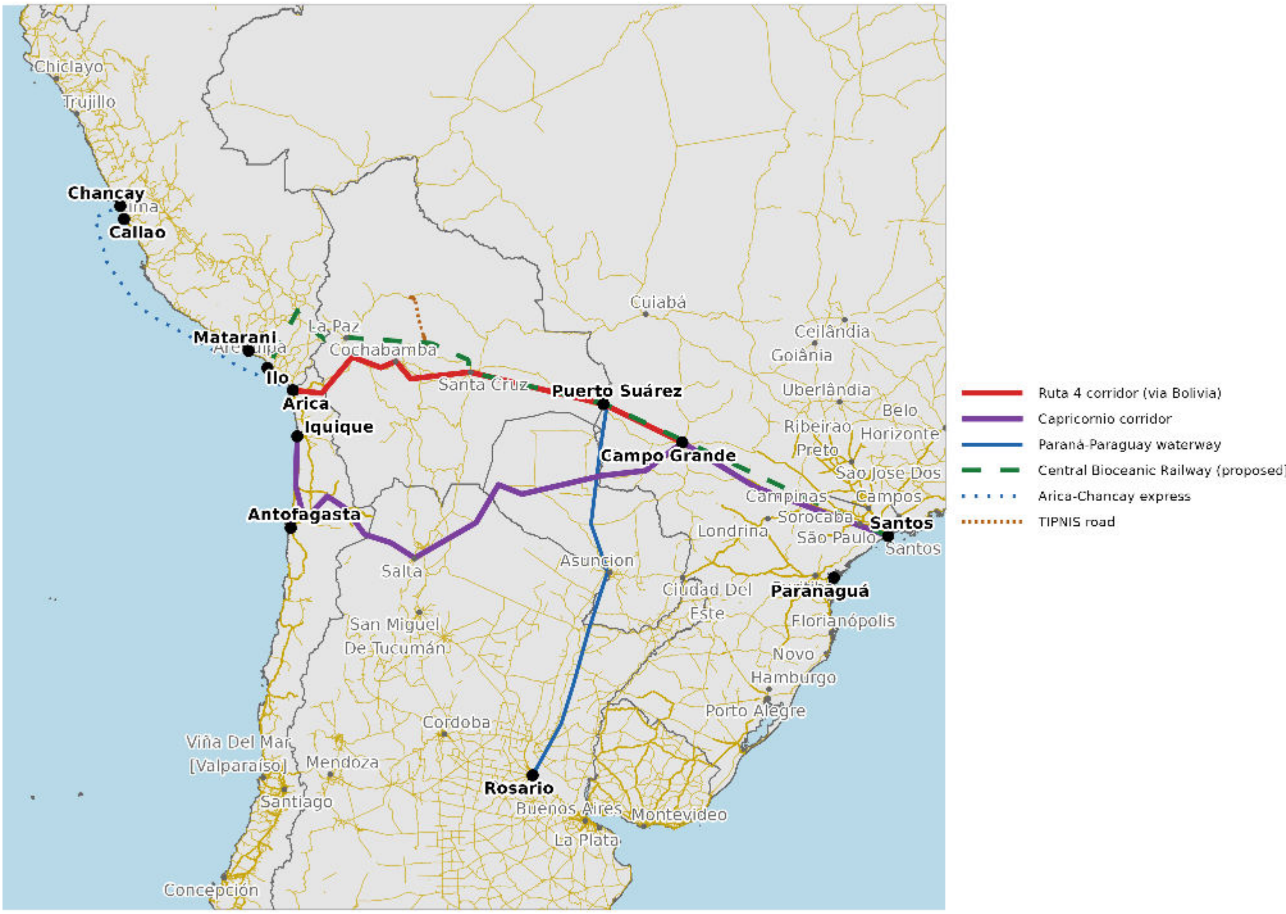
Embrapa was highly effective. A new paper by Akerman et al. (2025) finds that Embrapa increased aggregate Brazilian agricultural productivity by 110%, accounting for 39% of all agricultural productivity growth between 1970 and the present. Despite the high costs, it was remarkably cost effective, with a benefit-cost ratio of 17. Particularly interesting for Bolivia is that Embrapa's decentralized structure explains more than half of the total gains. One example of Embrapa's success is in the Cerrado, a 2-million sq km tropical savanna with highly acidic soils that was considered unproductive in the 1960s. Embrapa developed soil correction techniques, nitrogen fixation methods, and soy varieties adapted to tropical latitudes, transforming the region into one producing 42% of Brazil's soy by 2006 (Akerman et al., 2025). The Cerrado shares core agroecological features with Bolivia's Santa Cruz lowlands, and it's likely that Embrapa's research was an important enabler of Bolivia's soy boom (Mackey, 2011). Given Bolivia's similarly unique geographic diversity, and its low and stagnating productivity levels, it is likely that much of the technology developed by other countries and imported into Bolivia constitutes — it doesn't match the context well enough to be effective. The lessons from Embrapa are therefore particularly salient for policymakers today, with findings from Akerman et al. (2025) serving as a strong call to action.

Market access and trade barriers have been created by policy choices that hinder exporters. This includes export quotas, which hurt production and have sometimes fueled higher domestic prices (as seen in the beef industry). Moreover, a scarcity of effective phytosanitary agreements and lagging phytosanitary compliance capacity restricts access to more profitable international markets, despite demonstrated external demand (e.g., the rapid growth in beef exports following the 2019 agreement with China).

Logistics and infrastructure present a significant structural constraint, especially for a landlocked country. Efficient logistics are critical but are currently a major structural constraint, with Bolivia ranking poorly, at 115th out of 139 countries in the World Bank's 2023 Logistics Performance Index, well below regional peers including Peru (61), Brazil (51), and even similarly landlocked Paraguay (79). Issues include routine delays associated with inspection and certification processes (e.g., SENASAG), which create long turnaround times and high cost overruns (estimated up to 23% for land transport) (World Bank (2019)). These bottlenecks are especially damaging for perishable and SPS-sensitive products like beef.

Recent developments in infrastructure present new opportunities for Bolivia that have begun to be harnessed already. Figure 36 illustrates major logistics infrastructure in the region, approximating the routes of highways. The soon to be completed Capricornio corridor (in purple) connects the port of Santos in São Paulo on the Atlantic to several ports including Iquique in northern Chile. It does not run through Bolivia, but may potentially still provide improved access to ports for the southern departments like Tarija. The recently inaugurated port of Chancay has reportedly reduced the journey time to Shanghai by up to 7 days Alonso (2026), and shipments of frozen Bolivian beef have already begun to take advantage via the Arica-Chancay express (illustrated through the dotted blue line). Bolivia continues to push for funding support for the proposed central bioceanic railway (proposed route illustrated as green dotted line) which would further reduce transportation costs. At the same time, social unrest has often exacerbated Bolivia's shortage of logistics infrastructure. Protests often block route 4 in Bolivia (in red), leading to significant costs. Protests over the TIPNIS highway (in brown) have prevented it from being completed - indigenous groups living there fear that the presence of a major road would put immense pressure for deforestation and pollution of the rainforest Collyns (2017). In this way, the lack of credible forest protection has become binding on some major logistics infrastructure, which in turn has significant costs for economic growth.

Figure 36: Major Regional Logistics Infrastructure



Source: Own estimation

Irrigation repeatedly emerges as a critical factor in both constraining Bolivian productivity and enabling Peruvian agricultural success. In Bolivia, the traditional Altiplano region is constrained by water scarcity (World Bank, 2019), directly limiting production and expansion. Furthermore, the irrigation constraint is relevant given that the land use analysis highlights a significant share of land classified as permanent meadows and pastures. Conversely, for Peru, large-scale irrigation projects such as Chavimochic and the more recent Olmos project were fundamental enablers. They unlocked the potential for intensive, high-value agriculture at scale, transforming Peru into a leading exporter of products like mango, avocado, and blueberries, often by raising the productivity of land that was not previously conducive to agricultural use. Bolivia should consider where similar opportunities exist for using irrigation to bring new land online for viable and sustainable agricultural use, in particular focusing on exports, as the Peruvian examples have demonstrated positive spillovers from an export orientation. This suggests that investment in irrigation is a core policy lever for intensification and diversification.

The government of Bolivia has already recognized the importance of irrigation to raise agricultural productivity. In 2015, Law 745 declared the period 2015-2025 as "The Decade of Irrigation: Toward One

Million Hectares" (*Década del Riego: Hacia el Millón de Hectáreas*). The stated objective was to promote agricultural production through state investment in irrigation infrastructure, and expand irrigated cropland from 242,000 hectares to 1 million by 2025. As of 2022, the program more than doubled the cropland under irrigation to 556,000 hectares, affecting at least 98,000 families (*El País*, 2018; World Bank, 2024). However it still fell short of its goal by almost half. A World Bank project appraisal further noted that the program targeted mostly "traditional medium-sized irrigation systems", which was "impractical" to integrate with the highly fragmented landholdings of the highlands and the inter-Andean regions (World Bank, 2024). Only 2% of funding was directed towards small-scale household irrigation systems that have been successfully implemented in other rural development projects and allowed households to diversify their production (ibid).

The World Bank critique raises at least two margins for improvement to the existing irrigation model. The first is to continue to scale up irrigation projects in Bolivia — 556,000 hectares of cropland under irrigation is only 14% of the 3.9 million hectares of total cropland area according to FAO land use data. The second is to improve the composition of the irrigation projects so that they are more practical for areas with more fragmented landholdings.

However, to further the goal of diversifying and increasing exports, the program should be complemented with irrigation projects designed to facilitate commercial export agriculture. Peru's Chavimochic and Olmos projects were large and explicitly designed to open up new contiguous land for capital-intensive, export-oriented production. Taking inspiration from the significant success of this model, policymakers should incorporate its logic into the expansion of Bolivian irrigation. In particular, this would involve identifying strategically located land with export potential and building the infrastructure to make it productive at commercial scale.

Addressing these recurring, systemic constraints is essential for the next phase of agricultural policy and is a prerequisite for sustained, high-value growth.

8 Policy Responses

The analysis of land use, productivity and diversification opportunities reveals a recurring set of key constraints that hold back agricultural output growth. The constraints summarized above can be organized along two dimensions: whether they primarily affect production, or affect market access, and whether they are the product of immediate policy choices or reflect deeper structural gaps (Figure 37).

Figure 37: Recurring Constraints to Agricultural Production in Bolivia

	Policy-created	Structural
Production	Restrictions on Transgenic Seeds Restrictions on international fertilizer use Weak regulatory framework for machinery registration	Underinvestment in R&D Lack of effective extension programs Irrigation
Market Access	Unpredictable export quotas and bans Limited phytosanitary agreements with key markets Limited trade agreements	Logistics Infrastructure Weak phytosanitary compliance capacity SENASAG inspection bottlenecks Landlocked Geography

Source: Own elaboration.

The policy-created constraints represent the most immediate opportunities for reform. Lifting restrictions on transgenic seeds alone is estimated to improve yields by 28% for soy and 84% for maize (ANAPO, 2024), and improving access to fertilizer and machinery while credibly committing to removing export restrictions would reduce uncertainty and improve the investment environment for producers. Developing phytosanitary agreements with new trading partners will require improving phytosanitary compliance capacity, but it is only in pursuing these relationships that the specific requirements and corresponding know-how can be developed and scaled up. The 2019 agreement with China on beef demonstrated that Bolivian producers can react quickly to supply the additional demand coming from new markets.

The structural constraints take longer to improve, but are critical for longer-term sustained growth. These constraints require more sustained policy attention, capacity building and investment over time. Bolivia has a wide range of geographic and social environments in which agricultural produce is grown, with each geography and crop combination facing its own particular set of constraints. Scaling up funding of more effective public or mixed R&D institutions to help tackle these local problems can push forward the productive frontier across the country, as demonstrated by Embrapa in Brazil, where decentralized public R&D increased productivity by 110% with a benefit-cost ratio of 17. At the same time, investing in an expanded and more effective agriculture extension program will help disseminate these findings to farmers in the field, and help transfer knowledge of best practices to reduce the widespread productivity gaps between farmers. Bolivia has already committed to expanded irrigation through Law 745's Decade of Irrigation, and building on this foundation while reorienting investment toward commercially export-oriented irrigation can both raise productivity for farmers on existing lands (World Bank, 2019) and unlock the productive potential of underutilized agricultural land. Peru's Chavimochic and Olmos projects were integral to the success of Peru's exports in new, diversified products such as mango, avocado, blueberries and asparagus by opening up land not previously conducive to agricultural use. Logistics infrastructure and phytosanitary compliance capacity require attention, particularly given Bolivia's landlocked geography and current costs imposed by inspection bottlenecks, estimated at up to 23% overruns for land transport (Sánchez and Wilmsmeier, 2014).

High bandwidth policymaking is required to adapt policy initiatives to local opportunities and obstacles. The constraints documented above do not operate in isolation. Seed technology, irrigation, extension services, phytosanitary capacity, and trade policy interact differently across Bolivia's diverse agricultural zones, crop systems, and social arrangements. The specific combination of interventions needed to unlock productivity in the Altiplano highlands will differ markedly from what is required in the sub-Andean valleys or the eastern lowlands. For this reason, while this analysis can highlight recurring themes and constraints for priority attention, the specific set of actions to be taken must emerge from a sustained, high-bandwidth engagement between the relevant ministries, farmers, associations, and civil society. High-bandwidth policymaking refers to an iterative process in which the government maintains close, ongoing dialogue with economic actors to identify specific obstacles and opportunities, design targeted responses, and adjust course as implementation proceeds. This mode of policymaking, grounded in continuous feedback rather than top-down prescription, is essential to ensuring that reforms are well-calibrated to the realities on the ground. The question is what organizational vehicle can bring this process to life.

National strategies organized around concrete goals can provide a vehicle for this kind of high-bandwidth policymaking. By committing to a clear goal, a national strategy creates the institutional mandate for sustained engagement with farmers, associations, and ministries — generating the iterative feedback loops through which locally-adapted responses can be designed and refined. Bolivia's National Agroecology Strategy is a model of this approach: it sets a clear organizing objective, articulates a framework and monitoring structure, and creates the ongoing process through which policy is continuously calibrated to local conditions rather than fixed at the outset by a single top-down assessment.

We propose that Bolivia launch a National Strategy for Agricultural Potential, aimed at enabling each of Bolivia's distinct agricultural regions to reach its productive frontier. Bolivia's geographic diversity is an asset: the Altiplano, the Amazon, the sub-Andean valleys, and the eastern lowlands each possess distinct endowments that support different crop systems and production opportunities. The constraint is not a lack of potential but a lack of the region-specific infrastructure, technology, research, extension, and market access needed to unlock it. The strategy should include a dedicated R&D component that establishes research capacity across Bolivia's distinct agricultural zones, following the lesson from Brazil's Embrapa that decentralized, ecologically targeted research delivers significant positive returns. By organizing around this goal, the strategy creates the institutional mandate to identify and address the particular constraints holding back each region, assign responsibility for tackling them, and systematically work through the agenda of reforms that this analysis has identified. Export diversification — across products, markets, and geographies — is the natural outcome when more of Bolivia's regions are able to connect their distinct endowments to global demand. This strategy can reinforce and complement the agroecology strategy, as both share a commitment to unlocking agricultural production through grounded, iterative engagement with the specific and highly varied constraints that farmers face — one oriented toward ecological sustainability and social resilience, and the other toward enabling each region to reach its productive potential.

The analysis of deforestation dynamics also points to a distinct set of land governance reforms that are not captured in the productivity and trade constraints above, but are nonetheless important to address. The most immediate priority is credible enforcement of the existing land use plan: the pattern of retroactive legalization of illegal clearing has effectively signaled that forest use rules are not binding, and breaking this expectation is necessary to shift frontier behavior. The FES regime should be clarified so that landholders who keep forested land in its natural state are not at risk of expropriation; as long as clearing is perceived as insurance against losing land to the state, this dynamic will persist regardless of other reforms. The regulatory framework governing smallholder and community forestry should be redesigned to be workable for these actors, replacing a compliance burden built for large commercial operators with one that enables participation in legal forestry and raises the returns to keeping land forested. Finally, facilitating investments in pasture productivity — through grazing rotation, improved varieties, and better herd management — can decouple the growth of the cattle herd from land expansion, easing pressure on the frontier. Together, these reforms would shift Bolivia's land use trajectory from one of chaotic, incentive-driven clearing toward deliberate, planned management of the agricultural frontier that allows agricultural land expansion to maximize production gains and minimize environmental loss.

Figure 38: Policy Framework for a National Strategy for Agricultural Potential

Policy Priority	Description	Potential Action Areas
Improve Access to Markets	End unpredictable export bans and negotiate phytosanitary market access.	• Establish a rules-based, predictable trade framework with a credible commitment not to ban exports • Reform or eliminate the domestic supply certification requirement for export permits • Negotiate phytosanitary agreements with new trading partners together with producer associations • Invest in SENASAG capacity and turnaround times • Develop phytosanitary roadmaps for priority export products and destination markets
Improve Access to Inputs	Streamline agrochemical registration and legalize and regulate GM seeds.	• Conduct a targeted review of SENASAG's agrochemical registration process • Streamline the prior authorization process by supreme decree under Andean Community Decision 804 • Streamline the GMO approval process via supreme decree to enable faster, rules-based authorization • Legalize and regulate the GM varieties already in widespread informal use • Consider a zone-specific framework to balance social pressures
Improve Access to Infrastructure	Invest in logistics and transport, and scale irrigation for commercial agriculture.	• Invest in transport and logistics infrastructure • Reduce inspection and certification delays • Address bottlenecks at border crossings and transit corridors • Continue scaling up irrigation coverage • Reorient project design to match system scale with farm structure in highland and inter-Andean regions • Identify strategically located land suitable for large-scale, export-oriented irrigation investment
Improve Access to Knowledge	Build zone-specific R&D capacity and deploy extension networks.	• Increase INIAF funding and operational capacity • Build out an agricultural extension network across Bolivia's diverse geographic zones • Establish decentralized research capacity across distinct agroecological zones, drawing on Embrapa's model
Develop Sustainable Land Governance	Enforce the land use plan and protect forests; plan frontier expansion to maximize productive value and minimize ecological loss.	• Credibly enforce the existing land use plan; stop retroactive legalization of illegal clearing • Clarify the FES regime so keeping land forested does not trigger expropriation risk • Redesign smallholder and community forestry regulation to enable participation in legal forestry

		• Facilitate investments in pasture productivity to decouple cattle growth from land expansion

9 Appendix

9.1 A.1 Land rights and tenure

Bolivia has made remarkable progress in formalizing rural land rights, making the provision of formal titles an unlikely binding constraint to agricultural productivity growth. The 1996 INRA Law launched a nationwide land regularization program that has been one of the most extensive in Latin America. By 2023, INRA had regularized approximately 92 percent of its 103.4 million hectare target area, up from roughly 10 percent of land under smallholder and community tenure in 1992 Schling *et al.* (2026). Bolivia appears to have also reaped relatively high economic rewards to titling compared to peers. A cross-country comparison of the productivity effects of titling in Bolivia, Peru, and Ecuador finds that the returns to receiving a formal title are highest in Bolivia, where titled farmers show technical efficiency[10] 6.8 percentage points higher than untitled farmers, a 47 percent difference (Schling *et al.* (2026)). In Bolivia, titling is also associated with a 7.7 percentage point increase in the probability of accessing credit and a 7.3 percentage point increase in productive investment. In Ecuador and Peru, the same study finds positive but smaller effects of 5.8 and 5.1 percentage points respectively. The authors attribute Bolivia's stronger results to its more sustained regularization effort and to the fact that titling has been better integrated with functioning land markets and rural financial services. Given that the vast majority of rural land is now titled, further titling alone is unlikely to unlock large additional productivity gains.

Within this broadly positive picture, two residual features of the legal architecture create more targeted distortions, neither of which rises to the level of a first-order constraint but are worth noting. Bolivia's land regime has several distinctive features. First, smallholdings below specified size thresholds (less than 10 hectares in the highlands, less than 50 hectares for crop farms and less than 500 hectares for ranches in the lowlands) are constitutionally classified as non-seizable family assets: they are indivisible and cannot be seized for debt (Article 394 II of the 2009 Constitution). Second, indigenous communal territories (TCOs/TIOCs), which account for approximately 25 percent of all regularized rural land (about 25.6 million hectares), are inalienable, indivisible, and cannot be mortgaged. Third, medium and large properties are subject to a "functional and economic use" (FES) requirement, under which the state may reclaim land that is deemed unproductive, a determination that, as discussed in the Deforestation section, is dominated by agricultural-use criteria and has contributed to forest clearing.

An important channel through which these rules may constrain productivity for smallholders is credit. Even where land is formally titled, smallholdings classified as non-seizable cannot be pledged as collateral, because banks cannot take possession of the land in the event of a default. This limits formal credit access for capital-intensive investments such as mechanization, irrigation infrastructure, and improved pasture. Communal lands face an even more restrictive version of this constraint: TCOs/TIOCs are inalienable and cannot be mortgaged at all, pushing communities toward grants, public programs, or internal savings rather than bank finance. The World Bank's 2019 assessment finds that only a small minority of farms had access to credit, with lower rates among the smallest producers and in more remote departments (World Bank (2019)).

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[10] Technical efficiency measures the share of potential output a farm actually produces given its inputs, estimated via a stochastic production frontier. A score of 60 means the farm produces 60 percent of what would be feasible with its existing land, labor, and capital.

The evidence on whether non-seizability is in practice a binding constraint to credit access is mixed, and differs by land type. Murguía, Gianola and Schreiner (2018) identify the effect of the non-seizability clause by examining land values around the regulatory thresholds in Santa Cruz: if the clause is materially affecting the value of land, we would expect to see a sharp difference in land values on either side of the cutoff. For ranches, land just below the 500-hectare threshold — which is non-seizable — is worth roughly US$44–434 per hectare less than comparable land just above it (a wide range reflecting heterogeneity across ranch types and sizes). Since non-seizable land cannot be pledged as collateral, this discount implies that the non-seizability clause is preventing ranch owners from accessing financing against their land, and that this in turn constrains the value they can generate from it. The picture for small crop farms is different: land just below the 50-hectare threshold is worth approximately US$509 per hectare more than comparable land just above it. Not only does this argue against the collateral constraint binding for these farmers, it implies there is a positive premium associated with having a non-seizability clause — that is, being protected from seizure is itself valued. This in turn may signal that expropriation risk under the FES is a real concern for larger landholders, whose land sits above the non-seizable threshold and is therefore exposed.

In turn, evidence on whether access to credit reduces technical inefficiency varies by region. The World Bank's 2019 analysis of agricultural productivity finds that credit access helps to reduce technical inefficiency in the Lowlands and Sub-Andean regions, but not where subsistence and traditional farming are more prominent, as in the Highlands (World Bank (2019)). Credit access appears to have more impact when it is paired with integration into markets and access to basic services. The report concludes that policies expanding credit programs will have "limited impacts if other pressing gaps in connectivity and access to basic services are not addressed."

On balance, the evidence analyzed here does not point to land rights as a first-order constraint on agricultural productivity in Bolivia. The clearest finding is that non-seizability constrains credit for smallholder ranchers, whose capital-intensive operations suffer from the inability to pledge land as collateral. There is also suggestive evidence that expropriation risk under the FES may discourage investment on medium and large crop holdings in the Lowlands and Sub-Andean valleys. The evidence reviewed here does not cover communal lands or public lands, which together account for roughly half of Bolivia's territory. We therefore do not identify land rights as a priority constraint on agricultural productivity in the context of this analysis.

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