# The Nature Conservancy | Gran Chaco Regenerative Calf-Rearing Business Model

The Nature Conservancy
Latin America

# Contents

# Introduction

Within the framework of the Future Landscapes program, TNC, with the support of the Gordon Foundation and Betty Moore, co-designed an associative business model for the breeding and sale of calves in formal markets. The model is adapted for family production systems and adds value by integrating regenerative livestock practices, optimizing production processes and taking advantage of dry forest resources. The business model seeks to impact the more than 100,000 producers who make a living from livestock in the Gran Chaco cattle breeding provinces, ensuring their income while actively promoting the conservation and restoration of ecosystems.

The ecoregion of Argentina's Chaco Seco covers an area of 490,000 square kilometers, covered by xerophilic forests and Chaco plains. It is home to a magnificent diversity of flora such as the red quebracho and fauna with emblematic species such as the yaguaraté (jaguar), the tatú carreta (a giant armadillo) and the chancho quimilero (Chacoan peccary). It is one of the most important ecosystems in South America for its extensive environmental and cultural wealth, and is recognized worldwide for the quality of livestock that grows on its pastures. This is why TNC defined Gran Chaco as a Foodscape.

In the last 30 years, this ecoregion has gained relevance in the production of beef in Argentina, hosting 33% of the country's cattlestock, distributed mainly in the provinces of Chaco, Salta, Formosa, and Santiago del Estero. The breeding and marketing of calves stands out as the main livestock activity in the Gran Chaco, where the livestock production cycle begins, before being transferred to provinces with better forage availability. In 2022, more than 5 million calves were marketed to the provinces of Buenos Aires, Córdoba, Santa Fe, and Entre Ríos.

Argentina's Gran Chaco is one of the largest focal points of deforestation in Latin America. Between 2012 and 2018, almost 1 million hectares of native forest were lost due to the expansion of cattle farming into areas with forests, where forest cover is eliminated to introduce pastures, generating habitat fragmentation and loss of biodiversity.

In the Gran Chaco there are 36,860 registered cattle breeding establishments, of which 99% correspond to family production systems, characterized by their small-scale operations (<500 heads), managed by families following traditional practices of extensive breeding and with little participation in formal markets. The remaining 1% corresponds to business production systems, larger scale operations (>500 heads), where more intensive approaches are adopted, including silvopastoral systems, and with a significant participation in formal markets.

The traditional business model of calf rearing in the Argentine Gran Chaco is associated with extensive family systems, traditional livestock management, stock adjustments and management of inadequate grazing, without female breeding stock management strategies and poor management of replacement heifers. There are no risk management systems so producers are exposed to environmental and climate risks, which affect productivity and yields. This is why weaning rates are the lowest in the region (31%). In addition, they have great difficulties in marketing livestock and depend on intermediaries that buy livestock on the property, offering prices well below the formal market; however, it allows them to have liquidity to cover producers' basic needs.

The project has designed a methodology that allows identifying and prioritizing value propositions with regenerative attributes, using information from value chain analyses, supply

and demand, market opportunities and climate risk analyses. In order to define the value proposition, virtual and face-to-face workshops were organized with the participation of producers, local implementing partners, indigenous communities, consultants, public institutions and different experts. When prioritizing the value proposition, the potential environmental, social and economic impact, the viability of the proposal and its potential scalability were evaluated. Based on the value proposition, the business model was designed including a description of the entire process of creating, capturing and delivering value.

As a result, it was possible to develop an associative business model for the production of calves in the Gran Chaco. Establishing production units of 2,000 hectares where up to 6 animal cattle rearing families are articulated. The model creates value from the adoption of regenerative practices in livestock breeding, improving productivity, recovering degraded soils, taking advantage of forest resources and increasing producers' income.

Some of the benefits of the model are as follow:

**-Market access:** The model plans sales for the months with the highest growth rate and forage quality, ensuring uniform forage and better weight. This guarantees the quality and quantity requirements demanded by formal markets.

**-Increase in productivity:** The weaning rate is the key indicator to determine the productivity of the model. From the first year, a significant improvement in the weaning rate is projected, reaching 45%, which is 15% higher than the regional average. In the following cycles, a gradual improvement in the indicator is expected, reaching 75% in the fourth cycle.

-**Revenue growth:** A projection has been developed in a scenario with an investment of USD 100,000 per module, where net sales revenue is estimated to increase by 300% from USD 22,000 to USD 66,000 per year.

-**Ecosystem-based adaptation:** The model improves cattle breeding suitability through the recovery of arid plains, resulting in a decrease in grazing pressure on forests. This constitutes a solution for ecosystem-based adaptation to climate change, achieving increases in animal production.

**-Social inclusion:** The model allows the integration of cultural practices such as fruit harvesting and their use in large-scale supplementation, ensuring the equitable participation of all social groups, with income distribution, participation in training spaces, and decision-making and leadership.

**-Habitat recovery and biodiversity protection:** The model establishes enclosures with electric fencing to promote the installation of pastures, improve cattle roundup management and allow the progressive recovery of degraded soils and the recruitment of native grasses.

The model's financial indicators were established for a 10-year period, where a total investment per hectare of USD 50 is estimated. The adjustment and operating costs for the first year are a maximum of USD 29,000, financed in part by the sale of unproductive cows. As herd productivity improves and production costs such as the purchase of maize are reduced, a positive free cash flow is achieved from the 5th year of operation. It is estimated that after 10 years, the increase in free cash flow will be 300% if compared to Chaco's traditional production model, reaching an approximate cash flow accumulation of $104,000 USD.

This model has been shared with producers, public actors and civil society, seeking to generate interest based on anticipated economic benefits. In the short term, it is expected to establish a pilot module in the department of Santa Victoria Este and Rivadavia Banda Norte in Salta. Possible sources of financing covering 30% of the annual cost are being identified, for which local government and private actors have been involved with interest in developing financial tools that adapt to the requirements of the business model investment.

Even if the project prioritized the calf breeding module, in the medium and long term it is contemplated to develop the modules of other NTFPs, such as honey and carob flour. In the same way, it seeks to contribute to the transformation of fattening and meat consumption practices, and for this purpose it wants to develop a complete value chain that ends the productive cycle of fattening and slaughter in Chaco, allowing to cover the internal demand for meat.

Although this model is aimed at the local market for the sale of calves, it establishes the basis for meeting the requirements of the global meat market in the future. It will allow producers to access international markets that demand sustainable and deforestation-free production, such as that of the European Union. As the Argentine government's protectionist regulations are lifted, producers that already follow this model will have a competitive edge over traditional producers. Additionally, the integration of different NTFP production modules will allow them to take advantage of the natural resources of the dry forest, increasing their income and ensuring the profitability of regenerative cattle rearing and the sustainability of the Gran Chaco.

# Objectives and scope of the proposal

Starting from the premise that any intervention project must consider the integration between the availability of natural resources and the social, cultural and economic characteristics of the communities, a business model based on regenerative cattle breeding practices is proposed here to address and reverse the challenges faced by rural communities in Argentina's Gran Chaco. Ultimately, the goal is to scale up cattle rearing and productive strategies traditionally practiced by rural families in the area in order to achieve a sustainable and replicable impact.

The cattle breeding model places special emphasis on the family economies that are predominant in the region. It is a management approach capable of generating income and promoting the adaptation, conservation and restoration of native ecosystems through the integration of scientific and traditional knowledge. Among other advantages, it seeks to reduce the environmental footprint, increase resilience to climate change and improve productivity. At the same time, it is expected to foster social inclusion, gender equity, community health and livelihood improvement.

It arises from the opportunity to rethink local cattle rearing systems so that they adopt process technologies that allow calf-breeding families to improve production conditions and results. It contemplates the incorporation of practices for the recovery of the productive potential of degraded areas, the valorization of local resources such as forest fruits that can be used as supplementary food, the implementation of forest restoration strategies and a more efficient management of water and grazing.

Likewise, it is based on leveraging the knowledge of producer families, integrating the expertise of women in water management, veterinary herbalism, wild fruits, planning and administration, with that of men regarding the behavior of ecosystem and cattle. It is also aimed to shed light on the contribution of youth, who are increasingly trained in sustainable management and digital technology. Thus, efficiency and effectiveness of the system will be increased, and existing gender and intergenerational gaps will be reduced.

The scenario is also ideal for placing products in global markets that are becoming increasingly demanding in terms of verifiably sustainable, regenerative, and climate-resilient production standards. Given the constraints on commodity marketing to the European Union and other regions, the Gran Chaco faces an extraordinary opportunity to position itself as a leader in providing products free from native habitat conversion. For this purpose, it is crucial to develop tests that demonstrate the viability of the model in real-life situations, which, in turn, will require technical support and training to be scalable.

The ultimate goal of the model goes beyond simply adjusting practices, processes, and methods. Ultimately, it seeks to redefine standards and influence norms and values throughout the value chain, generating environmental, social and economic benefits along the way.

# Context

## Argentina's Gran Chaco

The Argentinean Chaco Seco ecoregion covers an area of 490,000 square kilometers distributed mainly between the provinces of Santiago del Estero, eastern Salta and western Chaco and Formosa. The landscape is characterized by being mostly flat and shaped by a low annual average rainfall regime (between 400 and 600 mm). The ecosystem diversity of the region is vast. It hosts a magnificent variety of flora such as the red quebracho and fauna with emblematic species such as the yaguaraté (jaguar), the tatú carreta (a giant armadillo) and the and the chancho quimilero (Chacoan peccary). Dry forests predominate, which in some areas, intermingle with bushes and grasslands. The humid environments include four large rivers – Bermejo, Pilcomayo, Salado and Salí-Dulce – as well as lagoons and marshlands with intermittent permanence. It is one of the most important ecosystems in South America due to its extensive environmental and cultural richness and is recognized worldwide for the quality of the cattle that graze on its pastures. This is why TNC defined Gran Chaco as a Foodscape.

From early on in human occupation, the Gran Chaco Seco has hosted various productive activities, which in turn have greatly influenced the culture and ways of life of its inhabitants and local communities. However, not all of these activities have achieved the same level of development and technological advancement, affecting their replicability at larger scales and, consequently, their impact on territorial transformation.

According to the crop and land use map from INTA (National Institute of Industrial Technology)[1] the Gran Chaco has nearly 34 million hectares suitable for cattle rearing. Livestock production is located in areas with forest predominance, where, in addition to family livestock farming, there are also commercial production systems that are more technified and larger in scale. These systems often remove the shrub cover from the understory to plant fast-growing megathermal pastures. In both family and commercial schemes, grazing occurs continuously throughout the year in generally large paddocks, without giving rise to the regeneration of the forest or the pastoral base.

The family group breeding scheme in the Gran Chaco has been subject to various analyses over time. In general, the aim has been to provide technical, financial, and health assistance to the breeding families in order to increase the efficiency of this type of production and reduce its impact on the environment. In this regard, there have been interventions by a myriad of actors, including the National State, provincial and municipal governments, producer associations, and civil society organizations.

## Beef Value Chain Analysis

The value chain of livestock and beef includes from the links of primary production, focused on calf breeding and fattening, to the marketing of the final product of the complex, beef and derivative products.

In its structure, a clear differentiation can be identified between a stage or phase of primary production and a second stage of transformation or industrial phase, each of which involves the participation of different actors with varying degrees of articulation with other links and actors. Additionally, intermediaries (consignees/commission agents) and transporters are included as agents that articulate the chain at each stage, as well as technical assistance and oversight agencies, transversely across the entire chain.

*Table 1. Summary of Beef Value Chain Theoretical Outline*[2]

| Beef Value Chain | Primary production | | | Processing or industrialization |
|---|---|---|---|---|
| **Process** | Breeding | Rebreeding | Grass-fed fattening<br>Feedlot fattening | Slaughter, conditioning and refrigeration of half carcasses and cuts |
| **Product** | calves and categories of culling | calves<br>heifers<br>young steers | young steers<br>steers | Half carcasses, cuts, offal, hide, viscera, other |
| **Direct Actor** | breeder | rebreeder | fattener<br>feedlot operator | Slaughterhouse - Meat processing plan |
| | producers´ associations | | | |
| **Indirect actor** | Livestock consignees | | | |
| | Logistics operators | | | |
| | Technical Assistance and Training<br>Supervision and control of the state | | | Supervision and control of the state |

In the region under study, according to the scale of production and primarily conditioned by the degree of formality of the activity, we can find varying degrees of integration and overlap between the links of the chain. At the same time, agroecological characteristics, on one hand, as well as infrastructure availability on the other hand, mean that the complete cycle of the chain is not fully developed competitively in each of the region's areas. This explains why in areas with lower rainfall and therefore more marginal, there is a predominance of breeding establishments, while in areas with better conditions, although in competition for land use with agriculture, rearing and fattening establishments are developed with pasture-based feeding supplementation or, as observed in recent years, with a strong presence in the region, migration towards feedlot fattening schemes.

For the selected region, breeding is the predominant livestock activity, aimed at producing weaned calves for subsequent fattening, a task usually performed by other actors and in other areas with better agroecological conditions. However, several establishments carry out the entire activity cycle, facing significant difficulties and inefficiencies, mainly due to the prevailing production limitations in the region. The main actor in this link is the livestock family, which is responsible, among other tasks, for managing the herds, including reproduction management, health care, and pasture and feeding management.

Because the region under study has a predominance of native forest cover, livestock farming is developed under traditional silvopastoral schemes with removal of part of the shrub cover and farm replacement by exotic pastures, in the case of more technical and larger-scale producers, and at the other end, family livestock systems under forest cover with limited or no on-farm interventions for management. In both cases, grazing management is often limited, and grazing typically occurs continuously throughout the year in large pastures.

The slaughter of the finished animal is carried out in provincial and municipal meat processing plants or slaughterhouses, depending on the case. From there, two half carcasses, cuts, and other derived products and by-products (hide, blood, fats, offal, and viscera) are obtained, each of which begins a particular production route.

In the industrial stage, there are other intermediary agents called slaughterers or slaughter users who do not have their own establishments to process their merchandise. These intermediaries have a license to purchase livestock and lease slaughter services to slaughterhouses, and then sell the half carcasses directly to wholesale or retail businesses.

It is worth noting that, in the area, it is common for the same slaughter operation to be carried out by retail businesses (local butcher shops) that purchase animals for slaughter directly from the producer, often in an informal manner, bypassing the required sanitary and bromatological controls.

Among the primary links, and between these and the industry, there is a great diversity of actors who engage in transportation and intermediation activities regarding the buying and selling of livestock, charging respective commissions and with varying degrees of negotiating power. Intermediation is greater when smaller-scale agents operate, who, due to their low sales volumes and limited information, lack negotiating power to close direct contracts.

Logistics operators play a crucial role in managing the distribution of livestock between livestock establishments, and between the latter and meat processing plants or slaughterhouses, handling everything related to route planning, coordinating suitable trucks for livestock transportation, as well as ensuring compliance with regulations and standards during transportation, especially on regulated circuits. At the same time, they are responsible for loading and unloading animals and all the necessary paperwork to ensure compliance with current regulations. This includes obtaining permits and necessary documentation, such as animal transport guides, sanitary certificates, and other documents required by the competent authorities.

Cattle traders are key actors in the beef cattle value chain. Their main function is to facilitate the buying and selling of livestock, acting as intermediaries between livestock producers and slaughterhouses, abattoirs, or other cattle buyers. These traders can play different roles and offer various services in cattle marketing. In some cases, marketing is carried out by consignees, who are responsible for organizing and conducting livestock auctions, where producers present their animals for sale and buyers make competitive bids. Auctioneers act as intermediaries, facilitating transactions and ensuring a transparent process.

Some cattle traders specialize in the direct sale of animals to buyers, whether they are slaughterhouses, meat processing plants, meat processing companies, or other intermediaries. These agents negotiate prices, delivery conditions, and other commercial terms on behalf of livestock producers. Some even reassemble batches of animals for sale to achieve better prices based on the age, weight, and quality of the purchased animals.

# Market Research

## Beef market

Beef market is part of the Argentinean culture, neighborhood butchers are part of the social structure of Argentinians. They know the tastes of their customers, they know how much they will ask for and how they want the meat cut, generating loyalty processes that are difficult to change, as consumers manage to satisfy their needs at the lowest cost. This makes little room for niche products such as sustainably labeled meats, which are associated with additional costs and still do not have a place in the showcases of traditional butchers. This is a trend that is generalized for all certified organic products (honey, fruits, milk, among others), of which only 1.4% are destined for the local market.

Argentina produces about 3.1 million tons of meat per year. 71% of this production covers the domestic market, where per capita consumption is 50.4 kilograms per year, more than in any other country in the world. Regarding exports, there are government restrictions to limit cut types and volumes, in part to ensure that local demand is met, but also to control prices. Given the hyperinflation that Argentina is experiencing, the most influential factor when deciding to buy meat is the price. This is why, although consumers showed interest in accessing sustainable meats, the preference is towards the cheapest product.

In Argentina, several factors influence the price of beef:

- **Supply and demand:** The dynamics between supply and demand play a crucial role in determining beef prices. When demand exceeds supply, prices tend to rise.
- **Production costs:** The costs involved in the production chain, ranging from breeding to commercialization, including feedlot, slaughterhouse, butcher shop, and taxes, are a key element that can directly affect the price of beef.
- **Inflation:** Price variability may be linked to inflation, as it can increase the costs of supplies necessary for beef production, thus impacting its price.
- **Public policies:** Government decisions and policies can have a significant impact on the beef market, influencing its price, such as the recent import bans to control price increases.
- **In the case of sustainable beef:** it is important to consider that its price tends to be higher than that of traditional beef. This is due to the additional costs associated with sustainable production practices.

## Sustainable beef demand

Converting producers to new, more sustainable production practices can increase their costs, and will eventually require improving existing infrastructure. However, access to more

sophisticated international markets, the development of local sustainable brands to reach environmentally conscious consumers, represents an opportunity for income improvement.

There is a growing demand for sustainable, regenerative, deforestation-free beef with biome care, both in the Argentinean and in the international market. However, in a study conducted by the consulting firm Kantar, it was found that 80% of consumers are willing to pay more for sustainable beef, but given the current economic situation in Argentina, they are now seeking products related to prices.

## Consumer trends

Argentinian consumers are experiencing a transformation in their preferences, marked by a growing interest in the transparency and traceability of meat products. This evolution is reflected in an increasingly high demand for detailed information about the origin and production process of meat[3].

Traceability, which allows for meticulous tracking of a product throughout the entire supply chain, has acquired a crucial role in purchasing decisions[4]. In Argentina, the traceability of beef is considered mandatory and is rigorously regulated by the regulations of the National Service for Agri-food Health and Quality (SENASA, as per its Spanish acronym) and the Secretariat of Agriculture, Livestock, and Fisheries.

Certifications and labels that support sustainable practices are now highly valued by conscientious consumers. These seals of approval provide tangible evidence that the meat has been produced ethically and sustainably.

This shift in consumer trends signals a profound transformation in Argentinians' relationship with meat. The quality of meat is no longer solely evaluated based on its taste but also on its social and environmental impact[5]. This evolution in consumer perception and preferences creates significant opportunities for producers and the industry as a whole. It is fostering the adoption of more sustainable practices, envisioning the possibility of a more ethical and sustainable meat industry in Argentina. However, it is essential to note that the transition to more sustainable practices may present challenges and will require the support and collaboration of all stakeholders, including producers, consumers, and the government.

## Global demand for sustainable beef

In the last decade, the global demand for sustainable beef has experienced an unprecedented increase, driven by the growing environmental and ethical awareness among consumers. This paradigm shift has found resonance not only in Europe[6] and the United Kingdom but also in China, where the Meat Association signed the China Sustainable Meat Declaration in 2017, signaling a clear commitment to more responsible practices.

- *Europe and the United Kingdom*. In these regions, sustainable beef has become increasingly attractive to consumers seeking to reduce their environmental footprint. The European Union has implemented stricter regulations on sustainability and animal welfare, making certifications essential for accessing more demanding market

segments. Transparency in supply chains has become a standard, and consumers seek assurances about sustainability from farm to plate.[7]

- *China*. The evolution of the Chinese market is notable. With the rapid growth of the middle class, the demand for high-quality and sustainable products has grown exponentially. The signing of the Sustainable Meat Declaration in 2017 by the China Meat Association demonstrates a tangible commitment to sustainability or can be seen as the Asian giant aligning with new sustainable rules across all areas, from lower carbon emissions to increased investment in renewable energies. In this scenario, certifications are fundamental to gaining consumer trust in a rapidly growing market.

## Challenges of the Traditional Beef Market in Argentina

Although demand for sustainable meat is on the rise, the traditional beef market in Argentina faces significant challenges. . The need to balance large-scale production with environmentally responsible practices raises questions about the economic viability and adaptability of traditional producers.

One of the biggest challenges is resistance to change. Many producers are rooted in traditional methods and may be reluctant to adopt new practices. Additionally, implementing sustainable practices may involve higher initial costs, which can be a barrier for some producers. However, we also know that several producer organizations are already including in their work agendas issues related to carbon footprint, sustainability, commitment to non-deforestation and deforestation-free meat production.

Furthermore, consumer education is a major challenge. Although awareness of sustainability is increasing, educating consumers about the implications of their choices and the added value of sustainable beef remains a challenge.

Adapting to new consumption trends and sustainable production presents significant opportunities for the transformation of the meat industry in Argentina. Differentiation through sustainable practices and the offer of certified meat are strategies that allow producers to stand out in an increasingly conscious market.

Finally, collaboration among producers, governments and industry organizations can be an opportunity to address common challenges and set higher standards for sustainable production

## Calf market

Cattle production in the Gran Chaco region stands out as a crucial economic activity, involving approximately 100 thousand cattle producers. This region features a significant stock of 9,163,000 heads, representing 17% of the national total, according to the latest national agricultural census[8]. Calf breeding emerges as the primary focus of livestock activity in this territory.

The diversity in the scale of producers is reflected in categories of family production systems with less than 500 head of cattle and larger-scale commercial production systems with more than 500 head. In the Gran Chaco, 99% of the property correspond to family production

systems[9]. Despite this breadth, cattle production faces significant challenges, evidenced by an annual weaning rate of less than 50%. Issues such as limited availability of forage resources, lack of infrastructure, inefficient herd management, and deficiencies in sanitary practices negatively impact the efficiency of the system.

However, cattle production in this region also raises environmental concerns, negatively impacting the environment, biodiversity, climate, and human rights. Deforestation and habitat conversion associated with this production chain demand the adoption and dissemination of sustainable practices. These measures aim not only to reduce negative impacts but also to contribute to the conservation of native forest in the Gran Chaco and add value to production.

## Calf exports to different provinces outside the Gran Chaco

The meat value chain in Argentina relies on the supply of cattle from the Gran Chaco, where the breeding cycle begins, to then end the chain in regions with better forage supply. In 2022, over 5 million calves were sold to the provinces of Buenos Aires, Córdoba, Santa Fe, and Entre Ríos, accounting for 30% of the livestock stock in the Gran Chaco.
As a result, the provinces of Chaco experience a structural deficit between production and meat consumption. Despite having 33% of Argentina's livestock stock in its four provinces (Chaco, Formosa, Salta, and Santiago del Estero), local butcher shops are forced to import slaughtered cattle from provinces like Buenos Aires. In 2021, the deficit between processed meat in Chaco and consumption was 36%.

As a proposal to overcome the challenges in the region, it is assumed that the breeding activity holds the greatest potential for improvement. This is because it is a system that, through good management practices, allows for the adjustment of herd requirements to seasonal variations and agroecological conditions in the region, ensuring greater adaptation to these conditions. Additionally, the breeding activity is crucial because it defines the future size of the region's herd, that is, the basis of the productive system.

# Possible integration of a meat production model + NTFP

To assess the feasibility of a business model integrating livestock production with NTFPs (Non-Timber Forest Products), the supply and demand of different products within the meat value chain and NTFPs (honey, carob, and handicrafts) were analyzed. The analysis of the supply considered all links in the chain and the different value propositions aimed at both local and global markets. It was identified that, although there is a growing demand for Chaco honey and there is a local market for carob flour, the infrastructure to produce both products and the technical capacity of local producers are still in the early stages, so long-term investments accompanied by training programs directed at small producers would be needed to create competitive production models.
However, one of the most important non-wood forest products for the implementation of the Business Model is the fruit of carob trees, which, due to their frequency in the forest and their forage quality, could be key to the implementation of the proposed production model.

Carob is also one of the oldest native foods used in South America and one of the main non-wood forest products in Argentina. Its consumption is linked to ancestral customs, as indigenous communities used to make carob flour with wooden mortars.

The primary production of carob mainly involves a phase of fruit production (legume or pods of the carob tree) and their harvest, through a technique of direct ground collection, once the pods have reached sufficient maturity and are naturally detached from the trees.

The carob tree begins to produce pods around five years of age, and it bears fruit between the months of November and February. Pod production varies considerably between years, species, sites, and even among trees of the same species. Traditionally, the pods are collected from the ground manually by the whole family, including women and children. Today, it is known that it is advisable for them to remain in contact with the ground for as little time as possible, as they are attacked by a variety of insects and microorganisms that deteriorate their quality. Collection begins in November and continues until February.

Primary production, linked to forest management and fruit harvesting, is mainly carried out by Wichí communities, although other ethnic groups and even criollo communities throughout the region also make greater or lesser use of these fruits.

## Climatic and environmental effects of traditional cattle breeding schemes

Land degradation is one of the biggest environmental problems affecting the region and has strong socio-economic consequences. Several studies indicate that this condition has resulted from anthropogenic causes stemming from the expansion of agricultural and livestock frontiers under inadequate management schemes.[10] [11] [12]

Continuous grazing is the dominant strategy for extensive cattle production in the region, which involves allowing cattle to graze in the same pasture throughout the year and using pens only for specific management purposes (e.g., health care). In arid and semiarid areas, it is characterized by spatial heterogeneity, with livestock concentration near permanent water sources. Due to increased grazing pressure, degradation processes are accentuated in areas closer to water sources, altering the structure and functioning of the ecosystem through changes along the entire gradient[13].

At the property level, when grazing is uncontrolled (continuous grazing), higher rates of degradation and loss of biodiversity are observed, particularly in arid and semiarid areas, around water sources, due to overgrazing. At the same time, when forage is indiscriminately available, animals tend to select grasses with better palatability, which allows for greater selection by the animals. This leads to the disappearance of species with forage value and the increased abundance of other plant species that are more resistant but have lower nutritional value[14].

According to the report published by the Ministry of Environment and Sustainable Development[15], land degradation is understood as the reduction or loss of biological or economic

productivity and the complexity of rainfed agricultural lands, irrigated croplands, pastures, forests, and wooded lands, caused by land use systems or by a process or combination of processes, including those resulting from human activities and settlement patterns such as: soil erosion caused by wind or water, deterioration of the physical, chemical, and biological properties or economic properties of the soil, and the lasting loss of natural vegetation. Environmental aspects, leading to two main. At the same time, it details a series of causes of degradation, emphasizing decreased fertility and reduced organic matter content, compaction, changes in vegetation cover, habitat loss, decreased diversity, or changes in the quality and composition of species, among others.

It is worth noting that degradation processes rarely occur in isolation. A soil degraded in its physical aspects will also affect its fertility (chemical degradation) and soil aeration, affecting biodiversity (biological degradation). This is how these processes are reflected in the environment in a chained manner, affecting multiple aspects that contribute to the integrity of ecosystems, which in turn impact the productive and economic outcomes of developed systems.
The characteristics generally found in traditional livestock systems have a double impact on env issues. On one hand, the simplification of management schemes in complex ecosystems promotes the expansion of activity on natural ecosystems.[16] At the same time, limited advancements in improving the productive yields of the activity keep livestock among one of the sectors that, locally, contribute the most to climate change through greenhouse gas (GHG) emissions, mainly due to enteric fermentation during rumination.

The National GHG Inventory shows that 49% of these emissions come from the agricultural sector, and within this sector, 58% of GHGs are generated from various sources related to grazing livestock. Mitigation strategies do not necessarily imply emitting fewer GHGs from the production system, but rather can result from increased productivity and, consequently, a lower amount of gas emitted per unit of meat produced.[17]

It is therefore necessary to implement a series of measures aimed at halting transformation processes, valorizing natural ecosystems as providers of ecosystem services, and at the same time, allowing for the efficient use of available resources to improve the outcomes of developed production models in environmental, social, and economic terms.

In this sense, considering the development potential of pastoral-based livestock production with strategic supplementation, arguments will be detailed later that point to regenerative livestock farming as a strategy for mitigating greenhouse gas emissions while conserving biodiversity.
For our country, the concept of emission intensity remains the most attractive mitigation pathway, as it allows for synergies between food security and development objectives and the objective of mitigating climate change.[18]

Therefore, for the implementation of regenerative business models, it is based on the premise that every intervention must be conceived as a coordinated planning of practices and instruments that will be applied to achieve the set goals and thus lead towards systemic sustainability. On the other hand, understanding that the implementation of these, in isolation,

without organization and foresight of the impacts, does not ensure the sustainability of the systems. At the same time, they must promote:

- The *management of resources and conservation of landscapes* when productions develop in natural ecosystems;
- Promoting the *recomposition of degraded areas* through productive restoration, and;
- P*roductive intensification* when dealing with previously converted areas.

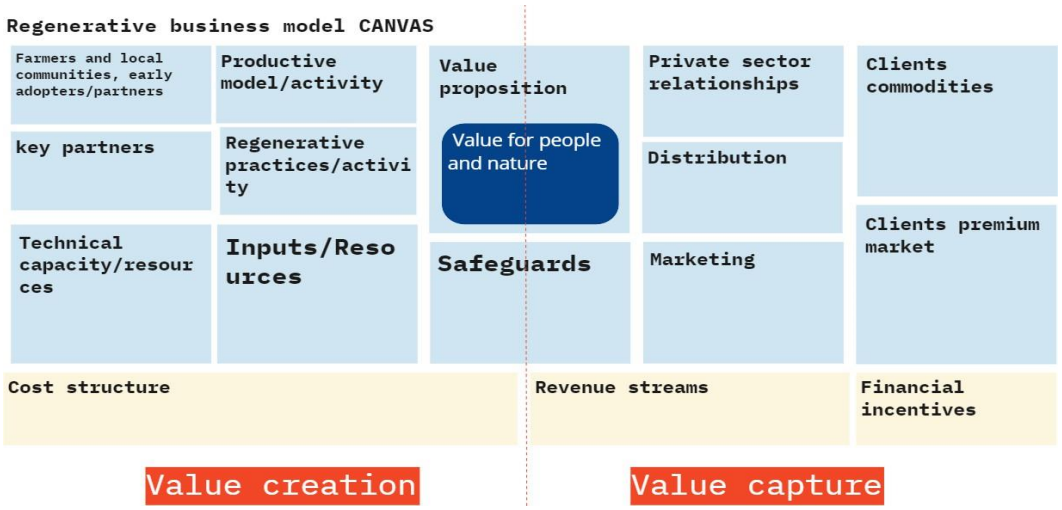
# Business Model Value Proposition

The identified value proposition is a two-way one, generated following the LINK 2.0 methodology of the International Center for Tropical Agriculture (CIAT) and adjusted using a methodology developed by the Future Landscapes program. As a result, a Canvas framework is proposed for a regenerative business model (Figure 2).

Value is generated towards the buyer by being able to offer batches of calves with constant weights, ensuring a stable and planned supply throughout the year. In this regard, and depending on the characteristics and preferences of the demand, the business model allows to achieve competitive marketable animals consisting of calves with good weight at weaning, good physical structure, and a high health status. This seeks to meet the demand of buyers of calves for rebreeding, fattening and rearing in the pen. In addition, it creates added value for meat producers with an export destination, since calves are produced on land without deforestation and with integrated management of natural resources.

Additionally, value is generated for various actors in the chain, as its implementation results in significant improvements for producer families on one hand, through increased economic-productive outcomes. And on the other hand, through the enhancement of environmental conditions as a result of the recovery and use of degraded areas, as well as the inclusion of women and youth.

Figure 2. Canvas regenerative business model developed by TNC.



## What is the value added of the proposal compared to a traditional system?

Unlike the business-as-usual (BAU) systems developed by small livestock producers in the region, an approach of systemic integration of the activity is proposed, with an emphasis on the recovery of degraded environments, reduction of grazing pressure on forests, and improvement of reproductive outcomes. This is achieved through the implementation of productive intensification schemes based on controlled grazing management and strategic supplementation with wild fruits.

From this intervention scheme, beneficial impacts are expected not only in terms of economic performance but also in aspects related to biodiversity conservation, promoting the recovery and sustainable management of natural environments, and the reduction of greenhouse gas emissions intensity as a result of improved reproductive efficiency of the herd.

In this sense, the model constitutes a solution for climate change adaptation based on ecosystems, local communities, and gender, which could result in significant increases in animal production. The proposal involves a substantial rise of cattle production, primarily calves, which would also regenerate the social value - through associations - and the environmental value of the livestock system.

The value proposition consists of a series of differential variables compared to traditional models:

In the region, it is common to promote the incorporation of new grazing areas through land use conversion or removal of certain forest strata to implant a monophytic megathermal pasture (e.g., traditional silvopastoral systems with removal of shrubland and planting of Gatton Panic). However, this model does not focus on the incorporation of grass forage as the primary proposal. Instead, it assumes that, with cattle management practices, resting periods, and rotational grazing, there will be a gradual recruitment of native grasses. Only the implantation of grasses - along with legumes - in the bald areas or clearings is suggested to promote rapid restoration of the herbaceous cover.

In addition, it incorporates periodic actions focused on fruit harvesting and its use in supplementation. While to a lesser extent this practice is culturally widespread for providing livestock with nutritional supplements during deficits, in this model, the action of harvesting and supplement delivery is considered key and necessary for revitalizing environmental restoration processes and maintaining the forest in a vigorous state. For this reason, it is proposed to carry it out on a large scale, with annual accumulated volumes exceeding 53 tons. This entails equitable participation of all social groups, as well as men, women, and youth, with income distribution, participation in training spaces, decision-making and leadership roles.

Regarding the distribution and efficiency of water use, it is pointed out that there are generally low levels of investment, and often low efficiency (e.g., open dams where all domestic animals and wildlife enter to drink, defecate, and they also bring in soil causing siltation and loss of the water retention capacity of the reservoir). An efficient water harvesting system that utilizes existing roads, channels, as well as natural drainage networks, will increase the possibilities of meeting

water requirements even with low rainfall. Fencing off dams and distributing water through water troughs will improve water use efficiency, reduce health risks associated with consuming water contaminated with feces from other animals, and control the level of water resources available at any given time.

Additionally, the restoration of arid plains or degraded soil areas is incorporated as a periodic, planned, and key action to increase the environmental benefits of the unit, as well as to improve the condition of low to medium-high productivity lands so that they can be incorporated into the grazing scheme. For better use of forage resources, the degree of rotational grazing suggested is higher than that existing in the vast majority of cases, and unlike the more extensive management practices in the region, it will allow different pastures to have effective resting periods so that the grasses can regain their vigor.

The sustainability of the Chaco landscapes occurs on a scale larger than 2,000 hectares, which, due to the characteristics of the region, necessarily encompass heterogeneous territories including forests in good conservation status, but also arid plains, small squares, poorer and arid soils. At the same time, the coexistence of these sites implies the generation of diverse resources such as wild fruits, native forages, textile plants, large and small livestock. This scale of intervention also allows the valorization of a diversity of actors, producers, both men and women, young and adults, who traditionally have been developing knowledge, adaptation strategies to climate change, and better utilization and resilience of their productions in these areas. In this way, the intellectual resources of diverse individuals are leveraged, with a gender and intergenerational approach that will allow for the maximum valorization of the farm.

# Regenerative production proposal

The proposed productive model incorporates notions of comprehensive property management suitable for regenerative management. Some of the most relevant are as follow:

- Planning and management of cattle, establishing goals to be achieved and the real possibilities of the system while minimizing disruptions in natural ecosystems.

- Organizing cattle roundup with breeding seasonal services during months of higher forage growth rates and quality.

- During critical periods, planning in advance the weaning and sale of unproductive categories (cull cows, bulls, empty heifers) to avoid the wearing out of the breeding females and relieve grazing pressure.

- Avoiding landscape fragmentation and the replacement of natural ecosystems is crucial. Habitat fragmentation and insularization are factors that can result in the loss of local populations of various species.

- Adjusting livestock stocking rates to match the forage supply, considering strategic rest periods to allow forest regeneration and accumulation of reserves to ensure future productivity and provision of environmental services.

- Managing or separating environments: Pastures often present different types of resources that produce forage differentially throughout the year. These different environments must be separated to be managed appropriately according to their requirements. The use of electric fencing is an excellent tool for separating environments due to its versatility and low cost.

- Along with the division of pastures, intensifying water distribution will be necessary so that both cattle and native wildlife have better access to water.

- Establishing rotational grazing contributes to improving primary and secondary productivity of the pastures (grass production and weight gain of animals respectively); it also improves the vegetation composition of the sward, achieving more productive and higher-quality pastures. By reducing the animal's selectivity, the growth of species of better quality, and therefore more consumed by the cattle, becomes more vigorous.

- Providing reserve areas such as biodiversity corridors.
- Directly and specifically restoring degraded soil areas, with the aim of improving the provision of ecosystem services, and the environmental conditions useful for the development of native fauna.

# Grazing management

To achieve greater use of the increased forage resulting from pasture seeding, the unit will be subdivided into at least 25 pastures (each less than 100 hectares), which will allow the planning of grazing considering alternation between periods of use and prolonged, strategic rests.

For the calculation of the average pasture area, it is considered that the total available stock of 220 AU (Animal Units), in a grazing period of 5 days per plot in Spring-Summer, would require covering a forage requirement of 1100 DA (days/animal). For an average stocking rate of 0.11 AU/ha, the average forage availability is calculated to be around 40 DA per hectare. Therefore, the average size of the grazing plot for a 5-day stay should be 27.5 hectares. This means that each stable lot could be subdivided into up to four grazing plots, adjustable according to forage availability.

In the grazing rotation, it should be considered to exclude 10% of the property, which should remain as a "rotating reserve". Additionally, there should be a planned alternation in the grazing timing of each plot, creating a rotation that increases diversity and distributes rest periods more effectively.

It is proposed to keep the cattle in a single cell grazing for as long as possible so as to maximize rest for the remaining property and thus promote its recovery. When it is necessary for management reasons to separate the bulls or first-service heifers, more than one management cell will be made available.

The disturbances necessary to carry out these subdivisions (clearings, limits) will be of minimal dimensions (2 meters wide for fence charger clearings, 4 meters for paths towards water sources and live lines), impacting the forest cover as little as possible (avoiding the removal of trees along the way and designing, in harmony with the landscape, the circuit of electric fences), and even using the presence of the same trees to set the path of the electric fence. The

grazing system to be implemented will be rotational, but with two differentiated periods in terms of objectives and criteria for deciding the change of pastures:

- Summer-Fall Period: This is the period of highest rainfall and vegetation growth pulses. During this period, shallow grazing, or "topping," is proposed, with animals moving quickly from one pasture to the next, with grazing periods not exceeding 10 days. The aim is to have minimal impact on the vegetation, allowing for rapid recovery and positive biomass accumulation. During this period, pastures undergoing recovery in the degraded soil areas should not be used, as the goal is to accumulate as much biomass as possible both superficially and in the root space, both crucial aspects for environmental restoration. If the year allows for biomass accumulation above 4 tons per hectare, it is recommended to carry out only one grazing to stimulate regrowth and biologically integrate nutrients into the soil through bovine feces.

- Winter-Spring Period: During this period, longer and deeper grazing is proposed, as it is a period of vegetation latency due to low average temperatures and low water availability. Supplementation with native fruits will be key, depending on the body condition of strategic categories. Grazing during this period does not cause deep damage due to the state of vegetation latency. It would be ideal to use the deferred forage accumulated in the degraded soil areas undergoing recovery during this time of year. This would have the dual purpose of reducing biomass at risk of burning, which ismore common in this period, and incorporating seeds through supplementation that will be available to set from early spring.

To the extent possible, these pastures should internally contain the same type of plant community, or at least the majority of the area should exhibit a high degree of homogeneity. This aspect is considered to ensure that herbivory impact within the pastures is as uniform as possible. When there is greater heterogeneity within a pasture, it is common for cattle roundups to use one environment more intensely than another, potentially leading to degradation. In addition to considering this in the design of the pastures, it should also be observed when designing the clearings for movable fence chargers and the temporal allocation of each grazing parcel.

The following figure (taken from the booklet of the Agroforestry Network of Chaco Argentina (REDAF) - Wild Fruits Workshop, 2018) shows the months of availability of the main forage sources in the Chaco forest. Taking into account the presence of these species in each pasture, the divisions of 100 ha parcels within the pastures and sub-parcels of 25 to 30 ha within them should be organized in order to keep the environments with different compositions separated and assign them at the appropriate time. To carry this out, each sub-parcel of 25 to 30 ha must be scheduled in an annual timetable where it will be recorded when and for how many days it will be grazed, and when it will remain resting. This usage calendar is simply a two-way table, with one column for each day of the year, and where the rows are the grazing sub-parcels. In the planning process, the appropriate allocation to the type of forage to be used will be taken into account, according to the composition and time of the year. This implies that the grazing sequence will not necessarily follow an orderly spatial rotation, but may require more intense cattle movement to have the animals in the appropriate parcels, at the right time according to the type of available forage.

For example, in the case evaluated, the central pasture, being in a lower topographical position, is

very likely to have the tusca as the most common. As one of the few shrubs that bear fruits between June and October, a fruit harvesting rotation should be organized for these months, alternated with the passage through arid plains that have recovered, to combine forages of different nutritional quality.

The final planning will be the result of a learning and observation process, guided by the guidelines described here. It is estimated that three vegetative periods are sufficient for producers to adjust the rotation system to the requirements of their animals. Within this timeframe, the system is expected to be stabilized, well-known, and with a fixed general planning, open to minor adjustments according to rainfall availability and changes in the number of livestock.

## Recovery of Arid Plains

It is assumed that 10% of the area is degraded and presents a landscape of "degraded soil areas," with almost no soil cover, low infiltration, and probably signs of water and wind erosion. Restoration actions on these areas are key both to improve ecosystem functioning, increasing environmental benefits for people and native flora and fauna, and to strengthen the forage

base that allows for rest and reduces grazing pressure in other pastures with forest cover in good condition. These areas (approximately 250 hectares distributed throughout the unit) will be intervened through three types of direct actions:

- Planting leguminous pastures (mainly *Melilotus spp*.) to enhance the soil nitrogen cycle, combined with rhizomatous-stoloniferous grasses that create dense soil surface cover, controlling erosive factors.
- Fencing with electric fences to promote the setting of pastures while grazing the pasture where the degraded soil area is undergoing recovery.
- Small actions for water retention, such as levees or other existing strategies, to create a longer amount of moisture in these areas after rainfall. These are generally soils with low infiltration, so it is necessary to implement actions to keep water on the surface for an extended period in order to allow for slow infiltration of the liquid.

## Strategic Supplementation

Livestock production systems, especially those based on the use of pastures and other forage species, often face critical periods due to the decline in natural forage availability caused by seasonal issues or, increasingly, extreme weather events. During these periods, the availability of water and food is affected, as well as the nutrient content in the food (digestible energy, nitrogen, and mineral elements), which can become deficient in relation to the animals' requirements.

Table. Distribution of the supply of fruits and forage from the native forest throughout the year

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tusca | | | | | | | | | | | | |
| Carob tree | | | | | | | | | | | | |
| Vinal | | | | | | | | | | | | |
| Mistol | | | | | | | | | | | | |
| Itin | | | | | | | | | | | | |
| Chañar | | | | | | | | | | | | |
| Guayacán | | | | | | | | | | | | |
| Native grasslands | | | | | | | | | | | | |
| Shrub | | | | | | | | | | | | |
| Fallen leaves | | | | | | | | | | | | |

By "strategic supplementation" we mean the incorporation into the diet of any food other than natural grass or implanted pasture, in this case, wild fruits. This supplementation is provided daily, in a balanced manner, to animals being fattened in feedlot systems during the winter period.

It is in this sense that it is proposed for regenerative livestock models to resort to strategic cattle supplementation based on the use of wild fruits that complement the animals' diet.

Based on forest inventory analyses from different areas of the Chaco region, and the diversity of species contributing forage fruits, it was decided to proceed with the specific calculation of the contribution of fruits from various species of the *Neltuma* genus, mainly known as carob trees.

The production of carob trees shows a certain degree of correlation with the canopy area of the productive tree. Although it has been studied more precisely for the species *Neltuma caldenia* (Lucía Risio Allione's thesis), an average value between years and sites of 27.64 grams/square meter was found, with a maximum value of 314.45 grams per square meter of canopy. For our estimate, we will use the average value, which is much more conservative.

To extrapolate the calculation to a unit of area (fruit production per hectare), different inventories from the semiarid region were used, and the density of tree individuals of the genus Neltuma for different diameter classes was filtered. These values were added, resulting in an average value of 1.11 square meters of DBH (Diameter at Breast Height) of tree species of the genus Neltuma per hectare. This value gives us an average estimate of fruit production ranging from 30 to 36 kilograms per hectare per year.

Based on this calculation, for the 1750 hectares of forest in the unit (excluding the area of degraded soil that would occupy 10% of the area), it implies an annual production of between 52.5 and 63 tons of carob fruits.

Considering that the cattle, excluding the animals sold, consists of a virtually permanent stock of 280 to 300 heads, we will take the higher value for the calculation of supplementation rations that could be provided by the forest pod production. At a rate of 2.5 kg of fruit supplementation per day, for 300 heads of cattle, once harvested it will allow supplementation for 70 to 84 full days.

Depending on the efficiency of the harvest, this value could increase as conservative average values of unmanaged forests were used for the calculation. If individuals with improved genetics for pod production (there are already genetic lines in this regard in the country) are progressively incorporated enriching the native forest, as well as forest management practices such as pruning and thinning to reduce competition with selected trees, it is highly likely that fruit production from the forest will be significantly increased over time.

On the other hand, the contribution of many other species of forage fruits that are well recognized by producers was not considered for this calculation.

Fruit supplementation will play a particularly valuable role in the recovery of degraded areas, as it will be a specific means of delivering sufficient propagules to ensure that the presence and coverage of native woody plants increase year by year, giving these areas an amplified expression of their environmental potential.

## Silvopastoral management - forest conservation guidelines

Under BAU conditions, it is common to have excessive coverage of shrub species, which significantly reduces livestock access and the penetration of light to the forest floor. To gradually improve forage availability, manual interventions to reduce shrub cover will be carried out in grazing areas where this is a significant issue. Mechanized treatments such as rolling will not be used for this activity. Transitioning from continuous to regenerative grazing practices and increasing instant livestock concentration with the use of small parcels with fence chargers will improve forage accessibility through the simple impact of animals. Shrub cover reduction actions will be implemented after the first two or three grazing cycles, only if deemed necessary to improve plot mobility.

At farm level, when grazing is carried out in an uncontrolled manner (continuous grazing), higher rates of degradation and loss of biodiversity are observed, mainly in arid and semi-arid areas, around watering points, due to overgrazing. At the same time, when forage is indiscriminately available, animals tend to select pastures with better palatability. This allows for greater selection resulting in the disappearance of species with forage value and the increased abundance of other plant species that are more resistant but have lower nutritional value.

On the other hand, since the provision of posts for the installation of the fence chargers will come from the property itself, some minimum forest conservation guidelines will be applied to reduce the impact of this harvest, until more detailed forest management plans are defined. The basic criterion for tree cutting for post production will be that of "future tree". This criterion establishes a classification of forest trees into four categories: a) mature harvest trees, b) future trees (not mature, but desirable for their species, shape, health, etc.), c) competitor trees (lacking the characteristics of future trees and competing with them), and d) indifferent trees (not belonging to any of the other categories). Priority will be given to cutting the so-called "competitor trees" for post harvest, so that their cutting releases future trees from competition, improving their conditions. The felling should be directed, with appropriate cutting practices, to avoid damage that the fall and subsequent dragging may cause to future trees. Since the use of fence charger posts is not very demanding in terms of tree shape, not only the main trunk but also the branches of the cut trees can be used, maximizing the use of available wood. It is estimated that about 4000 posts will be required for the complete assembly of fixed wire fences. The cutting of posts for this purpose should be distributed as evenly as possible across the entire area.

Post cutting and shrub cover reduction may not be applied in the sectors defined as shelterbelts, and during the application of rotary closures may not be applied in the affected lots. Particular use will be made of the trees that must be removed for the excavation of dams and the assembly of earthen tanks. The rest of the trees will be harvested in the vicinity of the picks that are opened to install the herdsmen, applying the selection guidelines described above.

With these minimal guidelines, the potential impact of shrub reduction and post harvesting will be minimized. In more advanced stages of the process, a forest management plan can be included to properly and in more detail plan the harvesting of timber products, as well as the rotations of livestock and their relationship with forest regeneration.

# Production process and scenario definition

## Field and stock

The analyzed module has a field with an area of 2,000 hectares, 288 breeding cows, 90 calves and heifers and 12 bulls.

The field is divided into three area categories to size the investments required in each:

- Rotating enclosed pastures
- Forest reserves and forest shelterbelts on pastures
- Arid plains or squares converted into forage reserves

### Field

| | | |
|---|---|---|
| Total area of field: | *Ha* | 2.000 |
| Percentage of conserved forest: | *%* | 20% |
| Area of conserved forest: | *Ha* | 400 |
| Percentage of forest with livestock: | *%* | 68% |
| Area of forest under management: | *Ha* | 1.360 |
| Percentage of pasture: | *%* | 12% |
| Area of pasture: | *Ha* | 240 |

The percentages of conservation areas and areas under management comply with the national and provincial laws for the area where the unit is located.

In this work, the forage supply of the field is not modeled, but a very conservative stocking rate is determined for the unit, well below the usual parameters, with an average stocking rate of 0.13 Livestock Unit per hectare throughout the year.

In the first stage of unit conversion, unproductive cows and cows carrying diseases such as brucellosis and foot-and-mouth disease are identified for culling from the cattle. A reduction in the number of breeding cows from 288 to 200 is projected, leaving only the younger animals and those in better condition in the field. This quantity of breeding cows remains stable throughout the 10-year projection.

The purchase of a bull is planned in the third complete year of the project to contribute to genetic and pregnancy rates improvements.

## Cattle restructuring and elimination of unproductive categories

Under this scheme, it is assumed that good results can be achieved for an average cattle composed of a stabilized livestock of 200 breeding cows, with an average reproductive efficiency of 65%, 15% annual replacement, and 4% bulls, resulting in the following cattle composition:

Cattle composition in approximate values

| **Category** | **heads** |
|---|---|
| First-serve heifers | 30 |
| Adult cows | 140 |
| Cows with last calf (CUT, as per its Spanish acronym) | 30 |
| Bulls | 8 |
| Breeding of replacement calves | 30 |
| Calves/heifer at the foot | 100 |
| **Total** | **338** |

It should be noted that this scheme aims to minimize the effect of unproductive categories, both on forage demand and on the intensity of greenhouse gas emissions, promoting a renewal of the cattle so that those cows with better adaptation to reproductive conditions are selected efficiently.

On the other hand, considering the average livestock capacity of the area (0.17 - 0.23 AU/ha), this scheme would work with an average annual stocking rate[19] of 0.11 AU/ha, minimizing the effects of forage scarcity that can occur in drier years.

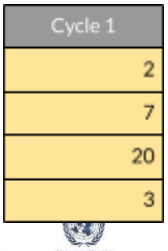
Therefore, under a conservative production scheme, regenerative systems would allow for an increase in the number of animals marketed per year, from 60 to 130 for the same number of cows, through the expansion of forage area (recovery of arid plains with pasture establishment) and its proper utilization based on dry matter production curves.

## Production Schedule

In order to organize the production and marketing schedule, seasonal breeding must take place. The introduction of this practice is reflected in the model with services scheduled in November of each year, so that deliveries occur in the months of August (20%), September (60%) and October (20%), at the time of best fodder availability.

The production schedule is also determined by the postpartum period variables, the term of calving at weaning, the period of rearing after weaning and the minimum age of first service of a heifer.

### Cattle schedule



| | |
|---|---|
| Term between birth and service | *Month(s)* |
| Term between birth and weaning | *Month(s)* |
| Minimum age at first service | *Month(s)* |
| Rebreeding term (after weaning / before weaning) | *Month* |

The values established for these parameters assume intensive and organized management of the livestock, and remain fixed throughout the 10-year projection.

## Breeding Stock Replacement and heifer Retention

The productive cycle of the cow determines the need to retain heifers based on the target number of breeding females. In the model scenario, the goal is to maintain a stable number of breeding females in the herd.

The culling of less productive breeding females is scheduled after calf weaning. Cows that have completed a certain number of reproductive cycles (calving) are classified as culls: in this scenario, it is determined that at the beginning of the project, a cow can have up to 5 calving cycles, and that improvements in management, health, and genetics allow this average to increase to 6 calving cycles, starting from the fourth cycle of the project.

| | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 |
|---|---|---|---|---|---|
| Number of cycles per breeding female | 5 | 5 | 5 | 5 | 6 |

Unproductive cows are also included in the cull cow category. In the model, two variables are used to determine the quantity of unproductive cows: the pregnancy rate and the percentage of non-pregnant cows culled based on the category of the cow. The pregnancy rate determines the number of cows that do not become pregnant after service. This indicator is closely related to the weaning rate. For each category of cows, the percentage of pregnant cows that move to the cull cow category is determined in each cycle.

In the model, a significant improvement in the pregnancy rate is expected, resulting from improvements in health practices, management (pastures and supplementation, water), and animal selection (culling unproductive cows). The projected pregnancy rate increases from 55% to 85% starting from the fourth cycle.

### Reproduction Indicators

| | | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 |
|---|---|---|---|---|---|
| Number of cycles per cow | *Total of births* | 5 | 5 | 5 | 6 |
| Conception rate for cow'1st and 2nd parity | *Pregnancy per cow* | 55% | 65% | 75% | 85% |
| | | 55% | 65% | 75% | 85% |

Conception rate for adult cows *Pregnancy per cow*

The percentage of non-pregnant cows entering the cull category (and being sold for slaughter) is established in the "Sale of Cows" section. In the proposed scenario, the following is suggested:

- Not culling any first-parity cows.
- Culling 25% of non-pregnant second-parity cows: It is estimated that after a review of the animals, in one-quarter of the cases, it is determined that the cow will not be productive again.
- Culling 75% of non-pregnant cows from the third parity onwards. In the first two cycles, this percentage is reduced to 50%, taking into account that at the beginning of the project, a diagnosis of the herd's condition was made, and 80 out of 200 adult cows were already culled, thus eliminating most of the unproductive animals.

## Sale of breeding stock and heifers

| | | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 |
|---|---|---|---|---|---|
| 1st parity non-pregnant culled cow | *% of culled cows* | 0% | 0% | 0% | 0% |
| 2nd parity non-pregnant culled cow | *% of culled cows* | 25% | 25% | 25% | 25% |
| Group A non-pregnant culled cows | *% of culled cows* | 50% | 50% | 75% | 75% |

It also determines the demand for heifer retention, and the mortality of breeding females. A parameter of low mortality level is established, in line with the practices of the model that significantly reduce the risk of mortality (healthcare, management of herding in rotational enclosed pastures, forage and water reserves). This indicator remains stable throughout the 10 business years of the projection.

## Mortality

| | | Cycle 1 |
|---|---|---|
| 1st parity cow | *annual %/average stock* | 0% |
| 2nd parity cow | *annual %/average stock* | 0% |
| Adult cow | *annual %/average stock* | 3% |
| Bull | | 0% |

The definition of assumptions for variables such as calving rates per cow, pregnancy rate, percentage of non-pregnant culled cow, and mortality determine the evolution of the breeding stock. The retention of heifers should be parameterized based on this evolution and the defined breeding stock target for the model. The retention percentage is adjusted cycle by

cycle, observing its impact on the breeding stock projection and making adjustments as necessary.

| | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 | Cycle 6 | Cycle 7 | Cycle 8 | Cycle 9 | Cycle 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sales of calves at weaning** | 25% | 25% | 25% | 25% | 25% | 50% | 50% | 50% | 75% | 75% |
| **Breeding stock after culling** | 220 | 194 | 212 | 180 | 198 | 196 | 208 | 204 | 213 | 210 |

In cycle 4, there is a noticeable decrease in the number of breeding females, falling significantly below the target of 200 females. This is due to the arrival of the culling cycle of the group of mothers with which the project begins. However, this decline is quickly compensated for by the entry of females from the previous cycle into the breeding group.

## Weaning rate

The weaning rate is the key indicator for determining the productivity of the model. It establishes, for each productive cycle, the number of animals that reach weaning, measured against the number of breeding females in the herd at the end of the breeding stage.

According to surveys carried out in the territory, this index is particularly low in the productive units of small-scale producers in the Gran Chaco region in the semi-arid area: it is estimated that the average weaning rate is 33%.

The success of the model depends on improving this indicator to achieve higher animal production and sales with fewer breeding females and livestock. A significant part of the planned investments are aimed at establishing conditions for this indicator to improve, transitioning from an extensive model with low productivity to an intensive model with moderate productivity. Optimal productivity assumptions are not considered for this scenario, taking into account the characteristics of the region and the genetics that best adapt to the local ecosystem.

From the first year, a significant improvement in the weaning rate is projected, resulting from the culling of 30% of unproductive females. By reducing the divisor coefficient of the index (unproductive females) by 30% without affecting production, this indicator rises to 45%. In the following cycles, a gradual improvement in the indicator is expected, reaching 75% in the fourth cycle. Afterward, this indicator remains stable. No difference in the index by cow category was considered.

### Reproductive indicators

| | Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 | Cycle 6 | Cycle 7 | Cycle 8 | Cycle 9 | Cycle 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1st and 2nd parity weaning rate | 45% | 55% | 65% | 75% | 75% | 75% | 75% | 75% | 75% | 75% |
| Adult cow weaning rate | 45% | 55% | 65% | 75% | 75% | 75% | 75% | 75% | 75% | 75% |

Weaning rate - initial situation

| |
|---|
| 33% |

## Weight and fattening

The weight at parity, the weaning weight of calves, and the weight gain of calves are also high-impact variables in the productivity achieved and the level of income generated by the model.

The model adopts conservative assumptions for the variables that determine the weight of animals at sale. It projects a birth weight of 28kg, a daily live weight gain of 550g for calves at the foot, 400g for calves after weaning up to 12 months, and 300g for steers and heifers from 12 to 24 months. These values are reduced by 20 to 30% during dry months when animals tend to gain weight more slowly.

## Weight gain

| Month (1 to 12) | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 | Month 11 | Month 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calf at the foot (up to the 7th month) | Kg per month | 10 | 12 | 15 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 13 | 12 |
| Calf (from weaning to the 12th month) | Kg per month | 8 | 20 | 12 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 11 | 10 |
| Calf/heifer (up to the 24th month) | Kg per month | 5 | 6 | 8 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 7 | 6 |

With these parameters, a calf with a short rearing period of 3 months reaches a weight of approximately 170 kg at sale.

Consistently with these fattening parameters, the weights of first-parity cows, second-parity cows, and adult cows are determined. Additionally, the average weight of the bull must be determined.

## Average live weight

| | Weight |
|---|---|
| Birth weight | 28 |
| Average weight of first-parity cow | 277 |
| Average weight of second-parity cow and cow A | 453 |
| Average weight of bull | 800 |

The weight of the animals in the herd is also used in the model to determine the dry matter requirement of the animals and the amount of supplementation that the unit must provide in months of lower forage availability. Therefore, determining the weight has a significant impact on income but also affects the costs of the model.

# Investments

The necessary investments were sized and valued to implement the regenerative livestock production model for a 2,000-hectare unit, in a standard field in the target region.

The costs considered correspond to real values, surveyed in December 2023, for both materials and works, according to information gathered in the field or published prices.

The initial investments to be prioritized are related to providing water and food to the animals and are grouped into two major categories: water and fencing.

## Water

Water management is increasingly becoming a crucial component in sustainable intensification strategies for animal production and adaptation to climate change. The latter will lead to more frequent and severe excess or deficit water problems, with consequent impacts on agricultural and livestock production, as well as on all activities requiring water, including domestic demand, ultimately affecting human well-being. In addition to availability issues, climate change will affect the increase in demand, as the rise in ambient temperature exacerbates the issues of thermal stress in plants, animals and humans. Likewise, it is necessary to identify for each production system the different components of total water consumption and the critical points, to define the management and production strategies (improvements in food conversion efficiency, the use of pastures, water facilities, etc.) necessary to optimize freshwater consumption and reduce negative environmental impacts.

The investment planned to guarantee water is designed for a field that does not have a deep or shallow well, a field without access to river or stream water. In other words, an investment that can guarantee the cattle's water supply throughout the year was evaluated.

| **Assumptions** | | |
|---|---|---|
| Each LU* requires | **60** | litres/day |
| Cattle comprises | **245** | LU |
| Daily requirement | 14,719 | litres/day |
| Required autonomy | 250 | days without rain |
| Annual requirement | 3,679,768 | litres/year |
| Annual requirement | 3 680 | m3/year |

| **Storage** | |
|---|---|
| Surplus (evaporation and losses) | **40%** |
| Total m3 storage | 5152 |
| Number of dams | **5** |

| | | |
|---|---|---|
| Volume per dam | 1030 | m3 |

* *Livestock Unit*

The scenario foresees the construction of 5 dug dams of 1,000 cubic meters. Each dam has a raised tank mounted on the ridge formed by the earth removed during the dam construction. The acquisition of a low-capacity mobile photovoltaic pumping system is planned to raise the water from the dam to the elevated tank. In addition, a distribution system that includes 8 troughs will be installed to ensure a good distribution of water access points throughout the property.

In total, an investment of USD 18,000 is projected, distributed mainly in the first two years of the project.

Depending on the configuration of the field and the existence or not of pre-existing water access solutions, this investment could be lower. Also, depending on the existence of shallow good quality groundwater, a borehole with a solar water pump system could be considered as a water access scheme.

In any case, the dams to be built must be installed following the natural lows and also taking advantage of the directed runoff given by the presence of internal roads or those external to the unit that can lead the runoff water to the reservoirs in ways to achieve the goals even with low rainfall.

These dams will be fenced to prevent the entry of domestic animals and, as far as possible, the entry of wildlife. With the earth removed for the construction of the dams, a raised earth tank-reservoir shaped as a truncated cone will be built next to them, with a medium cavity also shaped as a cone. The tank interior must be waterproofed with geotextile material, and the water from the dam must be pumped to this tank which, being raised over the ground, will allow the distribution of water by gravity. Pumping can be done by a solar or wind water pump system.

The water from the troughs will be distributed through buried pipes, pressurized with solar pumps or windmills where it may be possible to use them within the forest. A total of at least 8 troughs will be distributed from the dams, each of which must supply at least three paddocks. In this way, practically the entire area will have access to water, and in 70% of the area the maximum distance to be traveled by the animals will not be greater than 700 meters.

# Wiring

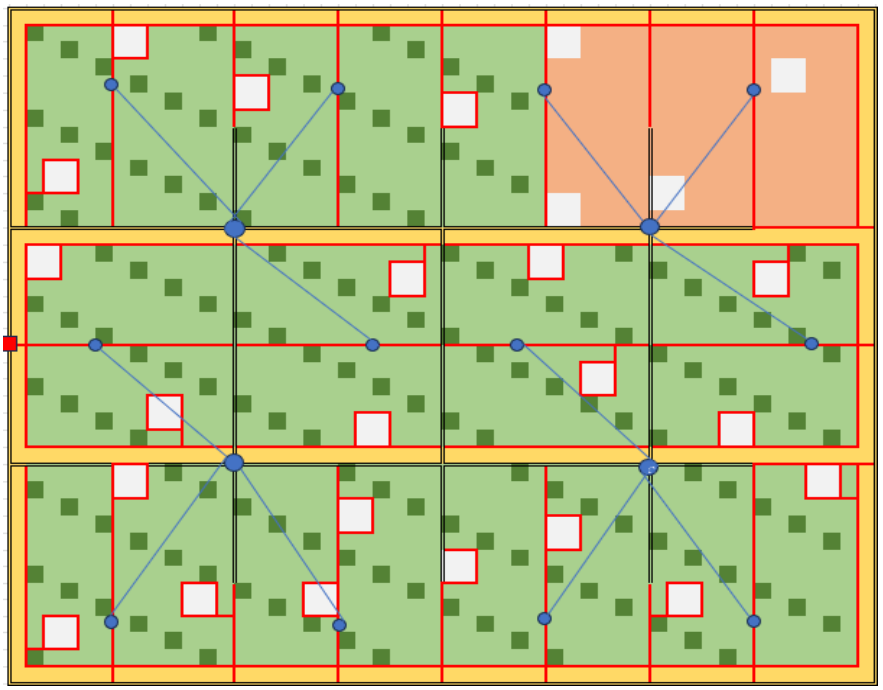
The organization of the property into paddocks, pastures, forest and renewal reserves implies the ability to subdivide the field into areas of 30 to 60 hectares. The strategy that envisages managing these areas on a rotating basis involves the mobility of part of the divisions.

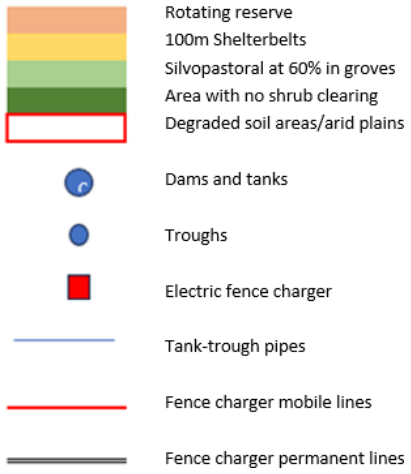
It is proposed to establish a perimeter wiring and internal subdivisions with an electric wiring system that includes a high-powered central fence charger. The layout consists of live lines (galvanized wire and electroplastic wire) that allow the current to be transported over long distances, and mobile lines (electroplastic wire) that have greater versatility. The live line

layout marks the perimeter and designs a main distribution of electricity in the field, which allows the formation of plots with mobile lines.

This perimeter route will allow connecting grazing plots to be separated with mobile fences, as well as to the electric fencing of the degraded soil areas. Cut out switches will be distributed to avoid keeping animal-free areas electrified. This electrified perimeter design is economical and also efficient for regenerative management, as it prevents the entry of animals from neighboring properties, thus giving plots the opportunity to rest as needed, while the animals are within a controlled plot. It would not be useful to keep the animals controlled on a plot if it is not certain that the rest of the property is effectively resting from grazing. If the means are available in the future, the placement of posts every 50 meters may allow the perimeter to be converted into permanent wiring, by adding the intermediate posts and replacing electric wire with common nonelectric wire.(Figure 3)

Figure 3. Suggested wiring scheme and plots.






| | | | | |
|---|---|---|---|---|
| | | Live line | 35 | km |
| | | Mobile lines | 47 | km |
| | | Minimum mobile lines (30%) | 15 | km |

| Maximum permitted by law for 2000ha |
|---|
| 1. Rotating reserve over 10% of the land |
| 2. Shelterbelts of 100m over "pastures" |
| 3. Keeping a minimum reserve of 40% within pastures |

In total, an investment in wiring and fence charger of about USD 30,000 is expected, of which about 20% corresponds to labor for the initial installation, and the demarcation. All this investment is planned for the first months of the project, when the field is divided into plots, and, given plot low reception, it should be possible to organize a faster rotation of the cattle.

To reduce the high costs of traditional wiring, a fence charger live line (with wire) is suggested for the perimeter enclosure, with a post every 50 meters and an electric fence rope at medium height, both supported by insulators on the posts and linked to the center of the area between posts by a wire thread so that the electric fence rope is maintained throughout its course at the same height.

## Other investments

Works to be carried out on each plot are considered initial investments. These investments are distributed over the 10 years of the project, with a greater effort in the first 2 years.

- Resources and labor are budgeted for the regeneration of degraded soil areas in pastures, with raking and sowing of pasture: 8 plots of 30 hectares totaling 240 hectares.
- Resources and labor are budgeted for the formation of 20 60-hectare silvopastoral pastures.

The acquisition of machinery and equipment necessary for the initial development and maintenance of paddocks, pastures and fences is contemplated, as well as the acquisition of equipment for the storage and processing of harvested wild fruits, to be used as supplementation in months of lower fodder supply.

Finally, as mentioned above, in the third year of the project, the purchase of a bull is included in the projection, aimed at improving the genetics and productive performance of the cattle.

# Logistics Plan

## Animal logistics

The logistics plan covers the transport of animals for sale from the field to the collection point, and lodging and weighing at the collection point. The buyer is responsible for the transport of the animals from the collection point to the buyer's field or refrigerator.

As a general rule, small producers tend to outsource the logistics of marketing to intermediaries. The sale of small numbers of animals does not allow them to solve this problem in a cost-effective way, and they depend on intermediaries to be able to take the animals out of the field and sell them. This places them at a disadvantage in business negotiation. By seasonal breeding and production cycles, the project will allow the production unit to have a critical mass of calves and/or cows in each sale opportunity, which will in turn enable it to assume a cost of sale that is not recharged on the sale of a few animals, and represents a reasonable percentage of the total amount of the sale. .

Logistics is a critical issue in the business model. The distance between the field and the point of delivery of the animals to the seller can affect the viability of the project, mainly in the initial

stage until the level of productivity and profitability of the production unit are consolidated. Fields whose access characteristics (distance, and road conditions) do not condition the success of the project must be selected.

Animal marketing will not be scheduled at times of the year in which climatic conditions (rains) run the risk of flooding the roads and preventing the animals from leaving the collection center.

The transport of standing animals is regulated and supervised by SENASA. Applicable laws and rules currently in force[20] provide that carriers must be registered at the Argentine Registry of Animal Transport (Registro Nacional de Transporte de animales). They also specify minimum conditions for vehicles intended for animal transport.

A transport service that complies with the regulations will be hired from the production unit each time animals (calves and slaughter cows) are sold.

For the transport of animals, both from the field to the collection point, and from the collection point to the cattle destination, the unit must provide the carrier with the Electronic Transit Document (DTE, as per its Spanish acronym), commonly called the Transit Guide, and issued through SIGSA (Integrated Animal Health Management System). The document is processed digitally, through the AFIP website, as a livestock producer informing the RENSPA[21] of the buyer's originating field as well as the carrier's information.
In addition, the veterinary certification of each animal and the animal identification ear tag must be available to enable the tracking of individual animals.

A collection center must be selected to unload the animals. This center will be equipped with a corral with sleeves, troughs and a scale. The collection service may be hired as needed from producers' associations equipped with this infrastructure or to producers and/or private intermediaries that have the necessary facilities for marketing animals. Logistics will be coordinated with the buyer so that the unloaded animals remain in this center for less than a day. In this center, they will receive food and have access to troughs. At the time of delivery, it will be made in the presence of representatives of the two parties; the weight of the animals will determine the amount of the transaction.
In the case of televised auctions, animal collection is usually carried out in a single field where the auction is filmed and the subsequent delivery of each lot to its respective buyer is made.

## Other logistical needs

The unit will have its own utility vehicle for the transport of material supplies and equipment. The acquisition of the materials of greater volume and weight that cannot be transported in the producers' vehicle will be "placed in the field," integrating the transfer cost into the price of the goods.
As for the wild fruits, the harvesters will bring the harvest closer to the collection point determined in the field, where the fruits will receive a first processing and will be stored in a silo prepared for this purpose.

# Administrative and Human Resources Plan

Under the conditions of the traditional livestock business model (BAU), the small producers sector usually does not have commercial organizational structures. Non-profit associations or similar organizations are common. They have been and are fundamental for the organization and growth of communities, since they have allowed them to channel support and technical accompaniment programs. However, these structures do not serve the communities to jointly face commercial activities, nor to associate commercially with other sectors needed by them to be competitive. This chapter suggests an organizational structure for the project that offers opportunities for pluralistic participation with a gender perspective, and that allows to generate cooperative alliances for sustainable businesses.

## Proposed Organizational Structure

It is proposed to work in two linked organizational levels. The first one is an associative space between producer families that share the same production unit. These groups are relatively small, from 4 to 6 families, and the objective of the organization will be to coordinate the property management plan, organize the use of shared resources and resolve the distribution of tasks and benefits. This organization will begin by being a de facto organization once agreements are formalized by means of an agreement signed by the participants, and the appointment of a representative. To provide greater opportunities for women to be represented, half of the family groups will be required to be represented by a woman. The agreement processes will be accompanied so that these organizations evolve to take the form of a Cooperative of producer families.

The second level of organization will be assumed by a Cooperation Consortium. The Cooperation Consortium is a contractual figure, introduced into Argentine legislation by Law 26,005, enacted in 2005. This was later repealed by Law 26,994, which modified the Argentine Civil and Commercial Code. However, applicable laws generally reflect the original regime. Cooperation Consortia (hereinafter CC) are figures of a contractual nature, without legal status. Therefore, CCs lack their own assets and cannot be subject to bankruptcy or reorganization proceedings under the Argentine bankruptcy laws. The parties to the CC must be registered with AFIP, and participate in the CC according to the terms set out in the contract. Both natural registered persons, as well as legal entities, of private, public, and mixed nature can participate in a CC. NGOs, public institutions, both from Argentina and abroad (if they establish a domicile in the Argentine Republic) can join a CC. CC registration is processed before the Public Registry of Commerce of each province, and when their participants have declared domiciles in different provinces, CCs must register before the Argentine Corporate Records Office (Inspección General de Justicia de la Nación).

The pre-established purpose of the CC is to "facilitate, develop, increase or materialize operations related to the economic activity of its members, whether or not defined at the time of their incorporation, in order to improve or increase their profits".
The CC is not a corporate form, but a type of contract, so it is not subject to tax liability in the way in which the former are. Impositions are transferred to the consortium members. In this sense, the economic results of the CC will be distributed among its members, who are obliged to

pay income tax, individually. Likewise, VAT must be borne by the participants.

CCs cannot purchase goods for themselves. The assets managed by the CC will be directly owned by its members, appropriated by contract to the organization. Upon the dissolution of the CC, items of shared use will be distributed proportionally as established in the contract and in the forms set forth therein.

The CC can hire employees, though it is important to consider that in case of debts related to such employees, the members of the CC are liable according to the distribution of interest agreed upon the incorporation of the CC.

.

The CC will consist of the following actors:

a) Legal Representative: a person or institution that will formally assume the representation of the CC before courts, AFIP and all instances that require a formal presence, and also the coordination of compliance and review of the terms of the CC contract. Attention scale: 40 management units.
b) Technical team: referents in key issues of support for implementation: veterinarian and other land technician(s). Care scale: a veterinarian for every 20 management units, a land technician for every 10 management units, all with their own mobility included.
c) Administrative and legal team: specialists in legal, tax and commercial issues that assist the operation. Attention scale: an accountant for all 40 units, and a lawyer for all 40 units.
d) Representatives of family groups: a representative for each family group participating in the project.

At the CC meeting, the terms of the interest of each actor in the direct sales of calves and discarded cows, the forms of distribution of profits and the percentage of participation of the technical, legal administrative teams and the legal representative will be established. At the beginning of the implementation, the costs of participation of the Legal Representative and the Technical Teams will be subsidized by the project, but as the project is applied, improving production rates and sales, this external contribution will turn to a contribution self-managed by the Consortium. This transition is explained in detail in the economic plan of the business model.

## Requirements for CC integration

All natural or legal persons that comprise the CC must have their respective individual registration with AFIP. In the case of representatives of family groups, they must at least be registered as Single tax system taxpayers. Families that do not have recognized possession of their lands or that are undergoing a process of litigation or conflict with third parties for the possession of land cannot participate in family groups or the consortium. The maximum number of management units to be gathered per CC is 40. If the units that are formed are larger, a new management module with a new CC must be created.

## Forest Legislation Compliance

The proposed design has been developed based on the limits and restrictions imposed by the Law of Land Management of Forests of the Province of Salta. The provision of 100m

shelterbelts dividing paddocks, the allocation of a 10% rotating reserve unit, the possibility of logging inside paddocks, and the conditions for making forest cuts, have been contemplated in the design established by legislation for forests zoned in category II, of medium conservation value. In addition, it should be noted that the project is aimed at the regeneration of forests and ecosystems in general, the scheduled forest cuts are of very low intensity; therefore, the project complies with the terms of European Union Resolution 1115/2023, as it does not promote deforestation or forest degradation.

# Marketing plan

## Current Situation

Essentially, small producers' sales are made to medium and large producers in the same area, who buy animals from neighboring fields and complete the cycle. Additionally, intermediaries or "integrators" who are dedicated to the purchase and sale of animals (they may or may not be producers).

The intermediary is a local actor fulfilling a necessary role:

- Logistics: Transport from the producer's field by road to the delivery point on the route, Animal collection on a property near the route.
- Financial: pays cash and collects sales according to the agreement with the direct buyer or according to the modality defined at the auction fair.
- Administrative / Tax: declares herd movements in SENASA and AFIP, and enables the marketing of animals in a formal circuit.
- Commercial: manages the relationship with the buyer and closes the sale that includes weighing the animals

Intermediaries have material and intangible resources that allow them to take animals from small producers to the formal marketing channels, and to capture a significant percentage of the income:

- Logistics: Truck with cage, land near the route with corral and sleeve infrastructure; scale.
- Financial: Self-finance and/or access subsidized financing from the province and/or commercial bank financing.
- Tax: In general, they are Single tax system taxpayers and manage several accounts of Single tax system taxpayers members of the family group.
- Administrative: Register in SENASA a "fictitious" herd (and pay taxes and health campaign costs for it). This allows for animals from small unregistered producers to be declared, that is, they can carry out herd operations in SENASA, buy ear tags and invoice the sale.
- Social: Agree to communicate directly with key specialists for their business, in the municipality, SENASA, the health entity, and at the provincial level. This contact network enables them to solve issues quickly, access information and identify marketing opportunities.

Both fattening producers and intermediaries are in an advantageous position in negotiating with small producers who are atomized and depend on this demand to market their animals. They dictate times: Depending on the market opportunity, they buy animals or not. They dictate

prices: as long as no other demand intervenes in the field, the price for the purchase of animals is the one established by these few actors.
A marginal part of the production is sold in local slaughterhouses and butchers':

It accounts for approximately 10% of sales, and affects almost exclusively large animals that are not bought by fattening producers. This sale is usually undeclared and at prices well below market prices.

There are experiences of sales in physical and televised auctions, this trend was consolidated with the development of televised auctions. They enable local production to reach buyers from other districts / provinces, and at prices more in line with market prices. It should be noted that, in a variable proportion, small producers' animals arriving at auctions do so through the above mentioned intermediaries.

The organization of auctions in a particular area has the indirect effect of rebalancing in part the negotiation between producers and local buyers, establishing a new reference price, and a form of competition in demand.

## Access Barriers and Opportunities

It follows from the above that the main barriers to producers' access to the chain's formal sales channels are:

- Producer informality: The vast majority of small producers are not up to date with AFIP and SENASA records.
- Low capacity to resolve logistical issues (mainly transport and collection).
- The lack of seasonality of the cattle, which does not allow the producer to offer homogeneous animals and plan the sale, and which partly justifies the existence of an "integrator".
- The lack of financial management, which leads producers to use animals as reserves of value and sell animals sporadically to respond to liquidity needs, or in critical situations (prolonged dryness, floods) to "relieve the field".

To these conditions, several limitations are added, namely related to the management of the animals, the low weight of the calves due to food and water shortages, insufficient sanitation practices, and the genetics of the animals.

These factors prompt producers to sell their animals at prices well below market prices. On top of this, the relatively low weight of calves should be added, which also represents a loss of monetary gain for producers.

Any effort aimed at overcoming the above mentioned barriers generates opportunities to significantly increase the income level of the production unit by promoting its direct access to market price.

# Prioritized sales channels

The sales channel that should be prioritized for the business units is the direct purchase by a fattening producer in fields on the margins of the Gran Chaco region.

Fattening producers already have channels and supply mechanisms in place. Therefore, these producers must be convinced of the interest involved in doing business with a new supplier, and directing production in order to meet the conditions under which the buyer needs to receive their calves.

To open this market, the initial management will consist in making direct contact with fattening producers established within a 150-km radius from the production unit, and will target, as the first goal, producers that adopted sustainability criteria in their production strategy.

The arguments that can convince these actors to start a purchase relationship with a local breeding unit are:

- Price: Negotiate a variable price according to a market index,[22] to offer producers greater predictability than purchasing through auction."
- Local purchase: Low logistics costs, and proximity to the field where the first stage of production is carried out.
- Traceability: Transparency about the origin of the animal.
- Sustainability strategy: conservation and regeneration of ecosystems.
- Social impact: inclusion of vulnerable producers in the supply chain.

In order to establish a relationship of trust, the following must be guaranteed:

- **Quality**: The delivery of animals must be guaranteed under conditions that correspond to the selection criteria of the purchasing producers: age and weight, genetics and health, animals accustomed to handling.
- **Quantity:** It will be necessary to achieve a sufficient quantity of calf production to justify management and logistical costs, which implies improving productivity and seasoning services so that the calves reach the required age for sale at the same time. In a second stage, growth will be sought through partnership with other local regenerative production units to reinforce the attractiveness of the proposal.
- **Reliability:** Production must be predictable for the buyer. Also, to the extent that the environmental and social impact are arguments valued by the buyer, the transparency of the production process and the image that the unit conveys are key elements in the relationship of trust with the producer.

## Auction fairs and televised auctions

Participation in televised auctions is the second potential marketing channel for the unit. While building a trust relationship with a direct buyer would be a priority, this alternative should be explored and put into practice. It is a viable alternative in the case of not achieving a solid bond with a fattening buyer. It is also a quick implementation option that mitigates the risk of relying on a single buyer.

To explore this channel, links must be established with active consignees in the region, who have organized televised auctions with producers of similar characteristics.

One or some of them must agree on an auction process with a schedule, detailing the terms of each stage, and propose mechanisms that simplify and expedite access to the televised auction, in particular the filming, the preliminary weight of the calves, and the collection at the point of withdrawal.

## In the medium-term

One of the objectives of the project in the medium-term will be to include the entire production process in regenerative production models in the Gran Chaco, and give an identity to the product marketed to the final consumer: grass-fed Creole beef and wild fruits with regenerative production in the Gran Chaco.

To this end, work should be done to identify and establish links with agricultural producers established on the margins of the cereal areas, in lands of low productivity and yield. The objective will be to jointly develop a production model that enables the conversion of deforested and degraded lands into pastures for fattening production.

Many of these producers ran into debt with their input suppliers, with each harvest that did not reach given goals due to climate reasons. For these decapitalized producers, the proposal to turn their field into a "lodging" for breeding and fattening with pasture in the framework of an environmentally sustainable and socially inclusive beef production project may be very attractive.

## Actions envisaged in the marketing plan

- Promotion/Sale of companies that buy fattening production located within a radius of 150 km from the unit.
- Relationship with consignees who carry out televised auctions - identification of key partners.
- Organization with public authorities: Provincial directorates of livestock production.
- Investigation of financing opportunities under favorable conditions to add attractiveness to the purchase/value to the product by offering purchase with deferred payment.
- Identification and linkage with agricultural producers established on the margins of cereal lands, in degraded lands and with low productivity.

# Financial Plan

The purpose of this section is to describe the methodology and assumptions used for the economic and financial evaluation of investments to be made to improve the performance of a regenerative livestock production unit of 2,000 hectares owned by small livestock producers in the Gran Chaco. [23]

# Modeling tool

The variables used to make the model are described, as well as the values considered for each of them, for the projected scenario. The results obtained for this scenario are also presented and analyzed.

It should be noted that the Excel model is built to enable a quick modification of the considered values and build other scenarios different from the one developed for this work.

In the Excel file, the variables where ad hoc values can be entered are indicated with yellow cells. These types of variables are all summarized in the yellow tabs whose name begins with "Assumptions". All other tabs are calculated automatically, according to the values set in the "Assumptions" tabs.

The white tabs present calculations and information that were used to complete scenario values in the assumptions tabs. The "BAU" tab presents a simplified projection of the "Business As Usual".

The main physical and financial results are detailed in the "Financial Indicators" and "Physical Indicators" tabs.

# Prices and macroeconomic variations

The values of acquisition assets and operational and management costs are recorded in ARS (real values as of December 2023), and the projection is presented in USD at a fixed exchange rate (USD 1 = ARS 800).[24].

Although most of the investments, operating and management costs correspond to payments in local currency, given its instability, the currency was unified to USD to simplify the construction and reading of the tool.

This is a "real projection" that does not contemplate any inflationary hypothesis, and assumes a stable real exchange rate. This modality allows the model to be evaluated without the combined impact of devaluation and inflation. It avoids making projections of exchange rate and inflation developments, which is very complex in the macroeconomic context of Argentina. The hypothesis of the real projection is that, over a long period of 10 years, no significant distortions are generated by devaluation or real appreciation.

# Current situation Scenario

A projection has been developed in a scenario in which investments are made to improve the performance of the production unit and at the same time conserve and regenerate the ecosystem. With an investment of USD 100,000 per module, the production unit is expected to:

- Increase its net sales revenue by 300% from USD 22,000 to USD 66,000 annually.
- Generate income that allows remunerating the equivalent of 3 full-time formal jobs, when the unit does not generate enough income to remunerate 1 full-time person in

the current situation.

- Have infrastructure that guarantees the resilience of the producer to face droughts that lately occur with greater frequency and intensity, and that generate decapitalization and destruction of production units in the current situation.
- Be able to include in its production process, practices and management aimed at the preservation of forests and recovery of degraded areas, when the extensive practice without a forest management plan, generates degradation and loss of forage capacity of the lands.

# Revenues and costs

A 10-year project is planned, including a first irregular exercise from June 2024 to September 2024, and 9 full exercises from September to September.

The income of the livestock breeding business unit and the costs of this same unit, including management costs related to regenerative practices are contemplated in the projection.

Costs and revenues of other business units that are developed in the same field are not integrated, given the framework of a management plan that contemplates the preservation and regeneration of ecosystems, and that should contribute to improve the profitability of the field, such as small livestock, beekeeping, and timber forest production.

## Revenue

The revenue of the business unit is generated by the sale of animals.

Months in which the sale is made are determined as follows:

- Scheduled sales in July and August when calves in each cycle reach 10 months and target weight for sale.
- Scheduled sales in March and November, in which essentially cull cows are sold.

Sales are not scheduled in rainy months, during which the roads are usually flooded and do not allow animals to be taken on the route.

The sale amount is the product of the number of kilos of live weight sold for the sale price determined for each category.

The price was set according to the sale price published by the Livestock Market of Rosario[25] for calves and heifers, and for cull cows, according to the sale price for 'regular cows' in the auction to slaughter report published on the Campo a Campo website.

Today, small producers are not inserted into the formal market and have few marketing opportunities at prices that are usually 50% below the market value.

| | | |
|---|---|---|
| Price per kilogram of calf | USD | 2,92 |
| Price per kilogram of heifer | USD | 2,10 |
| Price per kilogram of cow | USD | 1,33 |

By achieving the integration of the unit into the formal market through direct purchase by a fattening producer and/or through televised auction sales, the goal is to aim for the sale of animals at market price from the first year. In the following years, it is proposed to improve the quality of the animals produced, increase quality and continuity in production, and thus achieve a mark-up on the marketing price. With a conservative approach, this mark-up is not considered in the projection.

In the same way, the price of animals has accumulated a very important delay in recent years, as a result of the intervention of public policies on export and sale price of meat. This delay was partially offset in the last weeks of December, and an increase in the price of animals above the level of inflation should continue to be observed in the coming months. With the same conservative approach, it was decided not to integrate this future price increase into the projection.

## Sales

In the current situation, the producer has almost no cost of sale, which partly explains the difference between the price at which the animal is sold against market values. Producers usually sell to a buyer who removes the animal (s) in their field and pays for it in cash and at the time of purchase.

To access the formal market, the unit will have to assume several costs directly related to:

- Marketing including the cost of stay of the animals in a pen near the route and the point of delivery of the animals, administrative costs (management, SENASA ear tag), food during the stay. For these costs, 5% of the value of the sale is calculated.
- The commission of the consignee or other intermediary who can intervene in the sales process, enabling the connection between seller and buyer. This commission is estimated at 5% of the sales value, which corresponds to the commission established by the main consignees in the market.

| | | |
|---|---|---|
| Marketing expenses | %/Gross sale | 5% |
| Commission (consignee) | %/Gross sale | 5% |

- The transport of the animals from the field to the delivery point: to calculate this cost, the rate of the animal transport service providers in the Province of Salta, department of Rivadavia, district Banda Norte was used: a truck with a cage that can transport up to 15 animals charged ARS 1.5 x km in December 2023. A 100% increase was calculated over this cost taking into account the increase in the cost of fuel during the month of December. Transportation was calculated for a field located 60km from the town where the delivery is made, which could be considered as an average distance in the area.

| | | |
|---|---|---|
| **Cattle cage** | *USD/Km* | 3,0 |
| | *Distance* | 60 |
| | *Animals per cage* | 15 |

## Production Costs

Small producers, who work at an insufficient scale, with low productivity and high vulnerability, assume minimal production costs, since the low profitability of their unit does not remunerate the work of managing the herd and does not allow them to fully assume essential costs such as costs of health, supplementation and maintenance of the field.

The proposal provided by the project implies a paradigm shift, and the integration into the budget of the production costs unit aligned with productivity and quality objectives, and with the requirements of a sustainable and regenerative practice.

- The unit generates the equivalent of 3 full-time jobs. The cost of human resources is established based on the current daily wage of a laborer as of December 2023 [26] plus 25%. Two jobs are affected by the management of the herd and one by forest and renovation management.

- The contracting of various services for the maintenance of pastures, waterways, boundaries and fences is also included in the cost grid. These costs are calculated for the annual maintenance of 20% of the plots, 30% of the waterways, and 30% of the fences, allowing the maintenance of all the facilities with a reasonable frequency.

- Health costs are calculated to ensure the integral management of the herd, including mandatory vaccination campaigns. An average cost per animal at weaning and an average annual cost per animal were determined based on their category.

## Health

It should be noted here that the calculated cost of technical assistance also includes the care of a veterinarian.

| | | |
|---|---|---|
| **Calves (Weaning)** | *ARS/Weaning* | 2,75 |
| **Heifers** | *ARS/Head/Year* | 2,75 |
| **Cows** | *ARS/Head/Year* | 3,88 |
| **Bulls** | *ARS/Head/Year* | 3,88 |

The need for supplementation for the projected herd was estimated in the months with the lowest fodder supply. It was estimated that 30% of the dry matter needs of the herd should be covered by supplementation during the 3 months of lower forage supply in the field. This equates to approximately 75 Tn of food per month during the winter months.
In the first year of the project, it is planned to integrate 50% of wild fruits harvested in the field to 50% of corn into the composition of the supplementation. From the second year on, it should

be possible to harvest, process and store wild fruits that will cover 100% of the demand for supplementation.
The price of corn used corresponds to the price paid in the area in December 2023: USD 175 per ton. For the wild fruits, the cost of harvesting and the payment of wages to harvesters were considered, generating employment in the community in the months of flowering. A yield of 150 kg harvested per day was estimated, resulting in a cost of USD 125 per ton.
In addition to significantly lowering the cost of supplementation, the resource of wild fruits allows the unit not to be affected by the fluctuation of the course of the price of corn and guarantees the ability of the unit to provide food to the herd in critical times, avoiding severe losses in the cattle as it usually happens. A mobility expense is contemplated that includes current mobility expenses estimated at USD 100 per month. Values for estimating insurance costs were not integrated into the model. A survey was made about insurance companies in order to project this cost, which at the time of submitting this report has not been answered.

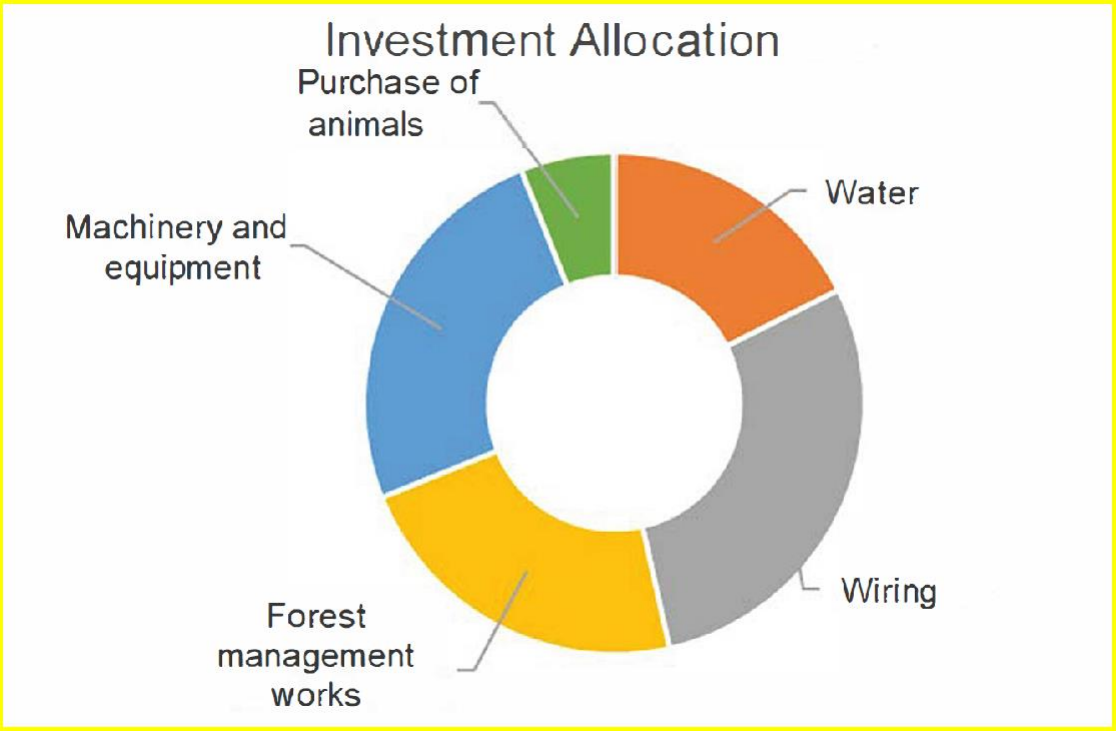
Finally, a payment for technical assistance calculated at 7% of gross sales is included in the cost structure. This percentage allows us to remunerate, at a level of USD 500 per month, an assistance and accompaniment structure, sized to serve up to 40 production units. The technical assistance unit includes a coordinator, veterinarians, and land technicians with their own mobility. This technical assistance unit must accompany producers in the elaboration of their strategy, the productive design of their field, the elaboration of their management plan, assist them in management practices, provide solutions adapted to their needs, supply inputs optimizing costs with scale purchases, link producers with buyers, develop image and build production traceability. The goal of the project is to form and consolidate this unit. In a scenario in which this unit did not exist, the producer would have to hire services from different suppliers to cover these needs, incurring costs greater than those estimated for this projection.

# Key findings

## Investments

The model forecasts a total investment slightly higher than USD 100,000. 50% of the investment will be made at the beginning of the project, and the remaining portion, essentially over the first three full years of the project. In terms of fields, the investment represents USD 50 per ha.

Figure 3. Investment allocation estimated for the model.




About half of investments comprise investments in water (18%) and wiring (29%). These investments are essential to achieve a structural improvement of the fields and make a production unit viable.

Investments in machinery and equipment (25%) could become operating costs: if a production unit does not have the necessary machinery and equipment to carry out the initial installations and certain maintenance tasks, it can hire third parties to provide those services. This would negatively affect the net margin for each year, but would ease the burden of investment.

Investments in forest management works (22%) are essential to ensure the sustainability of a production unit. These investments are directly linked to the regenerative nature of the project since they are aimed at restoring highly degraded areas, conserving forest areas, and developing areas of native-species secondary forests.

# Financing

Although the project optimizes investments to limit their burden on a production unit, the projection shows that a production unit of cattle breeding cannot fully repay these investments in the short term. In a scenario of a fully debt-financed project, the investment would be paid in 10 year (This term may vary according to the financial modalities and conditions defined for the debt incurred). In the current context of high inflation, high interest rates, and a lack of supply of long-term financing in Argentina, this financing option does not seem viable. An initial capital contribution that should represent no less than 30% of the initial investment is needed.

Producers also make an important capital contribution at the beginning of the project through the sale of unproductive wombs. The liquidity generated covers about 50% of the initial investment (USD 48,000).

A portion of the investment not covered by capital contributions and the initial sale of animals will require financing under favorable financial conditions and modalities tailored to the financial flows of the

producer. This financing will make it possible to complete the contribution to make the initial investments and cover the losses of the first full year, when the unit already incurs operating costs that are in line with the adopted production model, but the weaning rate and the level of productivity are still low.

In the proposed scenario, access to an open line of credit for the first 5 full years of the project has been considered. The maximum exposure of the unit during this period equals 50% of the initial investment and the average debit balance over these 5 years equals 15% of the initial investment.

| Financing need (USD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum need | -29,000 | -15,790 | -37,810 | -41,100 | -46,410 | -9,000 | -2,00 | - | - | - |
| Annual average | -9,000 | -4,031 | -18,589 | -20,342 | -19,991 | -750 | - 167 | - | - | - |

The interest rate used to calculate the financial cost of this line of credit is equivalent to the interest rate set by the Investment Fund of the Province of Salta for the Plan GANAR Revolving Fund [27] (Fixed Annual Nominal Rate 19% in ARS).

Participating in the initial financing of the capital contribution model and lines of credit at a preferential rate is justified by the dual social and environmental impact of the project. To effectively develop and expand to a regional level the proposal for establishing regenerative cattle farming units, which drive economic and social development, it will be necessary to attract impact investments. This involves tapping into climate financing and funds specifically directed towards fostering development. It will also be necessary to have access to lines of credit financed by impact funds through ordinary financial Institutions or "ethical" financial institutions that channel and manage these resources, as is the case of Sumatoria[28] in Argentina, for example. Therefore, initiatives that will enable monetizing the environmental impact of the project through payment for ecosystem services, or the trade in carbon credits must be developed.

## Analysis of financial results

The following table shows financial indicators of the projection prepared:

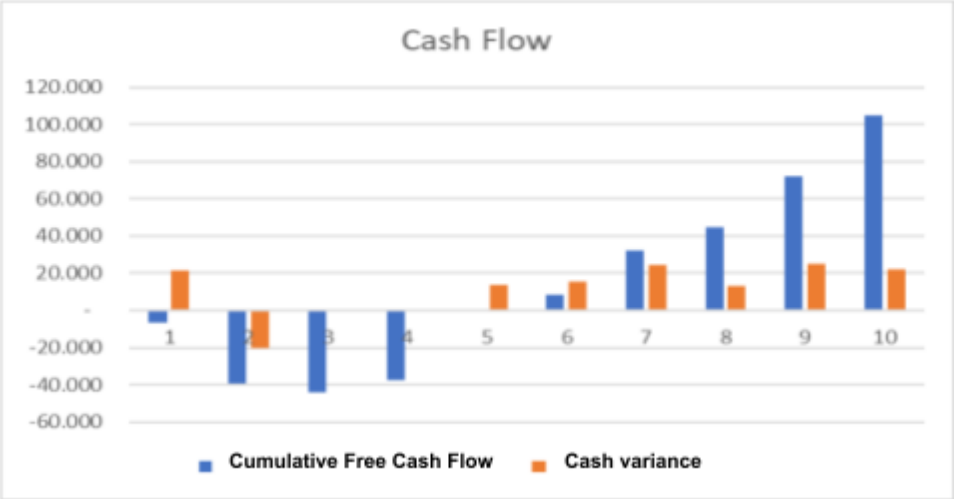
| Financial indicators (USD) | |
|---|---|
| EBITDA, (earnings before interest, depreciation, taxes and amortization) (Standard Year) | 25,564 |
| EBITDA BAU (Standard Year) | 5,033 |
| Maximum Negative (Free Cash Flow) | (55,787) |
| Year. Maximum Negative | 1 |
| IRR (internal return rate) (Free Cash Flow) | 27.56% |
| Net Present Value (Discount rate - 19%) | 12,084 |

It is observed that the EBITDA of the model for a standard year is five times higher than that of an equivalent traditional unit with extensive productive practice. The level of greatest investment

need occurs in the first year, with a negative of USD 55,787. The IRR calculated for this projection is 28.56% and the NPV with a discount rate of 20% (Annual Nominal Rate according to the GANAR Revolving Fund) is USD 12,084.

The graph below illustrates the changes in cash flows over the 10 years of the project. Free Cash Flow includes cash flows of the operation and investments, and cash variance also include non-reimbursable contributions, financing and financial costs.

Figure 4. Cash flow projected for 10 years period




This model shows an economically viable livestock production unit with a high social and environmental impact. To complete the analysis of the business model, other business units to be developed in the same field and with the same families of producers must be integrated into the project. The profitability and sustainability of the model will be consolidated with opportunities for the development of other production units, of small livestock, beekeeping and timber forest production.

As mentioned above, it is also important to include the development of projects that enable monetizing the environmental impact, especially through the production and trade of carbon credits, in the analysis and planning of activities.

# Analysis of environmental and climate impacts of value creation

The proposed business model has positive environmental impacts related to soil health, greenhouse gas emissions, biodiversity, ecotoxicity associated with the use of pesticides, water and provision of ecosystem services. The measures promoted by the model as a whole reduce the sensitivity of the socio-ecosystem and increase its adaptive capacity in response to climate change (droughts, extreme temperatures, increases in climate variability).

## Soils

Cattle farming in the Chaco ecoregion has followed different approaches in terms of production

efficiency, but all have resulted in significant environmental impacts on soils and vegetation. Traditional cattle farming practices (BAU) have led to erosion processes due to continuous grazing and have caused changes in vegetation, water dynamics and soil compaction. The introduction of cattle production, often carried out through deforestation and the establishment of non-native grasslands, has further increased the risk of water erosion and reduced the potential for water infiltration.

The model seeks to reduce the impact of cattle farming on soils by implementing practices such as rotational grazing and holistic cattle management. These practices can improve soil health, increase its water-holding capacity, and reduce erosion, helping to maintain soil quality and fertility. This model does not focus on the incorporation of grass forage as the primary proposal. Instead, it assumes that, with cattle management practices, resting periods, and divisions of pastures, native grasses may gradually start to grow. The implantation of grasses –along with legumes– in degraded soil areas is suggested only to promote rapid restoration. The implantation of grasses in degraded soil areas improves absorption of soil nitrogen and controls erosion factors when they are combined with rhizomatous-stoloniferous grasses that densely cover the soil surface.

In addition, restoring degraded soil areas is key to improving ecosystem functioning, as it leads to increased environmental benefits for people and native flora and fauna. It also plays a crucial role in strengthening the forage base that makes it possible for soil to rest and to relieve grazing pressure in other pastures with well-maintained forest cover.

## GHG emissions

BAU cattle farming in the Gran Chaco region contributes to greenhouse gas emissions in several ways, including deforestation, enteric fermentation in the digestive system of cattle, and manure management. Deforestation releases carbon stored in vegetation and soil into the atmosphere, while enteric fermentation and manure management produce methane. In addition, changes in land use and overgrazing can cause land degradation and lessen carbon sequestration, further exacerbating the problem of GHG emissions.

The ILNTF system can change these dynamics. It involves the implementation of practices that promote soil health and carbon sequestration, such as reducing soil disturbance and managing grazing in a way that favors vegetation regrowth and soil organic carbon sequestration and preserves secondary forests. In addition , regenerative cattle farming can reduce greenhouse gas emissions by mitigating the impact of deforestation, enteric fermentation and manure management.

A recent study in the Chaco region that quantifies the benefits of greenhouse gas emissions when regenerative cattle farming practices are used reports an average reduction of 2.44 tCO2/ha/year compared to BAU cattle farming practices, and these estimates may vary with specific practices. For example, reduced tillage when grass seeds are sown can increase soil carbon capture by reducing soil disturbance, which can lead to increased organic matter and improved soil structure. This practice can capture 1 to 2 tonnes of carbon per hectare per year. Additionally, the proposed production system reduces both the accumulation of biomass in the understory that derives from the vegetative growth of introduced grasses and the risk of fires difficult to control that have an impact on CO2 emissions and the functioning of the ecosystem.

The introduction of holistic management can reduce enteric fermentation emissions through

different mechanisms, some of which are directly related to feed management, the components of the diet and the relationship between them while others are related to the use of additives in the diet, such as methanogenic inhibitors. Improved forage quality and the use of additives can reduce methane emissions by 10-20%.

Improved manure management practices, such as composting, can reduce methane and nitrogen oxide emissions from manure by 10-30%. However, this estimate comes from measurement works carried out in only 3 places in Chaco. Complete estimates across the region showing the existing carbon sequestration potential as well as estimates of enteric fermentation and other sources of emissions are lacking in the literature.

## Biodiversity

Cattle farming in the Chaco forest has several impacts on biodiversity.The expansion of cattle farming often results in deforestation of large areas, which destroys habitats and leads to species loss. Overgrazing can lead to soil degradation and erosion, which negatively affects vegetation growth and reduces the quality of habitats for wildlife. In addition, loss of forest habitats and hunting pressure from humans can lead to a decline in wildlife populations, including endangered species such as jaguars and pumas (cougars). Cattle farming can also introduce non-native species of plants and animals, which can displace native species and disrupt ecosystems.

The shift from BAU cattle farming practices to ILNTF farming practices in the Gran Chaco region can benefit a wide range of species. By reducing deforestation and improving habitats, these practices can benefit threatened and endangered species, such as jaguars, pumas, and Pampas foxes. Practices such as controlled grazing can improve vegetation cover and provide more nesting and feeding opportunities for bird species, including grassland birds, raptors, and migratory birds. In addition, by improving soil health and increasing vegetation cover, the ILNTF system can also benefit reptiles and amphibians, which need stable and diverse habitats to survive. By promoting the growth of native vegetation, regenerative cattle farming practices can also benefit pollinators such as bees, butterflies, and hummingbirds, which play a critical role in maintaining healthy ecosystems. Soil biota, including bacteria, fungi, and invertebrates, can also benefit from improved soil health associated with ILNTF farming practices, which can promote the growth of diverse and abundant plant communities.

In addition, the removal of shrubs in the understory layer of the Chaco forest to increase the supply of forage for cattle can affect total carbon storage and overall plant diversity. However, not all removal methods appear to have the same level of impact. Roll cutting appears to have a lesser impact than manual cutting, as the former maintains higher levels of forage production, tree seedlings and functional diversity than manual cutting. Ensuring the regeneration of tree species is critical for the long-term persistence of the system.

Our understanding of these potential effects will increase with continuous studies and monitoring, which will enable us to determine the full scope of the benefits for biodiversity, especially those related to the restoration of the forest structure and arid plains and the monitoring of the regeneration of the bank of native grass species seeds.

## Ecotoxicity of agrochemicals

Agrochemicals, such as pesticides and fertilizers, are commonly used in modern agriculture, including livestock farming. However, their widespread use has raised concerns about their potential negative impact on the environment, including ecotoxicity. Ecotoxicity refers to the

harmful effects of chemicals on ecosystems and the organisms that inhabit them. ILNTF farming practices seek to minimize the use of agrochemicals and prioritize the health of the ecosystem.

In ILNTF farming, there are attempts to minimize pesticide use through sustainable management practices, such as rotation, controlled burning in areas with native grasslands, and the use of pesticides based on damage thresholds. However, the incorrect use of pesticides can have negative effects on the environment, such as pesticide resistance, disruption of food chains, water pollution and persistence in the food chain.

A clear example of this problem is shown in the treatment of the Rhipicephalus (B.) microplus tick, a very important species for livestock production in Argentina and tropical and subtropical areas of the Argentine northeast and northwest which causes direct losses in terms of decreased weight gain, leather damage, mortality, lower milk production and control costs in addition to being the sole vector of bovine babesiosis. To control this, different tools, such as chemical acaricides, pasture rotation, the use of fire and vaccines against tick-borne diseases, can be used. Although chemical acaricides are the main tool, their use may be limited due to agrochemical resistance and restrictions on meat or milk consumption. Pasture rotation and vaccines against tick-borne diseases are more sustainable alternatives. However, agrochemical resistance remains one of the biggest challenges in controlling this tick species and requires a comprehensive and sustainable approach in livestock management.

### Water

The promoted cattle farming practices contribute to the water cycle, allowing better infiltration and retention of water in soils. This can help recharge aquifers, keep soil moisture for longer periods and mitigate local drought.

The practices are supplemented by the promotion of water systems that allow the collection of the largest amount of water possible so that livestock, fauna and communities can have access to this resource, which is scarce in this region. The use of water collection systems coupled with efficient water harvesting practices that take advantage of pathways and natural drainage systems will create more possibilities of meeting water requirements even in periods of low rainfall .

## Provision of Ecosystem Services

The business model promotes a regenerative system that has direct environmental benefits. In connection with this, a healthy ecosystem can improve cattle productivity by providing better quality forage, benefiting local farmers and ranchers. Finally, it can have a positive impact on the local economy and the resilience of communities.

Comprehensive planning includes conservation areas and intensification areas. Improving the efficiency of land use promotes the recovery of the structure and functioning of the ecosystem, and, therefore, the provision of ecosystem services –not only those services associated with the provision of goods (calves), but also services related to regulation (shade for cattle, temperature attenuation) and cultural services for local communities (identity, knowledge transfer). Table 1 below lists the contributions of natural ecosystems to people (NCP), which are grouped into four categories. The impact of both conventional cattle farming (BAU) and ILNTF farming on each benefit is indicated.

Table 1: Perceived Environmental Benefits in BAU and ILNTF Farming Systems in Chaco

| Component | Benefit | BAU | MNR |
|---|---|---|---|
| Animal wealbing | Temperature control | - | + |
| | Animal wealth by providing acces to water, conditions for shade and access to forest seeds and forriaje | - | |
| Climate | Increase climate change resilience due to soil coverage, moisture retention, water access, forest coverage | - | + |
| | Carbon emissions reuction | - | 2.44 tCO2/h/year |
| | Carbon secuestration | - | 1 ton/h/year |
| | Metane reduction | - | 10-20% |
| Economic | Acces to formal markets and increased revenue | + | + |
| | *EBITDA (TTM) USD* | $ 5,033 | $ 25,564 |
| | Enable touristic activities by enabling 2000 hectares of areas with production lots and conservation zones that could be of | - | + |
| Environmental | Maintaining ecological services and health to enable honey, fibers and caob flour production | - | + |
| | Water cycle regulation | - | + |
| | Area of forest protection | 10% | 25% |
| | Soil regeneration | - | + |
| Productive | Hectare required per animal unit | 10 | 2 |
| | Cow weaning rate | 30% | 75% |
| | Use of seeds and NTFP to reduce production costs | - | + |
| | Use of external feed inputs corn, soy, maize | - | + |
| Social | Número of families in 1 productive unit | 1 | up to 6 |
| | Gender inclusion through implementation of regenerative practices (fruit recolection, intensive production) | - | + |
| | Increase associativiness by creating cooperatives with up to 6 families formalized under a CC scheme | - | + |

# Challenges and opportunities for the business model

Regenerative cattle farming models in the Chaco region must follow a set of Good Farming Practices (GFP) based on knowledge of the dynamics of natural vegetation and the following principles:

- Understanding the ecology of natural forage ecosystems, forests and their spatial and temporal heterogeneity as key aspects for their regenerative use.
- Recognizing that native species and naturally generated resources have the most adaptability to the environment and, consequently, will be able to have the best reaction or show resilience to climate change.
- Showing men's and women's different knowledge about natural resources and their ecosystems as a key tool to achieve regenerative transformation.
- Highlighting that the cost-benefit of management based on process technologies remains significantly lower compared to other input technologies that involve habitat replacement or transformation.
- Understanding that, in production systems, there is an important margin for increasing physical production without endangering the ecosystem services provided by natural ecosystems when production increases.
- Identifying minimal natural and anthropogenic disturbances that can be translated into opportunities to improve productivity without affecting the quality of the habitat.

In order to promote regenerative cattle farming models that make the sector competitive before the markets, there are a set of factors to be regarded as leverage points, as they are comparative advantages, and challenges to meet based on the current situation of the production system as a whole.

To summarize the information obtained, the SWOT (Strengths, Weaknesses, Opportunities and Threats) matrix methodology was applied. This was useful to identify the positive and negative internal factors (strengths and weaknesses) and external factors (opportunities and threats) that affect the cattle farming sector when producers turn to regenerative production schemes.

The matrix was developed with the data and contributions obtained through various techniques used during the study, such as interviews with key informants, exchanges of ideas with the consulting team and the bibliographic review of secondary information sources, including partial consulting reports and statistical data.

# SWOT Analysis

| Strengths | Description |
|---|---|
| Natural capital and climate, favorable to conversion-free cattle production | The regenerative cattle farming sector has growth prospects, and the availability of land suitable for production, characterized by its natural resources and large areas with productive capacity, is regarded as a natural strength. This factor gives the Gran Chaco region competitive advantages over other exporting regions in the world. |
| Cattle farming established as a traditional activity and pillar of the regional economy | Cattle farming was established as a traditional economic activity in the region, which is shown by its presence throughout the territory, the size of cattle and the number of existing production units. At the same time, families that produce cattle tend to consider production to be linked to family traditions, so they are less affected by market speculation. |

| | |
|---|---|
| Beef traceability system for the whole country | Argentina has a beef traceability system implemented by the National Service for Agri-food Health and Quality (in Spanish, SENASA) which ensures total transparency of procedures and clarifies the responsibility of each actor, such as breeders and fatteners, hauliers, meat processing plants, slaughterers, exporters, distributors, butchers, etc. This system records data of owners[30], establishments of origin and target establishments and numbers, categories and brands to identify cattle, allowing quick access to information if a health event occurs. |

| Strengths (continued) | Description |
|---|---|
| Creation of the National Climate Change Cabinet | In December 2019, Law No. 27520 on Minimum Principles of Adaptation to and Mitigation of Global Climate Change was published to guarantee adequate measures, instruments and strategies for mitigation of and adaptation to climate change throughout Argentina. The National Climate Change Cabinet (GNCC, in Spanish) aims to connect the different areas of government of the National Public Administration, the Federal Environment Council and several civil society sectors to develop consensual public policies, with a strategic view to reducing greenhouse gas (GHG) emissions and generating coordinated responses for the adaptation of vulnerable sectors to the impacts of climate change. As a result of this connection, the law establishes that the National Climate Change Adaptation and Mitigation Plan (PNAyMCC, in Spanish) will be developed and |

30 Unfortunately, data on owners do not show the role of women and their involvement in the production chain. Therefore, empirical evidence leads us to believe that women's level of involvement in the cattle farming system is much greater than what SENASA data on ownership shows.

| | |
|---|---|
| | implemented. The PNAyMCC prioritizes vulnerable communities and social groups, and includes a gender perspective and intergenerational equity as core principles that extend to the whole initiative.[31] |

| Strengths (continued) | Description |
|---|---|
| Alignment to the international political framework and existing national and specific public policy instruments for the development of sustainable cattle farming | The Argentine regulatory framework is in line with the international legal and political framework and is comprised of, among others, the SDG 2030 Agenda, constant updates of the NDCs, the National Agro and Climate Change Action Plan, the National Forest and Climate Change Action Plan and the National Forest Management with Integrated Livestock Plan (MBGI, in Spanish). |
| Animal health status | Argentina is recognized as a country free of foot-and-mouth disease with vaccination. At the international level, products of animal origin from Argentina are known to pose negligible risks of Bovine Spongiform Encephalopathy (BSE), commonly known as Mad Cow Disease. The foot-and-mouth disease-free status without vaccination fundamentally opens up the opportunity to export bone-in meat to the EU. |

31 Executive Order No. 1030/2020 governs the application of Law No. 27520 by implementing the tools introduced by such law to ensure the development and implementation of appropriate measures and strategies for the adaptation to and mitigation of climate change nationwide. The order formalizes the internal working structure of the GNCC, establishes the functions of the Administrative Technical Coordination (CTA, in Spanish), for which the Secretariat of Climate Change, Sustainable Development and Innovation (SCCDSeI) is responsible, and sets out the powers of the Ministry of Environment and Sustainable Development (MAyDS) as the national enforcement authority of Law No. 27520. The order also sets forth the importance of ensuring gender balance in the workspaces of the GNCC and the External Advisory Council (Executive

Order No. 1030/2020, 2020).

| | |
|---|---|
| Official beef grading system | The system developed by the Argentine Ministry of Agriculture in collaboration with the National Institute of Agricultural Technology (INTA, as per its Spanish acronym), production and industry representatives, allows to classify beef into different types through the assessment of widely known quality attributes, opening up new commercial opportunities, since, in addition to providing objective information to producers, the industry sector and consumers, it is comparable with grading systems in international beef markets, which helps to position our products. |

| Strengths (continued) | Description |
|---|---|
| Predominance of pasture-based production models | Cattle production is mainly carried out in extensive schemes with the use of pastures and grasslands as the primary source of food. In general terms, the greater the inclusion of forage in the ration, the lower the costs and the greater the economic competitiveness. |
| Official R&D, academia and private research centers | Argentina has sufficient human resources in technological developments applied to agriculture in general and cattle farming in particular. This is shown by the number of resources addressing the issue in different research organizations, such as the National Scientific and Technical Research Council (CONICET, in Spanish), the National Institute of Agricultural Technology (INTA, in Spanish), national and provincial universities, and the Argentine Beef Promotion Institute (IPCVA, in Spanish), among others. |

| Weaknesses | Description |
|---|---|
| Gap between productive strata | There is a significant gap between different productive strata in terms of technology, investment capital, infrastructure and technical assistance. Primary production is concentrated, and there is a large number of small producers. 74% of cattle farming establishments that have up to 250 head concentrate only 22% of the total stock. In contrast, larger producers which represent 5% of total establishments concentrate almost 40% of cattle in large establishments with more than 1,000 head. |
| Gender gaps | There is evidence that women are as productive in farming as men, but they do not have the same opportunities to gain access to resources, production loans, training, decision-making spaces and markets. At the same time, although women also participate in production, they are rarely paid for their work, and are also responsible for the household chores and family care. |
| No sanitary, reproductive and economic records by producers | Many producers do not know the financial, technical, sanitary, quantitative and qualitative aspects of their establishments, management, and cattle precisely. This weakness makes property planning and the forecasting of associated risks more difficult. |

| | |
|---|---|
| Informality in the sector | Mainly, low strata producers and family farming producers operate outside the formal sphere. The lack of information and state absence in some territories give rise to parallel market structures in which the benefits associated with keeping tax and health records are unknown. In general, in these cases, the lack of communication and connectivity infrastructure worsens the situation. |

| Weaknesses (continued) | Description |
|---|---|
| Margin of improvement of reproductive parameters of national cattle | The average reproduction indicators at the national level do not exceed 60% of weaning, and this value decreases to about 30 to 50% for medium and small producers. |
| Unproductive categories | The possession of unproductive animals in roundups is seen as a status symbol and a form of savings, mainly in small establishments. For many small producers, cattle farming is a form of investment rather than a business activity, and in times of need for liquidity, they sell some animals to meet unforeseen expenses. |
| Little emphasis on specific environmental or sustainable production certifications | No protocols or certifications of good practices, including those specifically related to environmental issues, that result in benefits for producers as a form of incentive have been developed in Argentina. |

| Opportunities | Description |
|---|---|
| Production intensification | It is based on the idea of "producing more" in terms of time, area or animal. This approach proves particularly relevant to prevent significant changes in land use, enabling an increase in productivity while simultaneously reducing the intensity of emissions. |
| Greater integration of value chains | Livestock value chains could be greatly strengthened through the integration of players that still are not fully integrated, such as family and small producers. This would contribute to reducing practices like informal sales or ending the existence of establishments that do not comply with health regulations. |
| Maximizing the use of installed capacity. | Currently, in contrast to past times, there is a large installed capacity at the industrial level, and its use could be maximized: infrastructure, logistics, value addition. |

| | |
|---|---|
| High level of apparent beef consumption per capita nationwide | Argentina has a well-developed domestic market that consumes more than 70% of the annual production. The remaining 30% is sold in the foreign market. |
| Access to deforestation-free meat markets | Due to the restrictions imposed by European markets for the commercialization of Deforestation-Free meat, our country has an exceptional opportunity to focus on supplying that market. In addition, with the implementation of sustainable technology packages and the strengthening of the Reporting and Verification Monitoring systems, Argentina's beef sector could enter carbon markets. European regulations will start to set new trends in international trade. |

| Opportunities (continued) | Description |
|---|---|
| Informed, increasingly empowered and environmentally responsible consumers | In this technological and information era, there is a greater number of informed and empowered users. This could be taken as an opportunity to use campaigns to promote regenerative cattle farming. |
| Development of a strategic communication plan, including the promotion of the benefits of sustainable cattle farming | It is necessary to develop a strategic communication plan which establishes the dissemination guidelines to achieve the goals set, including the social, productive, economic and environmental benefits arising from mitigation options. |

| Threats | Description |
|---|---|
| High vulnerability of primary production to climate change | According to the "Impact and Vulnerability to Climate Change Study: Possible Adaptation Measures", cattle production in the region is exposed to risks of reduced output created by unfavorable climatic conditions (droughts, extreme temperatures, frosts, and precipitation). |
| Heat stress in cattle | The combination of the climatic factors identified as a threat in the previous section leads to high temperature-humidity indexes (THI), which cause heat stress in domestic ruminant species. According to data gathered discontinuously between 1986 and 2001, heat stress may occur between 10 and 30 days per year. |
| Marked forage seasonality | The existing pastures, especially in the predominant natural fields of the country, experience marked forage seasonality due to climatic conditions (lush pastures in summer and scarcity/lignification in winter). |
| Bad press | There is a strong prejudice against the agro-productive sector developed by the media. As a result, the agro-productive sector is associated with massive logging of native forests, practices affecting biodiversity, eviction of indigenous peoples or indiscriminate burning of grasslands. |

# Conclusions

At the crossroads of the Argentine economic situation and the deep-rooted preference for meat consumption, the introduction of a product called "deforestation-free meat" to the local market in the Argentine Gran Chaco is a strategic opportunity in line with global sustainability trends. Growing consumer awareness of the environmental impacts of beef production, coupled with an increasing demand for sustainable products, provides a unique opportunity to single out and position this innovative product in the market.

Successful implementation of sustainable cattle farming practices, responsible land management and commitment to deforestation-free production standards not only address environmental concerns, but also are in line with changing consumer preferences. Although it is crucial to consider the additional costs associated with these practices, growing awareness and appreciation of sustainable products support the acceptance and potential success of this proposal in the Argentine market.

In addition, collaboration with sustainability initiatives and certifications, along with an effective communication strategy to highlight the environmental and social benefits of the product, could strengthen its positioning in a market that is increasingly receptive to responsible products.

In the global context, trends in Europe, the United Kingdom and China as well as Uruguay's experience as a producer of sustainable meat reinforce the viability and relevance of launching "deforestation-free meat" as a product to the Argentine market. In Europe, there is a growing demand for sustainable meat, with consumers who are increasingly aware of the environmental impacts of food production. The UK, in particular, has implemented stricter regulations on sustainability and animal welfare, creating a market that is receptive to products that meet high environmental standards.

China, where the market is rapidly expanding and there is a growing middle class, has seen a significant increase in demand for high-quality and sustainable products. The introduction of "deforestation-free meat" as a product could have a positive impact on the global market, by being in line with the preferences of sustainability-conscious consumers.

These international trends suggest not only a growing demand for sustainable meat worldwide, but also the possibility of establishing strategic connections and accessing external markets with standards that are more rigorous in terms of sustainability. By positioning the Argentine product as an option that meets the expectations of European, British and Chinese consumers, producers could take advantage of the growing global appreciation of responsible practices in food production.

Entering the "deforestation-free" meat market not only addresses the current demands of environmentally conscious consumers, but also lays the foundation for a strong long-term position. By embracing sustainability and environmental

responsibility, the Argentine Gran Chaco has the opportunity to lead the evolution

of the beef market, standing out not only for the quality of the product it offers but also for its unwavering commitment to preserving the environment. In a world where sustainability becomes a crucial distinguishing feature, this strategic step could not only meet current market expectations, but also build Argentina's reputation as a global leader in sustainable and deforestation-free meat production.

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