TFA
TROPICAL FOREST ALLIANCE

ANALYSIS

OF BEEF PRODUCTION PRACTICES IN THE ARGENTINE GRAN CHACO

CONTENT

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BY REQUEST FROM MESA ARGENTINA DE CARNE SUSTENTABLE

The work was entrusted by the Tropical Forest Alliance (TFA) to the Argentinian Roundtable on Sustainable Beef (MACS) and developed by the Faculty of Agronomy of the University of Buenos Aires (FAUBA).

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1. CONTEXTO GLOBAL Y LOCAL

In a context of higher volatility of agricultural products, with an increase in average prices nearing the record prices observed at the end of the 2000's, beef is faced with a scenario in which:

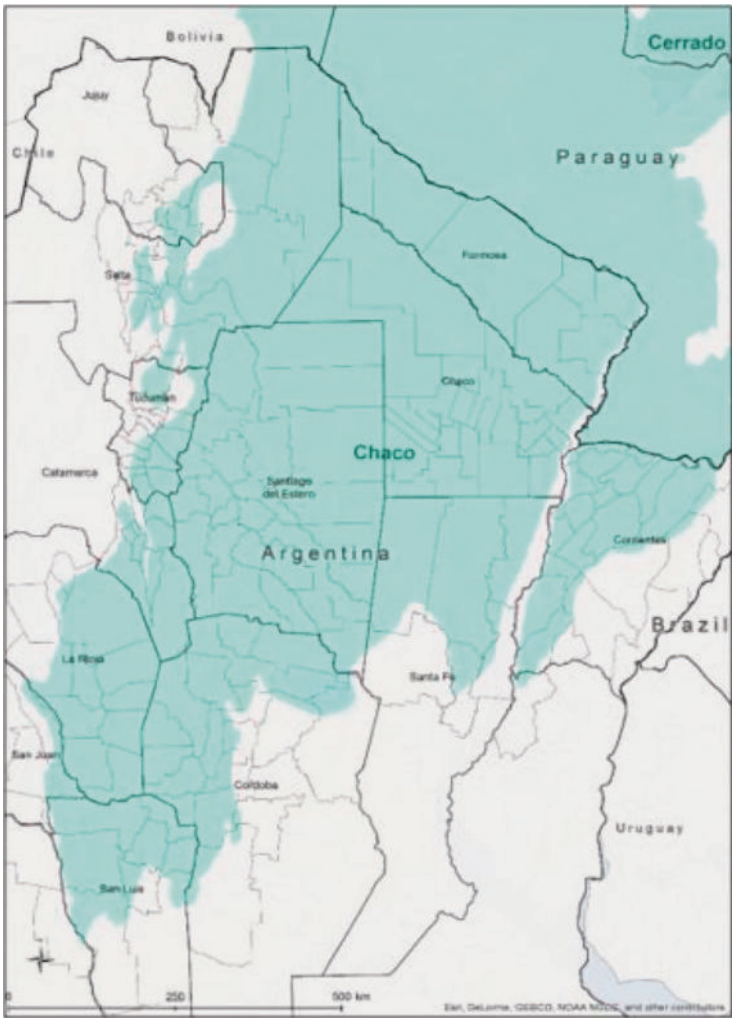
- Supply and demand of national and international markets is increasing
- Price scenarios have become more complex because protein prices have, in general, increased less in percentage than inputs
- World-class beef products are still strongly demanded with a tendency towards further growth

In the meantime, the situation in Argentina regarding beef production has been somewhat stagnant on average for the past seven decades, even though a true "boom and bust cycle" can be observed during this period. This has been typically a market where most of the beef produced has been sold in the domestic market, although different institutional changes have created growths and falls in beef exports.

Argentina's beef sector is highly atomized at every single stage within it with almost 200 thousand farmers, 500 slaughterhouses (including federal, provincial and municipal abattoirs) and over 40 thousand points of sale including butcher shops, supermarkets and other retailers.

The Gran Chaco Region occupies most of the Northern part of Argentina (**Map 1**), stretching across the provinces of Chaco, Santiago del Estero, Formosa, North of Santa Fe, Córdoba, and San Luis, East of Salta, Tucumán, La Rioja, Catamarca, West of Corrientes and areas in Jujuy and San Juan.

MAPA1. DELIMITATION OF GRAN CHACO REGION IN ARGENTINA



- The **Gran Chaco Region** is located in South America, occupying parts of Argentina, Bolivia, Brazil and Paraguay
- It is the **second largest forest** in the continent, after the Amazon rainforest
- The **argentine section** of this biome stretches North to South from western Salta and all of Formosa to northern San Luis and East to West from western Corrientes to eastern La Rioja and San Juan

Source: Sebastián Senesi & Marcos Daziano (2017).

This region has been gaining importance in beef production over the past 3 decades as the Pampas have shifted towards more crop production.

For Gran Chaco region, figures indicate that there are almost 100 thousand beef farmers, while in the focus area of the provinces of Chaco, Formosa, Salta and Santiago del Estero there are 36,860 registered cattle ranches[1].

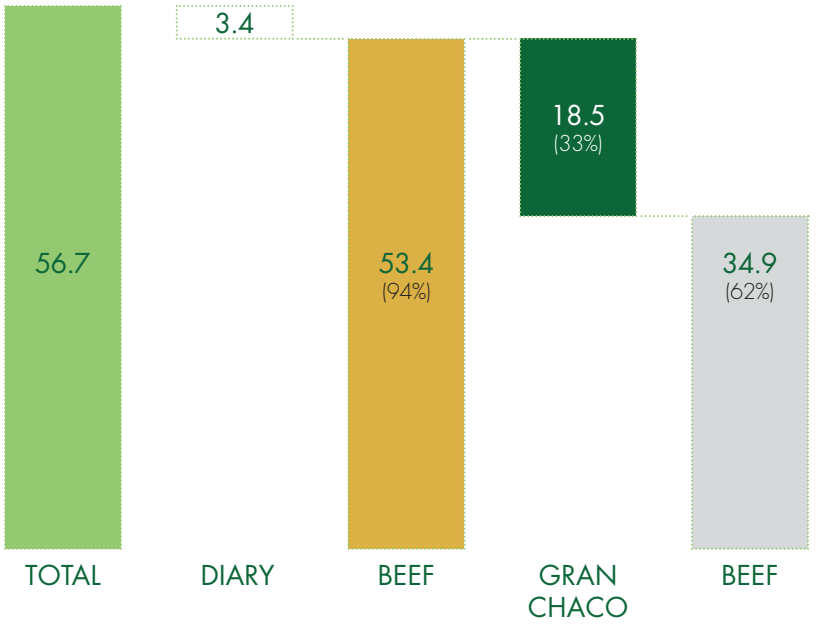
With this research, Tropical Forest Alliance seek to contribute to improving the understanding of the current status, growth dynamics and adoption and diffusion of conservation practices in beef production in the Gran Chaco biome, with particular focus on the abovementioned provinces. This analysis will allow the cattle sector to add a new tool, to a market-based focus that has the objective of eliminating natural habitat conversion, improving productivity and competitiveness.

2. BEEF PRODUCTION AND COMMERCIAL SYSTEM IN GRAN CHACO REGION

Argentina's total stock added up to 56.7 million heads in 2022, out of which 53.4 million heads (94%) were destined to beef production. The heads of cattle destined to beef in the Gran Chaco Region represent 33% of the total heads in the country[2]. **Graph 1** shows these figures.

GRAPH 1. STOCK IN ARGENTINA BY TYPE OF PRODUCTION

March 2022, Million heads of cattle.



- Out of **56.7 million** heads of cattle, **94%** are destined to beef production
- **33% of the heads of cattle** destined to **beef** production in Argentina are located in **Gran Chaco**
- The predominant feeding system in **Gran Chaco** is **grazing** with **94%** of the animals being raised in these systems

% of animals on pasturelands*	95%	94%	96%

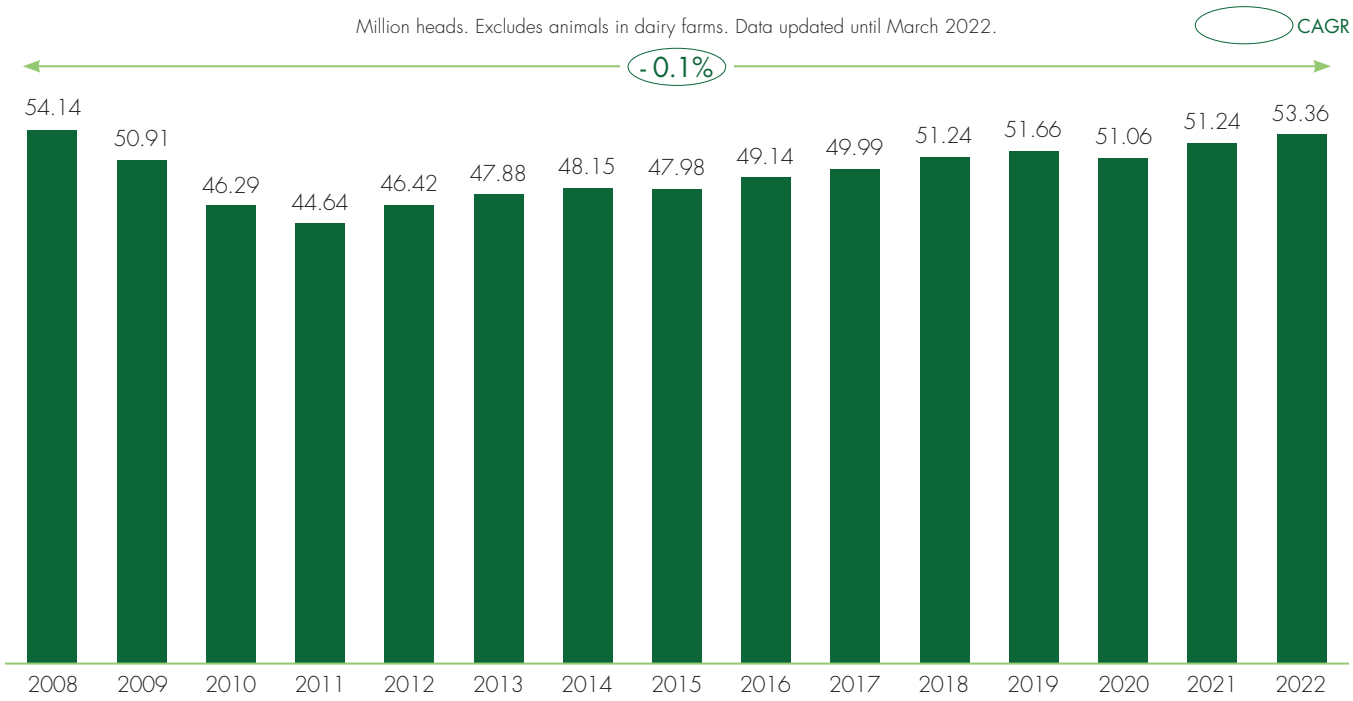
*Pastureland cattle is mainly raised on grass and may or may have grain supplementation.
Source: Sebastián Senesi & Marcos Daziano (2022) based on SENASA

Beef production in Argentina stands at around 3 million tons. The last fifteen years have been marked by a cycle of divestment and stock reduction between 2006 and 2011 and a cycle of reinvestment and stock growth since then and until 2020, although 2021 was a down year. From 2012 to 2022 beef cattle stock grew by 15% to 53.4 million heads, while the number of heads slaughtered increased by just 13.5% to almost 13 million heads from 2012 to 2021. At the same time, the stock in the Gran Chaco region has grown by 53% to over 18 million heads[3].

The following graphs show the evolution of Argentina's herd size since 2008. **Graph 2** shows the evolution of the stock in the country between 2008 and 2022, while **Graph 3** shows the stock by province in 2022.

GRAPH 2. EVOLUTION OF STOCK IN ARGENTINA BETWEEN 2008 AND 2022

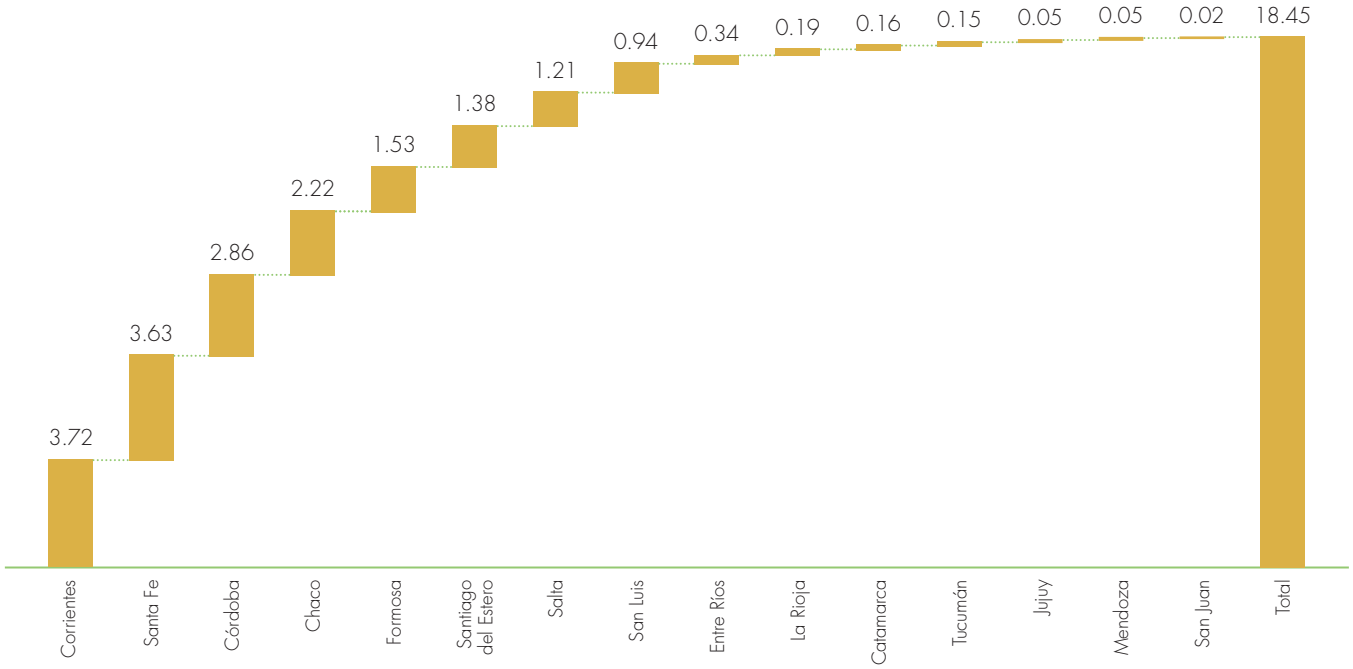
Million heads. Excludes animals in dairy farms. Data updated until March 2022.



Source: Sebastián Senesi & Marcos Daziano (2022) based on data from SENASA, Minagri and provincel Statistics.

GRAPH 3. GRAN CHACO STOCK BY PROVINCE IN ARGENTINA IN 2022

Million heads. Excludes animals in dairy farms. Data updated until March 2022.



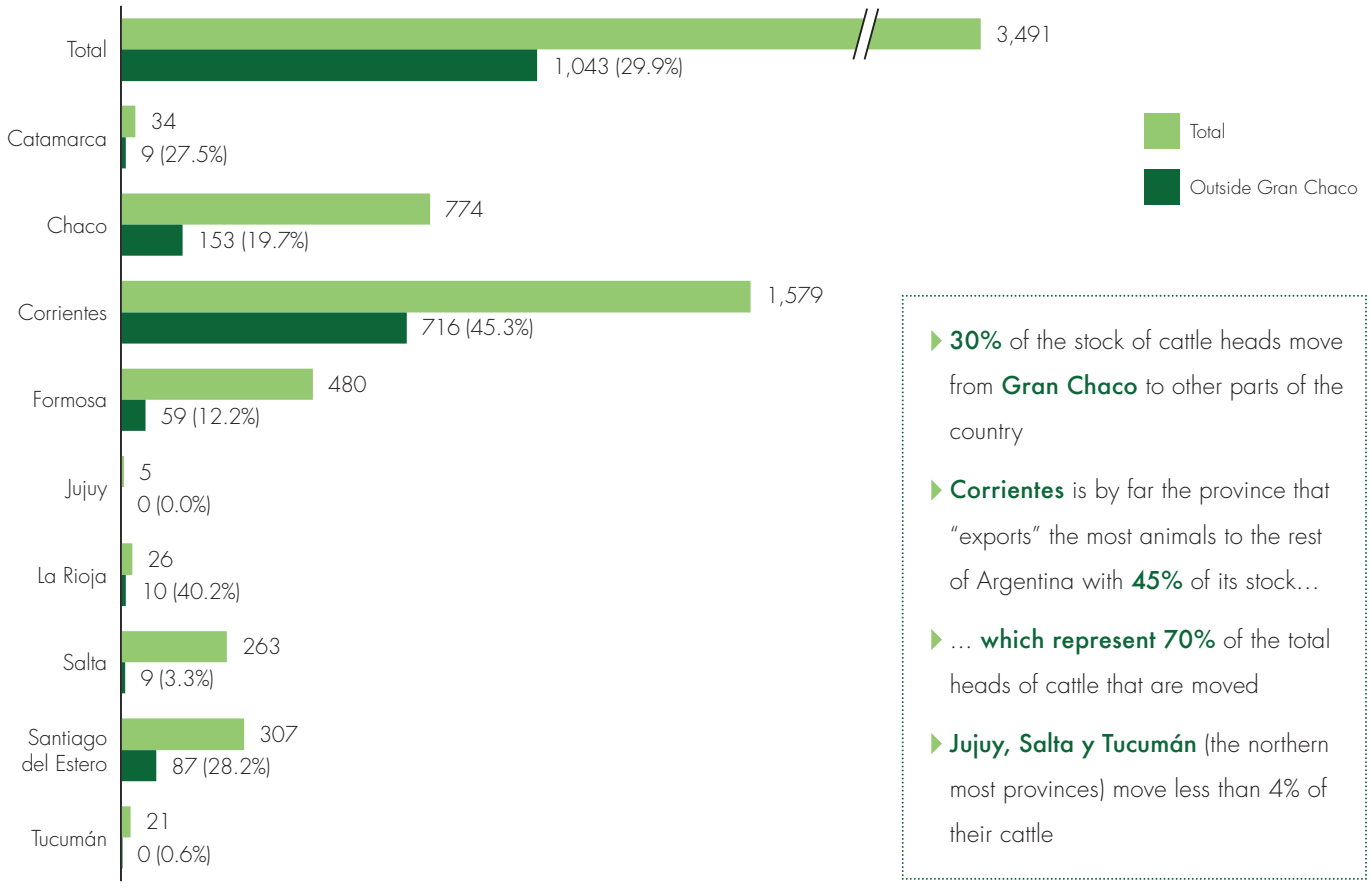
Source: Sebastián Senesi & Marcos Daziano (2022) based on data from SENASA, Minagri and provincel Statistics.

It is of great importance to state that out of all the cattle that is moved from farm to farm in the region, 30% of the animals are shipped to farms outside of Gran Chaco in order to fatten and/or be slaughtered. This means that, for the year 2021, more than a million heads were moved from the Northernmost provinces to provinces such as Buenos Aires, Entre Ríos and Southern Santa Fe and Córdoba. **Graph 4** shows this data by province. Corrientes is by far the province that "exports" the most animals to the rest of Argentina with 45% of its stock, which represent 70% of the total heads of cattle that are moved. Jujuy, Salta and Tucumán (the northernmost provinces) move less than 4% of their cattle[4].

These movements become of key importance further along the supply chain because many agents operating outside Gran Chaco depend on the influx of cattle from this region. This is particularly true for export markets seeking heavier animals which are the trademark product from Corrientes for example.

GRAPH 4. CATTLE MOVEMENT IN GRAN CHACO

2021, Thousand heads. Excludes animals in dairy farms. Number of animals being moved to other provinces. Percentage of animals being moved outside Gran Chaco.



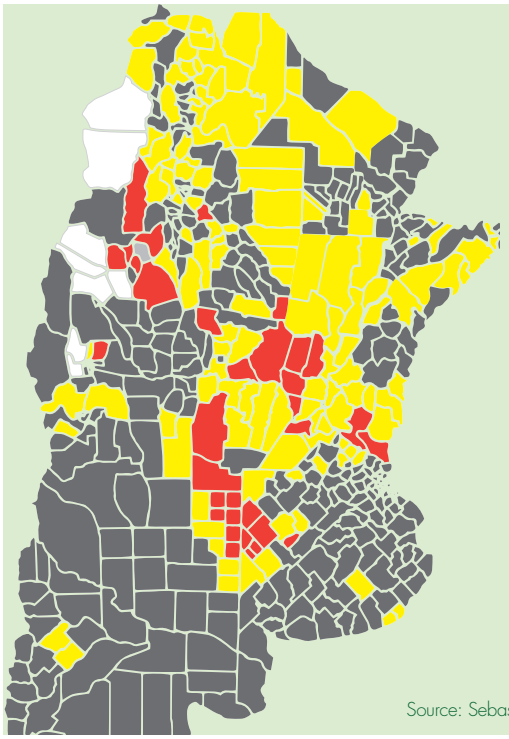
- **30%** of the stock of cattle heads move from **Gran Chaco** to other parts of the country
- **Corrientes** is by far the province that "exports" the most animals to the rest of Argentina with **45%** of its stock…
- … **which represent 70%** of the total heads of cattle that are moved
- **Jujuy, Salta y Tucumán** (the northern most provinces) move less than 4% of their cattle

Source: Sebastián Senesi & Marcos Daziano (2022) based on data from SENASA, Minagri and provincel Statistics.

It is important to understand that Argentina is a country where the most important cattle activity is producing calves. This means that in most of the country, the predominant type of farm are cow-to-calf operations. **Map 2** shows this regionalization, where gray areas are those where Cow-to-calf operations are predominant, orange areas are those where Calf-to-steer (fattening) farms are predominant and yellow areas are mixed.

MAP 2. AREAS OF PREDOMINANCE ACCORDING TO TYPE OF FARM

March 2016, Steer/Cow Index.



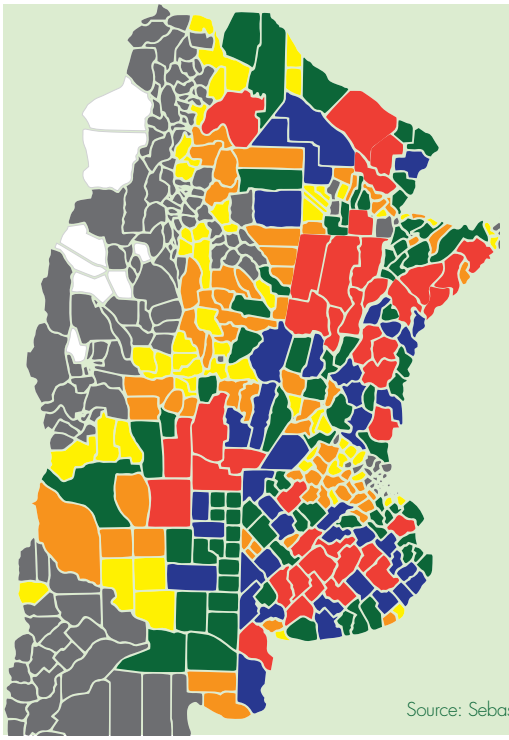
- The **largest part** of the area is occupied by **Cow to Calf** operations
- In Argentina, these farms are predominantly located in **less fertile areas**
- **Calf to Steer** operations have shifted, from being strictly pasture-based in more fertile areas towards **more intensification and geographical diversification**
- A recent **process of holding on to cows and heifers** has changed some yellow areas into grey areas
- The **majority** of the area in **Gran Chaco** is either **grey or yellow**, which means that the area is more prone to producing **calves**, rather than **steers**

Source: Sebastián Senesi & Marcos Daziano (2022) based on SENASA

Added to this, almost the entirety of the animals in beef production are raised on pastureland. This figure stands at 95% for the country as a whole and it drops to 94% for the Gran Chaco Region. **Map 3** shows the number of animals per department in Argentina.

MAP 3. HEADS OF CATTLE ON PASTURELAND BY DEPARTMENT

2016, Heads of cattle.



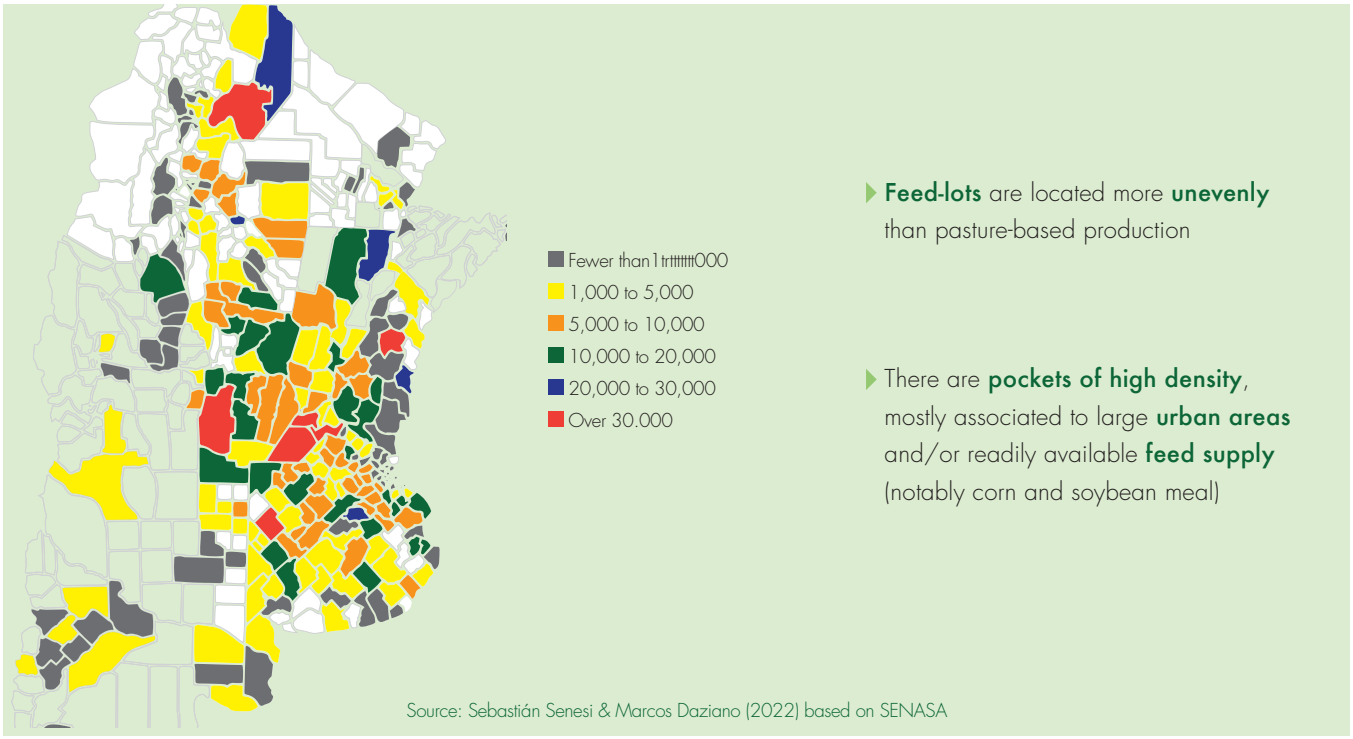
- The **highest concentrations** in terms of heads of cattle occur in the **central** and **northeastern** parts of the country
- **Gran Chaco** también tiene la mayor proporción de cabezas en el este

Source: Sebastián Senesi & Marcos Daziano (2022) based on SENASA

The number of animals being fattened in feed-lots has also been increasing over the past 2 decades. **Map 4** shows the number of heads of cattle in feed-lots by department. As can be observed, the distribution of these animals is not as even as those on pasturelands. In fact, the largest pockets of animals in feed-lots are associated with either a large availability of feedstock (high-yield agriculture areas, where corn and soy meal are readily and abundantly available) and/or the proximity of a large urban area, as is the case of large feed-lots located near the cities of Salta and San Salvador de Jujuy.

MAP 4. HEADS OF CATTLE IN FEED-LOTS BY DEPARTMENT

2016, Heads of cattle.

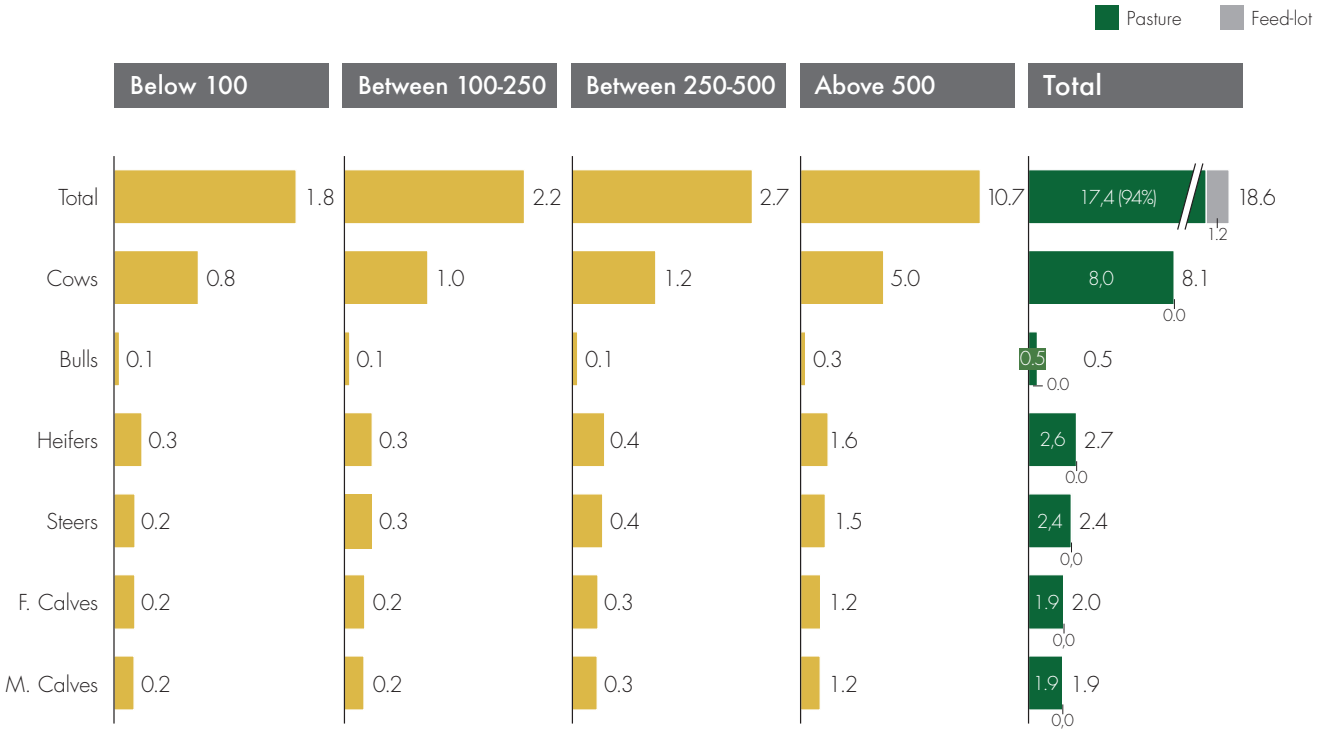


Source: Sebastián Senesi & Marcos Daziano (2022) based on SENASA

When we analyze the Gran Chaco Region, the number of heads in professional farms jumps up to two thirds of the total heads. The number of heads in feed-lots stands at 6% when we consider the rotation of these farms, where the shorter cycles allow farmers to fatten many more animals than on pastureland. **Graph 5** shows this data.

GRAPH 5. CATTLE HEADS DESTINED TO BEEF PRODUCTION IN GRAN CHACO BY FARM SIZE

March 2022, Million heads of cattle on pastureland, Million heads of cattle for feedlot (including rotation).

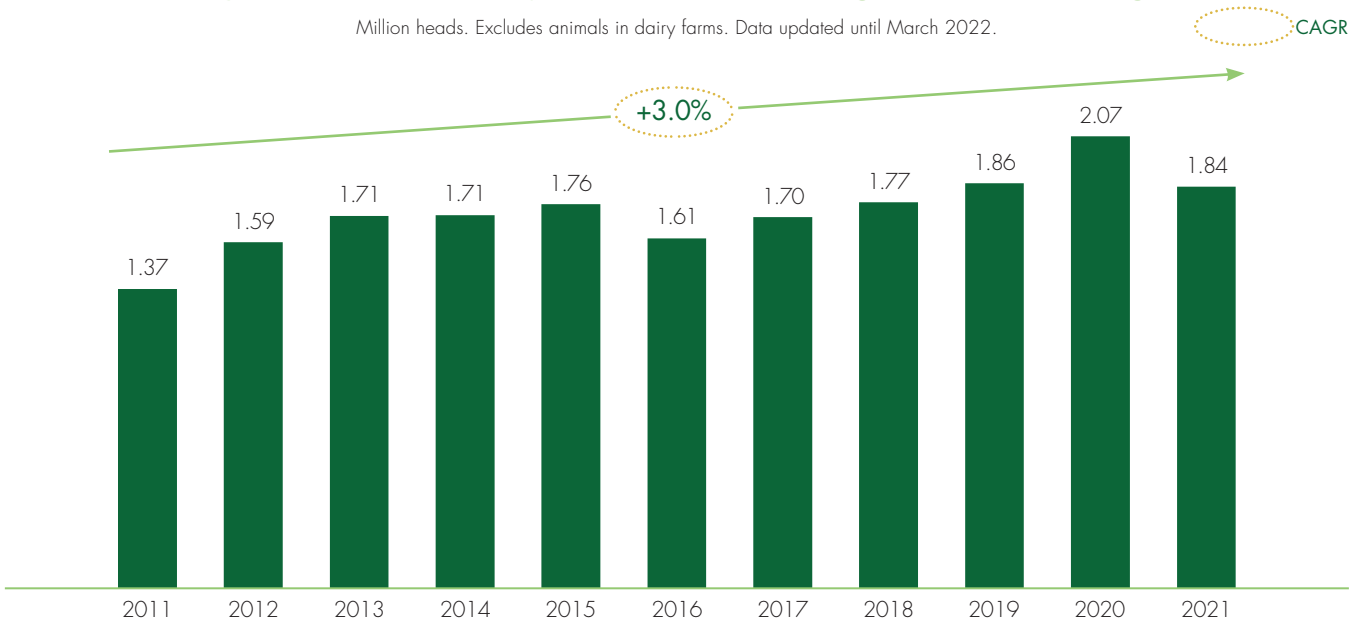


Source: Sebastián Senesi & Marcos Daziano (2022) based on SENASA

As for slaughtering, in Argentina there are almost 500 abattoirs, which add up to an installed capacity of close to 19 million heads a year. For Gran Chaco region, slaughtering capacity stands at 2.8 million heads a year. **Graph 6** shows the evolution of the slaughtering for Gran Chaco region, where the increase was above the national growth with a 34% increase between 2011 and 2021. **Graph 7** shows the evolution of the amount of beef produced in Gran Chaco.

GRAPH 6. EVOLUTION OF CATTLE SLAUGHTERING IN GRAN CHACO BETWEEN 2011 AND 2021

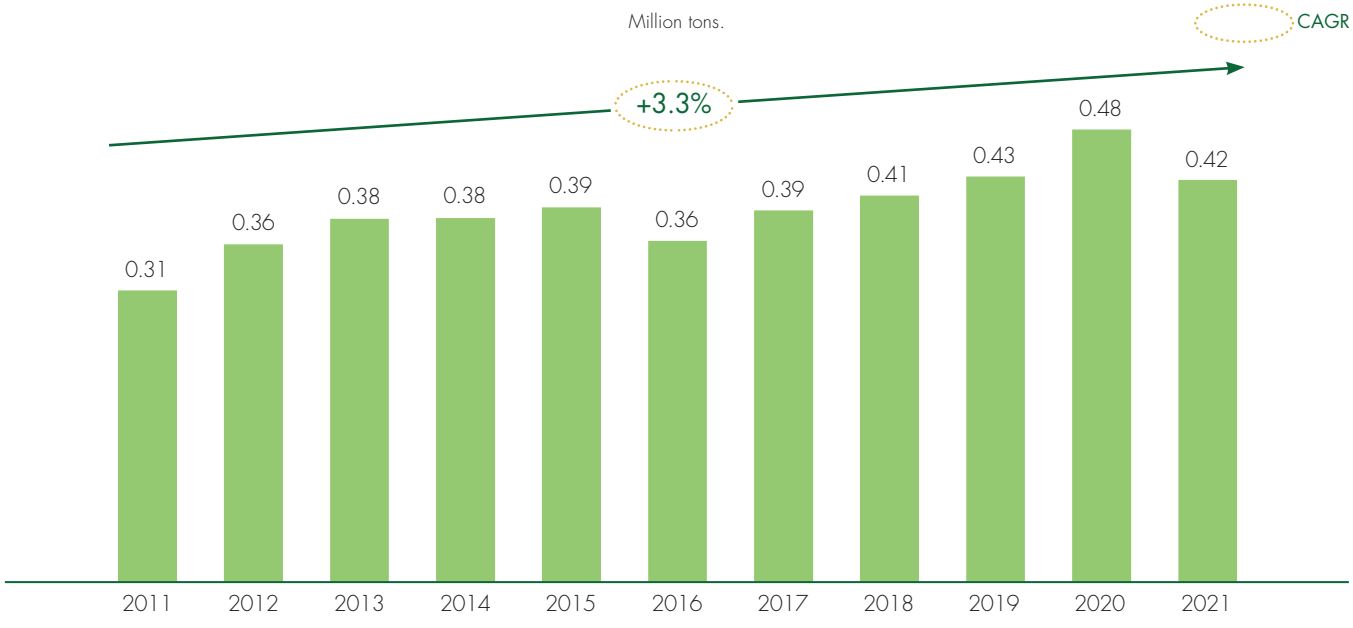
Million heads. Excludes animals in dairy farms. Data updated until March 2022.



Source: Sebastián Senesi & Marcos Daziano (2022) based on data from SENASA, Minagri and provincel Statistics.

GRAPH 7. EVOLUTION OF BEEF PRODUCTION IN GRAN CHACO BETWEEN 2011 AND 2021

Million tons.



Source: Sebastián Senesi & Marcos Daziano (2022) based on data from SENASA, Minagri and provincel Statistics.

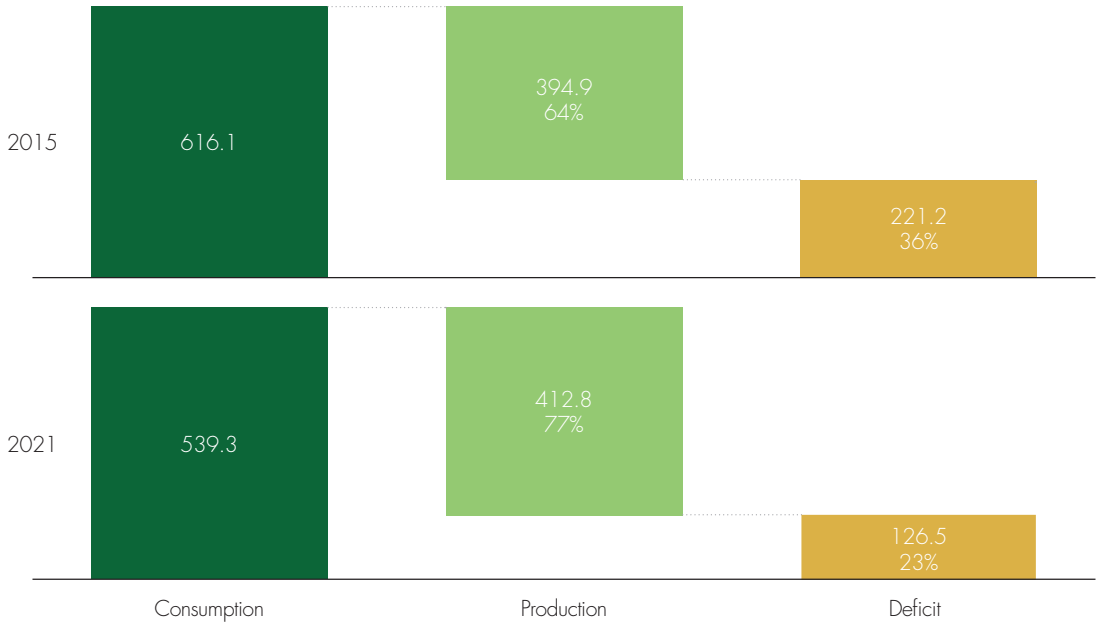
The fact that most of the industry produces half carcasses as end product has a strong impact on the commercial chain, which generates the necessity for beef retailers to acquire this product and produce the cuts themselves. A recent initiative to cut the half carcass in thirds for retailers to not be obliged to buy a full half carcass was strongly opposed to the point that its application, stipulated to come into action on November 2022, was postponed until January 2023 and currently postponed again without a definitive date.

Statistics for 2021 show that 1.8 million heads were slaughtered in Gran Chaco region, producing just under 400 thousand tons of beef. It must be stated that 82% of the slaughtering was carried out in SENASA-approved abattoirs. Non-SENASA-approved abattoirs can be approved for provincial or municipal transit and, therefore, can only sell their production in the jurisdiction for which they have been approved[5].

Gran Chaco region presents a structural deficit between its consumption and production. Basically, the region "exports" calves and "imports" beef for consumption to and from other parts of the country, respectively. Between the years 2011 and 2015 this figure stood consistently at over 200 thousand tons, with a peak of 255 thousand tons in 2013. Since then, that deficit has slowly but surely decreased progressively. Despite this figure having been reduced, the fact that there exists a deficit means that the Region is still a net "importer" of beef from other regions of the country. **Graph 8** shows this deficit for 2015 and 2021.

GRAPH 8. BEEF PRODUCTION AND CONSUMPTION IN GRAN CHACO

2015-2021, Thousand tons of beef with bone.

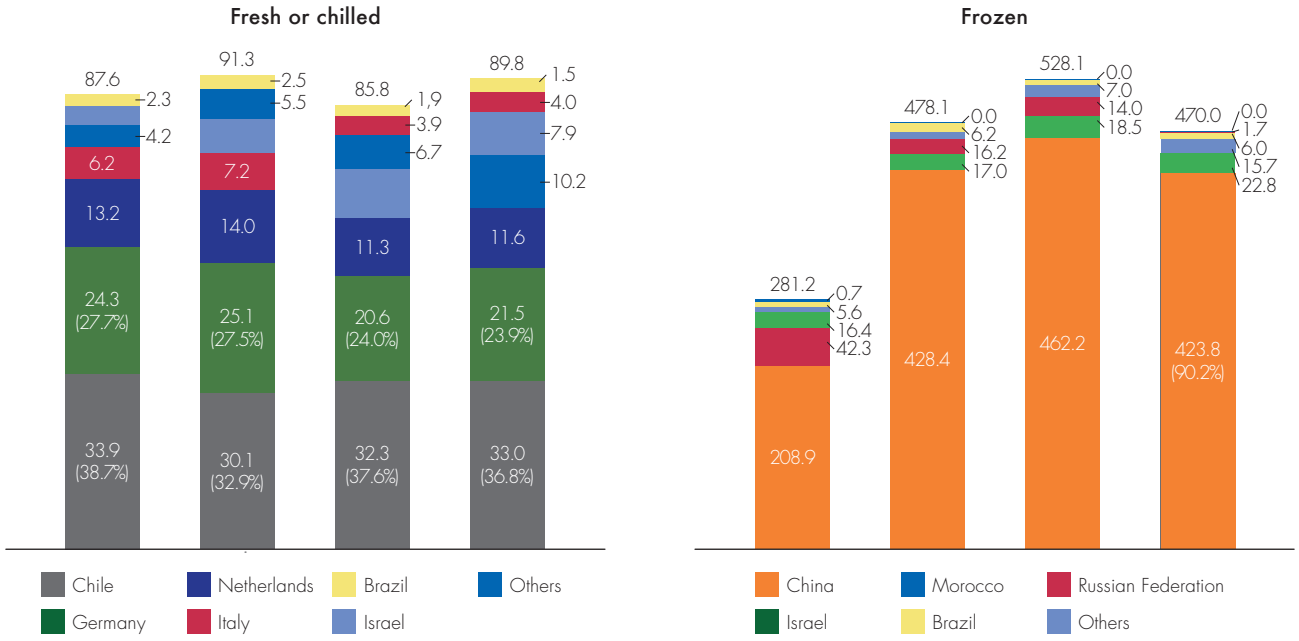


Source: Sebastián Senesi & Marcos Daziano (2022) based on data from SENASA, Minagri and provincel Statistics.

Argentina added up to over 700 thousand tons in beef exports in 2019 and 2020. The main markets have also changed, mainly, with the irruption of China. The EU is still the most important market for high-value products, with a growing share by the US market, although new EU regulations and Forest Act (in process in the US), among others, may affect the entrance of products coming from producing areas linked to deforestation, slavery conditions and other human rights non-compliance issues.

GRAPH 9. EXPORTS OF BEEF BY DESTINATION

Thousand tons.



Source: Sebastián Senesi & Marcos Daziano (2022) based on data from SENASA, Minagri and provincel Statistics.

3. RELEVANT ASPECTS REGARDING SUSTAINABLE BEEF PRODUCTION AND ITS INSTITUTIONAL FRAMEWORK

This chapter will analyze the institutional framework that affects beef production with a focus on the Gran Chaco region.

Within the formal institutional framework the salient points are National Laws 25,675/02 (Environmental Law), 25,080/98 for cultivated forests, 27,520/19 for climate change adaptation and mitigation (article 41 in the Argentine National Constitution) and 26,331/07 for protection of indigenous forests. The National Husbandry Plan (GANAR) must also be noted.

National Environmental Law 25,675/02

The law establishes a minimum for the achievement of a sustainable and adequate management of the environment, the preservation and protection of biological diversity and the implementation of sustainable development in Argentina.

This law ratifies the Federal Environmental Pact, which is an interjurisdictional agreement signed in 1993, declaring the importance of the Federal Environmental Council (COFEMA) as an instrument for environmental coordination in the republic and this pact, in turn, follows the guidelines of Agenda 21[6] (Project XXI is an agreement of the United Nations (UN) to promote sustainable development).

The environmental policy and management instruments determined are six: environmental land use planning, environmental impact assessment, control system over human activities, environmental education, environmental diagnosis and information system, and economic regimen for promotion of sustainable development[7].

Regarding the coordination of measures, as already stated, COFEMA is established, emanating from the local and central state has federalism as its guiding principle and has as its main objective contributing to the generation of an environmental policy of integration between the provinces and the federal government.

Among some of its agreements and in compliance with the corresponding National laws, COFEMA established certain strategic technical guidelines such as Sustainable Forest Development (Sustainable Forest Management at Basin Level and Forest Management with Integrated Livestock or MBGI, from Spanish), the restoration of degraded forests, the sustainable use of biodiversity and strengthening of conservation areas, the prevention of forest fires, among others[8].

These guidelines allowed the elaboration of the National Program for the Protection of Indigenous forests through the Ministry of Environment and Sustainable Development, in coordination with other national, regional and international bodies, with provincial jurisdictions, with the academic-scientific sector, with proprietors and representatives of indigenous peoples and civil society organizations and which is directly linked to the National Strategy to address Climate Change.

National Law 27,520/19 for climate change adaptation and mitigation

In the last version issued by Argentina of its Nationally Determined Contributions (NDC) of October 2021, the country committed not to exceed 349 million tons of carbon dioxide equivalent (CO2eq) in emissions by the year 2030, applicable to all sectors of the economy[9].

The goal proposed in the NDC is absolute, unconditional and applicable to all sectors of the economy. Added to this, Argentina declares that the agricultural sector will play a leading role in achieving these goals by increasing productivity by using new technologies based on the knowledge economy and the diversification of production systems and their practices.

The policies and actions required to achieve the goal of this contribution will be implemented without affecting the use of the financial mechanisms provided. Although the implementation of this new goal is not contingent on international support, Argentina understands that the support that developed countries can provide to achieve their national ambition will generate significant global benefits[10].

National Law 25,080/98 for cultivated forests (Law 27,467 until 2029)

It provides for an investment promotion program to be made in new forestry ventures and in the broadening of existing forests, which will rule within the scope and limitations established.

Likewise, the application by each province may benefit the rooting of new forestry-industrial ventures and the broadening of already existing ones, as long as timber supply is increased through the implantation of new forests.

The law grants economic refunds (AENR) and tax benefits (Fiscal Stability, Early VAT Value Added Tax Refund, Amortization of capital assets, Forest Appraisal, Exemption from municipal fees, among others).

The regime was extended twice (2008 and 2019) and is currently in force under Law No. 27,467 until 2029.

National Law 26,331/07 for protection of indigenous forests

It provides the minimum Environmental Protection budgets for the enrichment, restoration, conservation, use and sustainable management of indigenous forests and the environmental services they provide to society. Likewise, it establishes a promotion regime and criteria for the distribution of funds for farmers, for the environmental services provided by indigenous forests[11].

It also establishes that the provinces must carry out the territorial ordering of their indigenous forests (OTBN) every 5 years through a participatory process, where the possible uses for forested lands are categorized, from conservation to the possibility of transformation for agriculture or other uses, including the sustainable use of the forest.

The National System for Monitoring indigenous forests of the Argentine Republic provides annually updated information on the country's indigenous forest resources and allows monitoring the implementation of this law, collaborating with compliance with the international agreements taken on by the country regarding climate change and providing information to society about the importance of indigenous forests[12].

Accordingly, the importance of the Deforestation Early Warning System (SAT) must be mentioned as a tool for monitoring the loss of indigenous forest, but in this case continuously.

Every 15 days, the system automatically processes Sentinel and Landsat 8 satellite images, applying algorithms that analyze time series and spatial patterns with various techniques. 100% of the alerts are then validated and processed in a Geographic Information Systems environment, to be crossed with related secondary information such as the Land Management of Indigenous forests and the National Registry of Plans[13].

National Husbandry Plan (GANAR)

It plans to generate an increase in production and sustainable productivity over time, by improving access to working capital and property investment conditions, adequate incentives to mobilize the sector and facilitating access to investments in sustainable technologies and innovations[14].

To achieve this objective, a set of financial instruments, tax incentives, technological assistance, changes in marketing, among others, are proposed to promote the increase in the efficiency of beef cattle stock.

The strategic lines to comply with the objectives of the plan are the following:

- Increase in value chain production and productivity
- Increase in local value-added
- Development of rural community infrastructure
- Incorporation of technologies and innovation in production processes
- Strengthening of the beef chain for adaptation to and mitigation of climate risks
- Improved marketing channels
- Fiscal measures to promote sectoral investments
- Promotion of development for access to new markets

The plan also presents relevant aspects for the objective of reducing deforestation and degradation in the Argentine Gran Chaco region, with specifics for each province. For the region as a whole, the following aspects are stipulated:

- Promoting an increase in implementation of pastures and forage crops, leveraged by an access to water and efficiency of use plan
- Promoting the efficiency and sustainability of cow-to-calf operations, considering the agroecological and socioeconomic context
- Providing financial and fiscal incentives to improve productivity
- Promoting the adoption of individual identification and traceability
- Promoting the normalization of land tenure
- Promoting the use of technologies
- Unique sanitary standard
- Determination of environmental footprints
- Improving marketing channels
- Identification of products with environmental and social differentiation for export markets

Regarding the objectives and specific actions by province, these are grouped by region, although they do not account for biome and heterogeneities (environmental, social and economic).

National Traceability System

Argentina currently presents, from the mandatory point of view, a traceability system by cattle group. The resolutions that endorse this system encompass a series of records, such as the Animal Transit Guide and Electronic Transit Document and other instruments to comply.

The collected and traceable information from the corresponding records and instruments is finally transferred into a digital platform called the Integrated Animal Health Management System (SIGSA).

It is important to mention that there are private standards that ensure individual traceability from the field to the plate, under compliance with SENASA Resolution 280/01. Several programs can be mentioned, such as: Argentine Angus Beef, Black Angus and Red Angus Attribute Certifications, Cuts of meat from grass-fed bovine animals, Animal Welfare, Hilton Quota and 481 Quota, among others.

The implementation of the described system is circumscribed mainly in national resolutions 15/2003, 391, 2003 and 1698/2019 among others (Annex I).

4. FARMER SURVEY ON SUSTAINABLE BEEF PRODUCTION PRACTICES IN GRAN CHACO

This section will address which the usual practices of beef farmers in the Gran Chaco region and what is the level of knowledge they have about those of a greater degree of sustainability. Consequently, a series of interviews with farmers was carried out to approximate the level of diffusion that such practices have and their consequent effect on the general sustainability of the livestock system. The target audience was made up of cattle farmers and advisors who operate in the Gran Chaco region. They were asked about the usual practices they use in their farms and some more general aspects of sustainability.

The interviews were carried out by the consulting team between August 30 and December 22, 2022. The guide questionnaire was agreed upon with members of TFA and the Argentine Roundtable for Sustainable Beef (MACS in Spanish), based on the principles and sustainable beef criteria within the framework of the Global Roundtable Sustainable Beef (GRSB). The survey generated 49 responses and the methodology used to achieve the objective was based on a structured questionnaire of 51 questions.

The number of interviewees is adequate (from the point of view of the quality of the answers) for the depth of the questions asked, so that the results allow for a more complete understanding of the usual practices than a more superficial survey where the "n" searched should be greater.

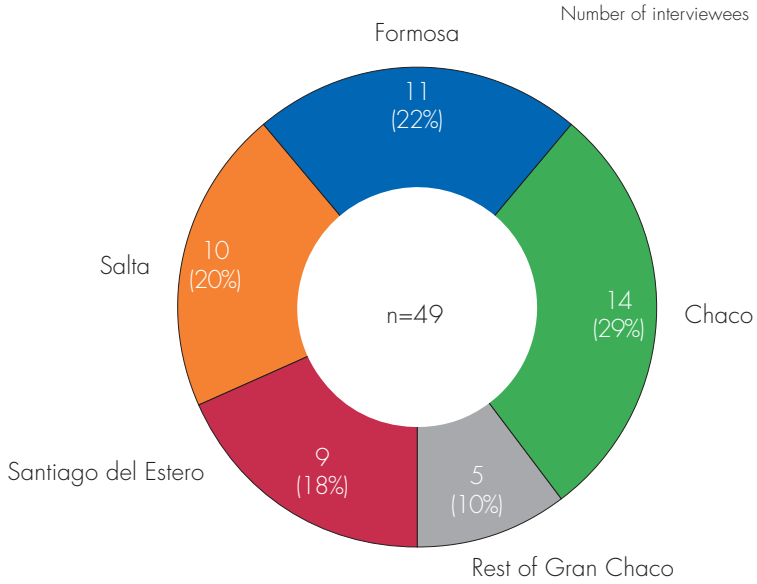
The number of interviewees is adequate (from the point of view of the quality of the answers) for the depth of the questions asked, so that the results allow for a more complete understanding of the usual practices than a more superficial survey where the "n" searched should be greater.

The limitation of this study associated with the scale of the surveyed population must be stated. The population of interviewees that was available to answer the interview has the limitation of being made up of medium and large-scale farmers, which could generate a bias in the results obtained. In any case, and in accordance with what was explained in the characterization of the system, this is a highly representative sample of the farmer characterized as professional, who concentrates approximately 60% of the heads of cattle in the region.

The results of the survey are presented in an aggregate to protect the anonymity of the respondents.

All the focus provinces were reached, while 5 responses from farmers from other parts of the Gran Chaco were added. The Province of Chaco led with 14 responses, followed by Formosa with 11, Salta with 10 and Santiago del Estero with 9 responses each (**Graph 10**).

GRAPH 10. RESPONSES BY PROVINCE IN GRAN CHACO REGION



- **49 responses** were obtained from the target population
- **Chaco** was the province that was more prominently represented with **14 responses**
- Following were **Formosa** with **11 responses**, **Salta** with **10** and **Santiago del Estero** with **9**
- The rest of Gran Chaco region generated **5 responses**

Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

The interviewees added up to a total area of 257,870 hectares (**Graph 11**) of which 164,970 are dedicated to husbandry (**Graph 12**).

GRAPH 11. TOTAL AREA BY PROVINCE IN GRAN CHACO REGION

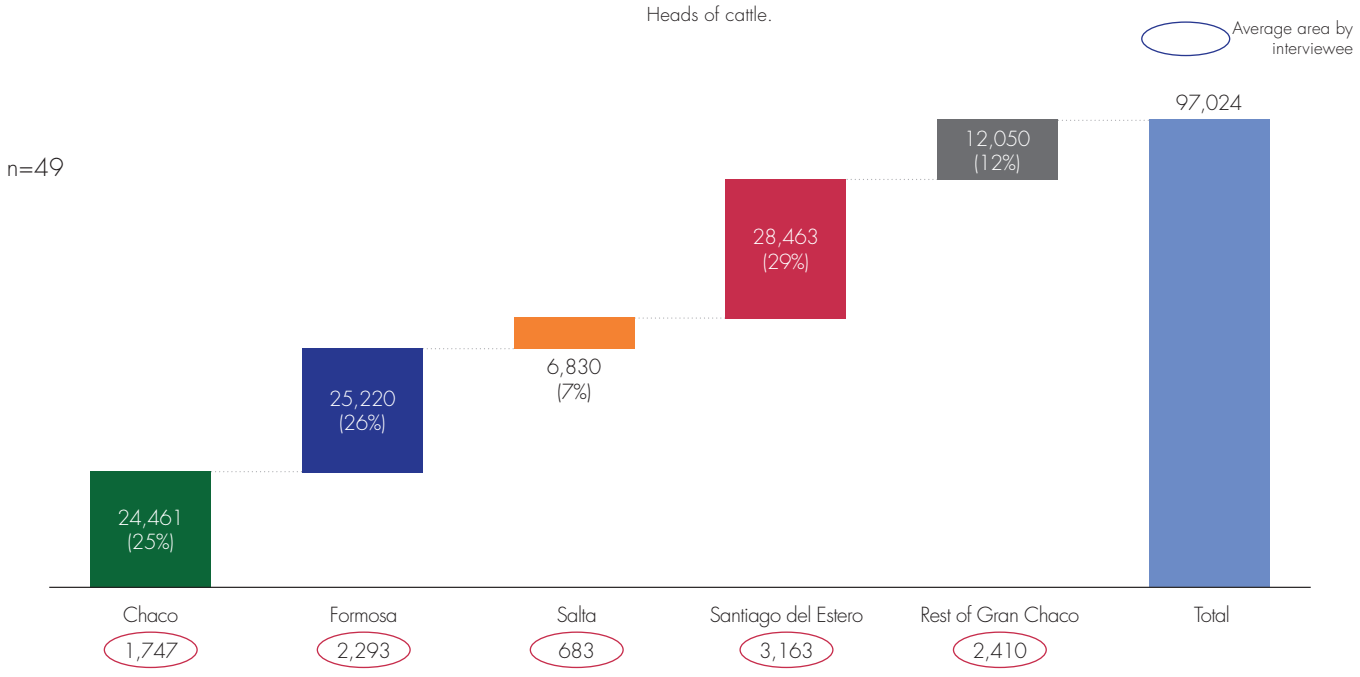
Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 12. AREA USED FOR CATTLE RAISING BY PROVINCE IN GRAN CHACO REGION

Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

On this area, the interviewees operate 97,024 heads of cattle (**Graph 13**). It should be noted that the interviewees from Formosa and Santiago del Estero tended to be larger in scale than those from Salta and Chaco.

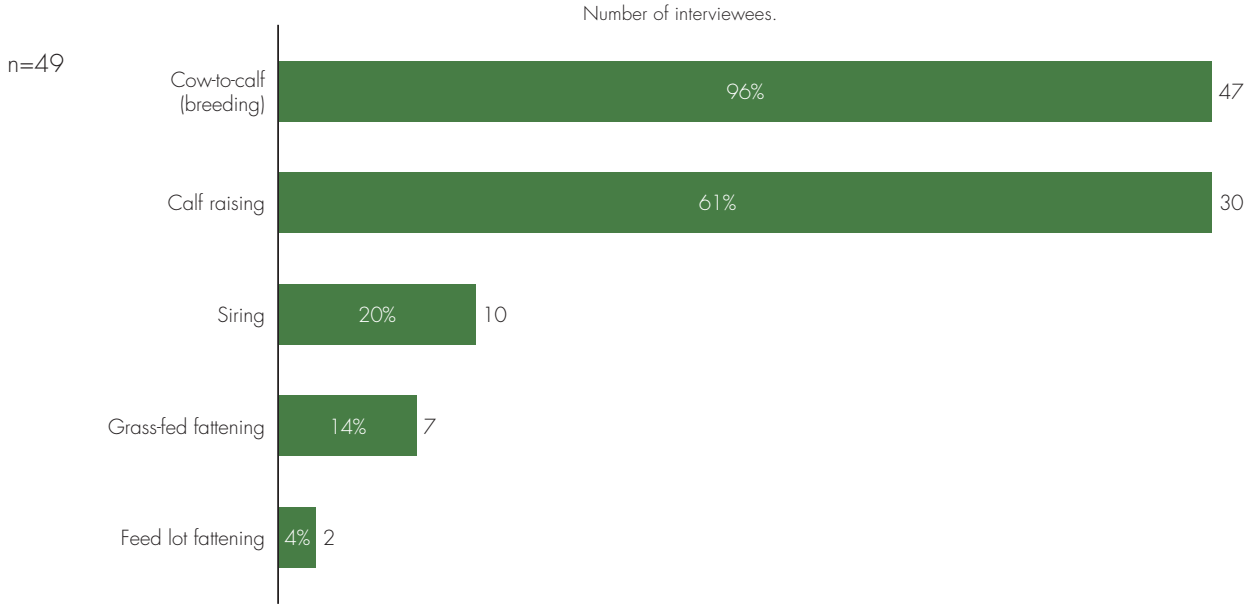
GRAPH 13. STOCK FOR CATTLE RAISING BY PROVINCE IN GRAN CHACO REGION



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

The main activity is breeding (cow-to-calf), carried out by 96% of the interviewees, followed by calf rearing on grass with 61%, siring with 20%, fattening (calf-to-steer) on grass with 14% and feed lot fattening with 4% (**Graph 14**).

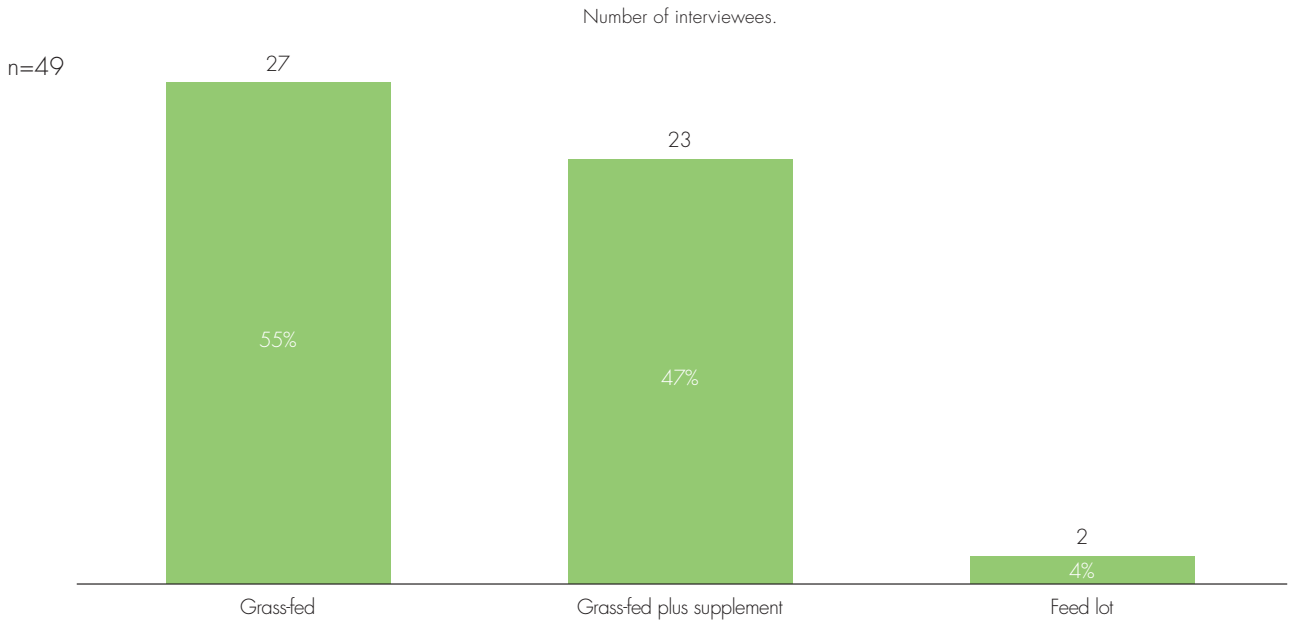
GRAPH 14. ACTIVITIES CARRIED OUT BY THE INTERVIEWEES



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

As for feeding, grass dominates with 55% of the total, while 47% use grass with some supplementation and in two of the cases (4%) they are fed in a feed lot (**Graph 15**). It is worth clarifying that these percentages do not add up to 100% because overlaps are generated when an interviewee uses more than one feeding method.

GRAPH 15. TYPE OF FEEDING

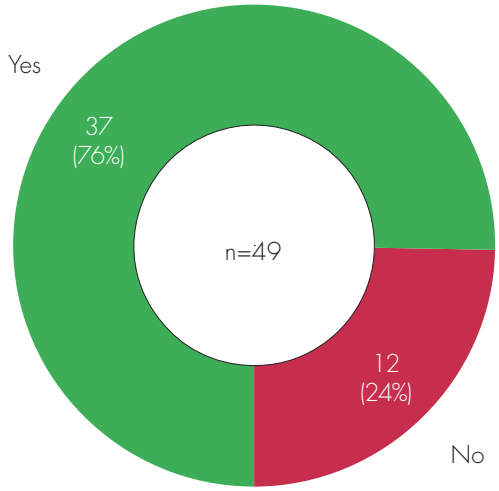


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

When the interviewees were asked about their knowledge on the types of soil present in their farms and the condition in which they are found, 76% declared having this knowledge (**Graph 16**). After this query, the interviewees were asked if they implement some type of measure for the conservation of soil resources, mainly associated with non-erosion and loss of fertility, to which 73% answered affirmatively.

GRAPH 16. DO YOU KNOW ABOUT THE TYPES OF SOILS THAT ARE PRESENT IN YOUR FARM(S) AND THEIR CONDITION?

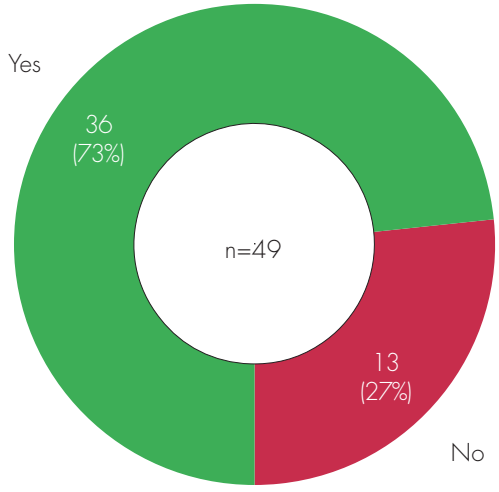
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 17. DO YOU IMPLEMENT MEASURES TO IMPROVE, KEEP AND/OR CONSERVE SOIL CONDITION?

Number of interviewees.

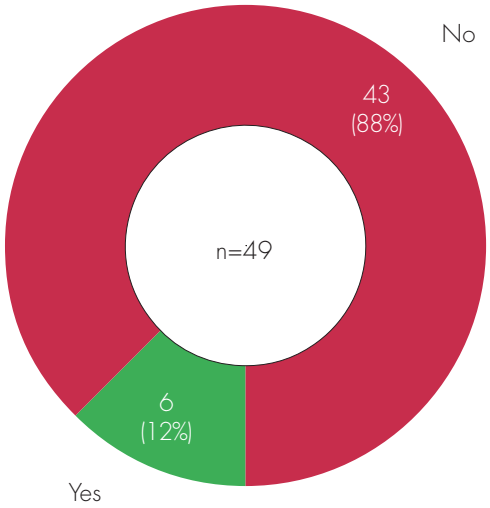


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Only 12% of those interviewed take part in an initiative related to the capture of greenhouse gases (**Graph 18**), while 29% carry out a biodiversity monitoring plan within their farms (**Graph 19**).

GRAPH 18. DO YOU TAKE PART IN ANY INITIATIVE RELATED TO THE CAPTURE OF GREENHOUSE GASES?

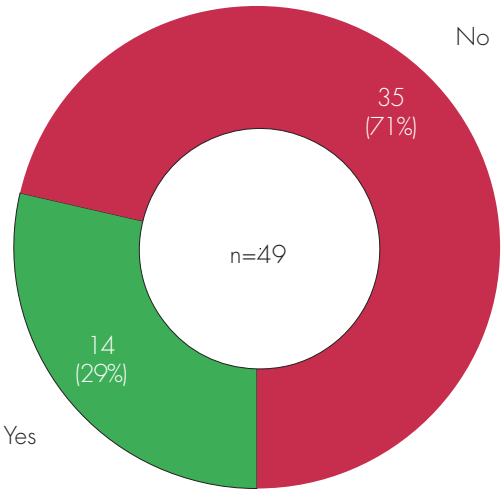
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 19. DO YOU CARRY OUT ANY TYPE OF BIODIVERSITY MONITORING PLAN WITHIN YOUR FARM(S)?

Number of interviewees.



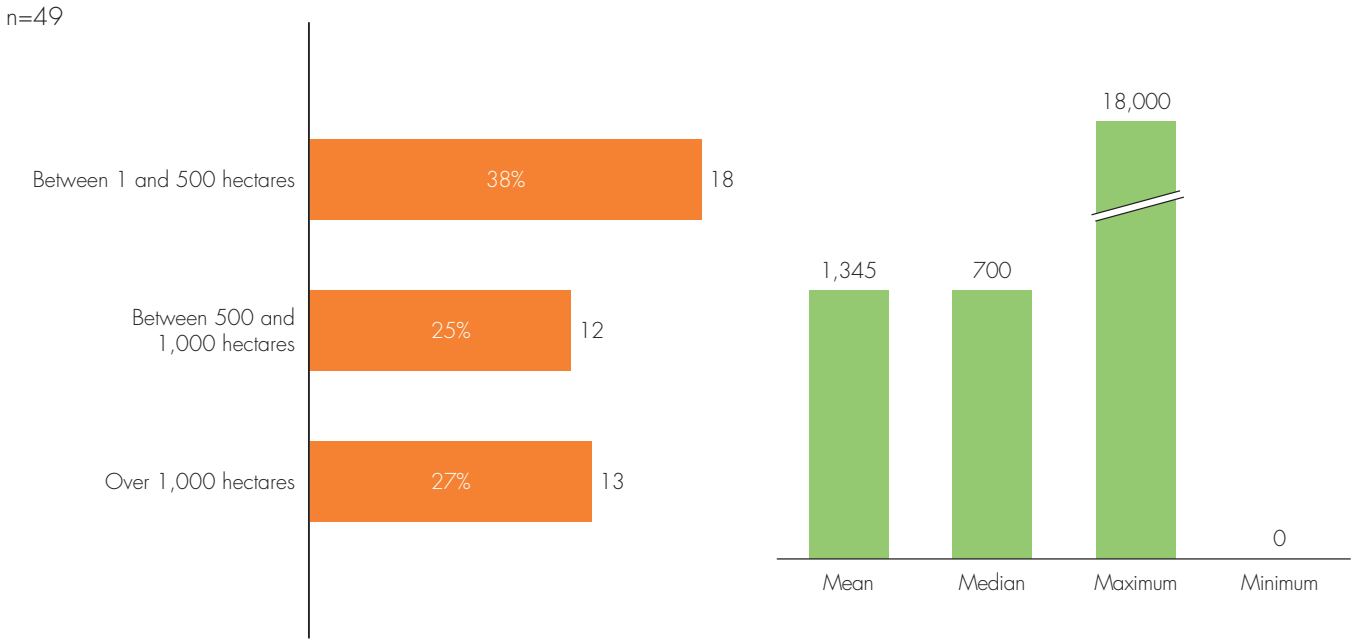
Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

The vast majority of those interviewed declared having areas of indigenous forest and/or natural grasslands within their farms. Only 5 declared not having any area with indigenous forests, while 8 declared not having any hectares of natural grassland.

The average area of natural forest exceeded 1,300 hectares while that of natural grassland was almost 2,000 hectares (**Graphs 20** and **21**).

GRAPH 20. HOW MANY HECTARES OF INDIGENOUS FOREST DO YOU HAVE IN YOUR FARM(S)?

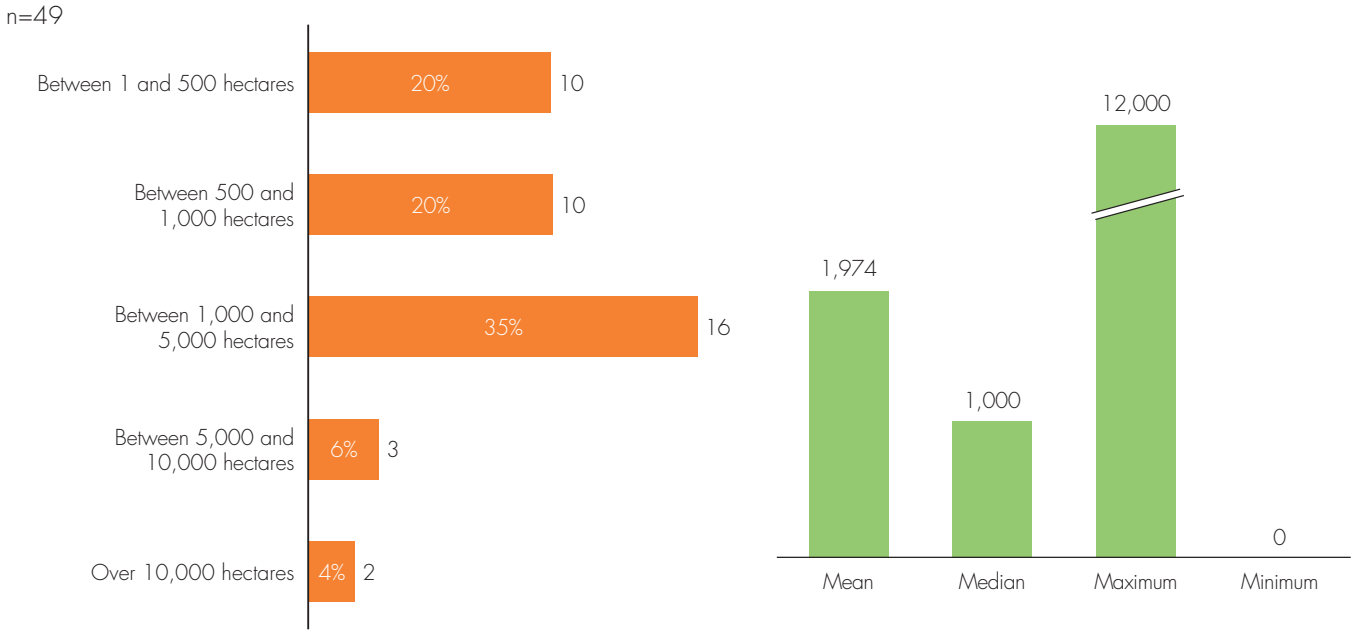
Number of interviewees, hectares.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 21. HOW MANY HECTARES OF NATURAL GRASSLAND DO YOU HAVE IN YOUR FARM(S)?

Number of interviewees, hectares.

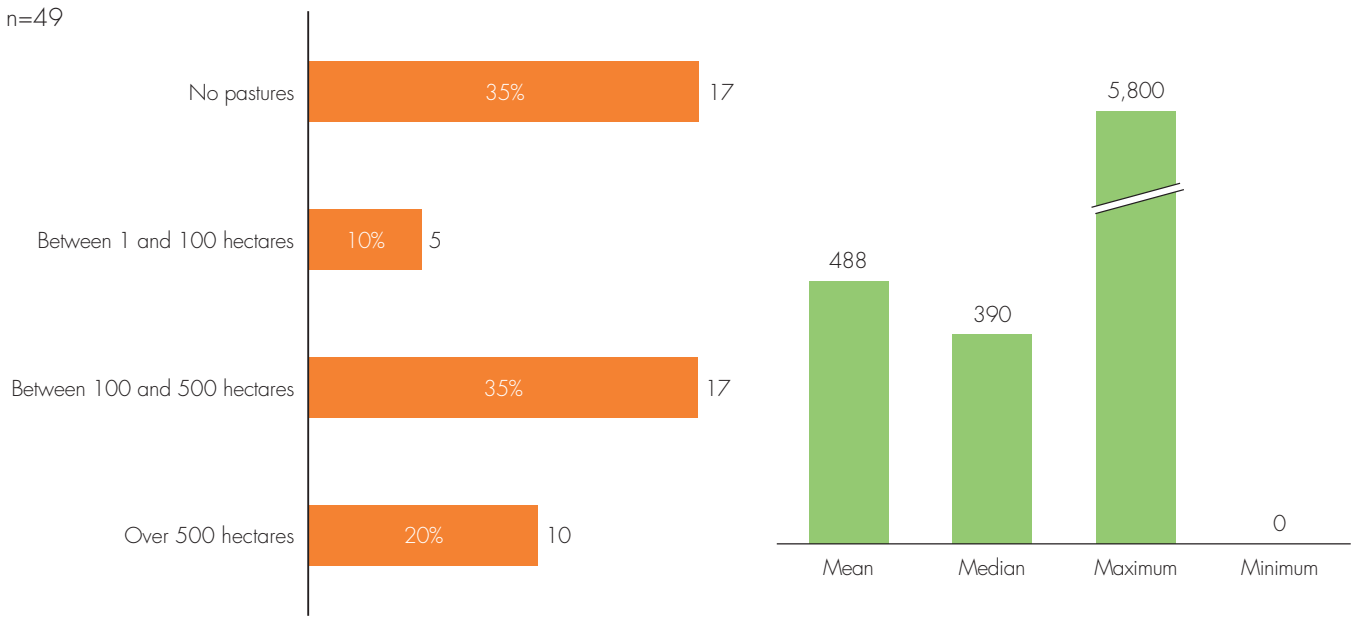


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Graph 22 shows that the interviewees have an average of more than 480 hectares of pastures on their farms, although more than a third state that they do not do so. It should be noted that in all cases these pastures consist of non-indigenous species.

GRAPH 22. HOW MANY HECTARES OF IMPLANTED PASTURES DO YOU HAVE IN YOUR FARM(S)?

Número de encuestados, hectáreas.

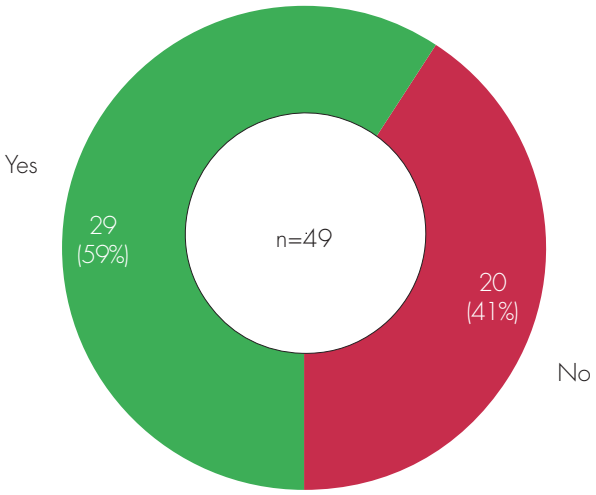


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

When asked if converted areas in the surveyed farms existed, 29 interviewees (59%) answered affirmatively (**Graph 24**).

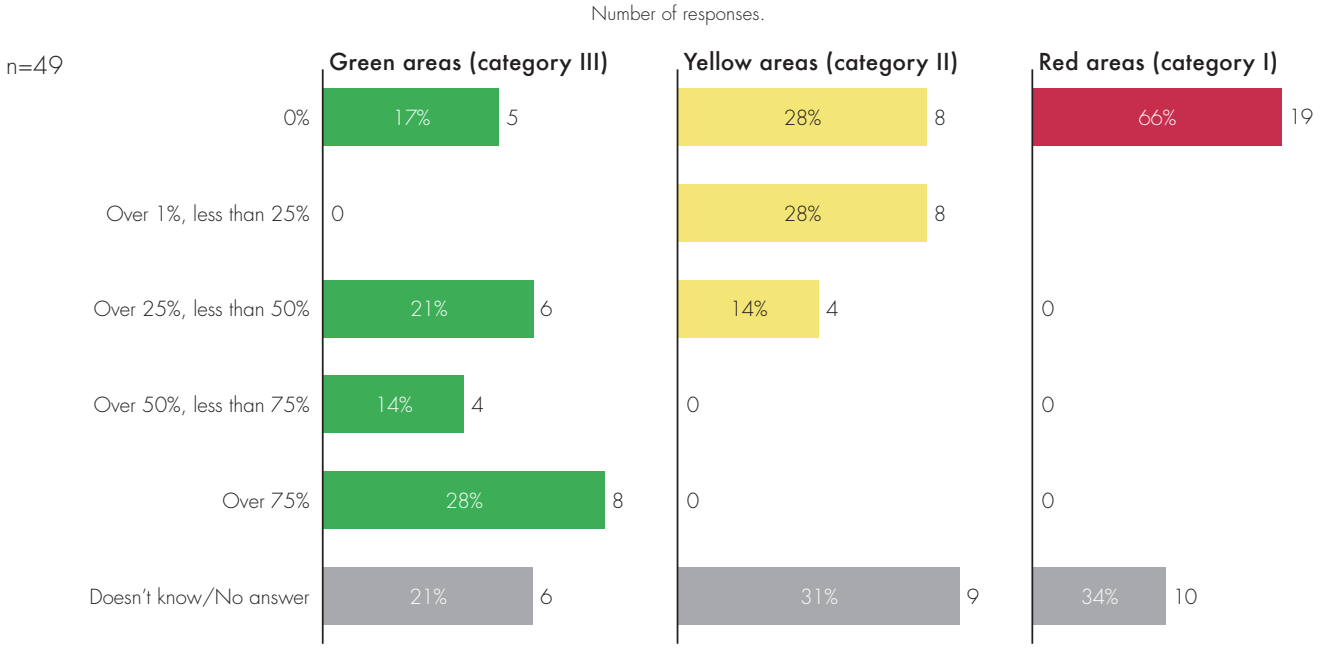
GRAPH 23. ARE THERE ANY CONVERTED AREAS IN YOUR FARM(S)?

Number of interviewees.



In terms of the type of area converted, the respondents generated very uneven results, where category III areas had a higher level of intervention, although categories I and II generated 19 responses of the "Don't know/No answer" type (**Graph 24**).

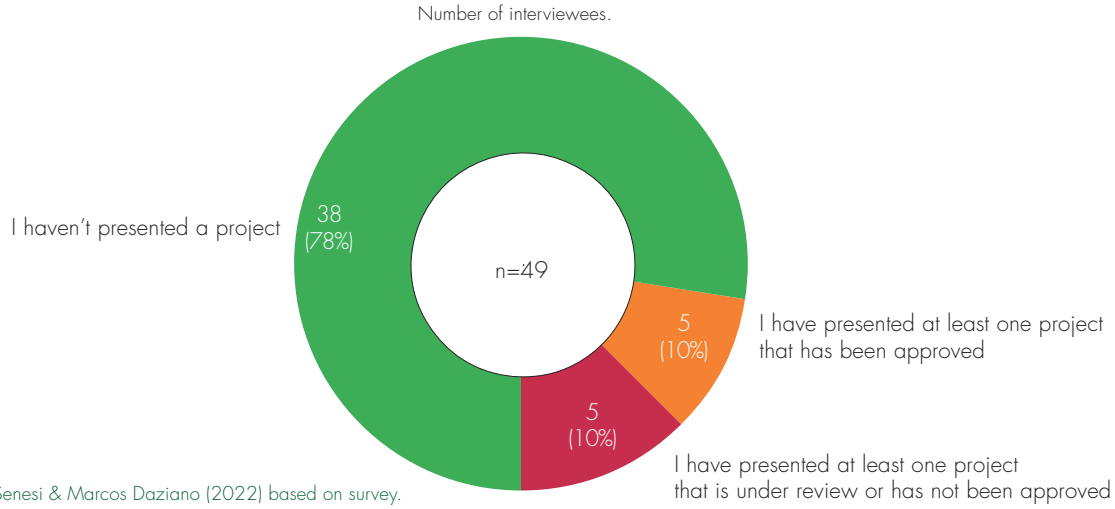
GRAPH 24. WHICH PERCENTAGE OF THE AREA HAVE YOU CONVERTED ACCORDING TO TYPE OF AREA?



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Graph 25 shows that 78% have never presented with the local application authorities an intervention project on indigenous forests, while of the remaining 22%, five interviewees declared having had a project approved. This does not preclude illegal situations of increasing the productive area without a formal presentation before the corresponding authorities.

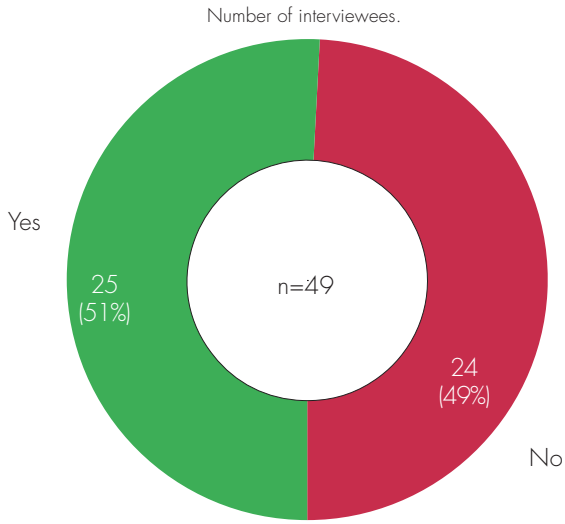
GRAPH 25. HAVE YOU PRESENTED AN INTERVENTION PROPOSAL ON INDIGENOUS FORESTS WITH LOCAL APPLICATION AUTHORITIES?



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

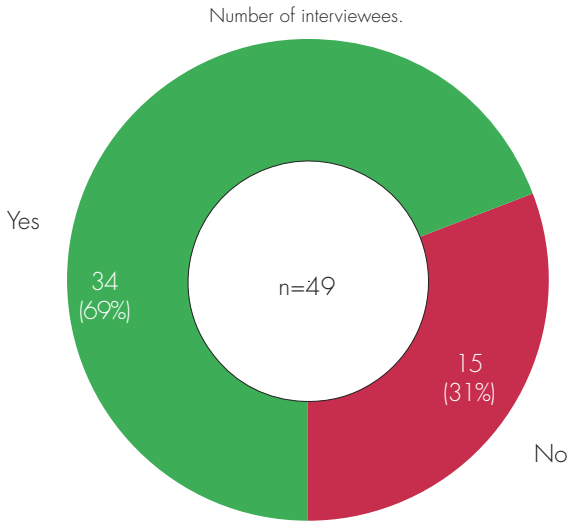
Approximately half of the interviewees know of mechanisms to compensate farmers for maintaining forests that could be legally converted (**Graph 26**), more than two thirds of the total would be interested in participating in mechanisms that compensate farmers who maintain natural areas (**Graph 27**), although only fifteen interviewees know about the National Fund for the Enrichment and Conservation of Indigenous Forests (**Graph 28**).

GRAPH 26. DO YOU KNOW ABOUT MECHANISMS THAT COMPENSATE FARMERS FOR CONSERVING FORESTS THAT COULD BE LEGALLY CONVERTED?



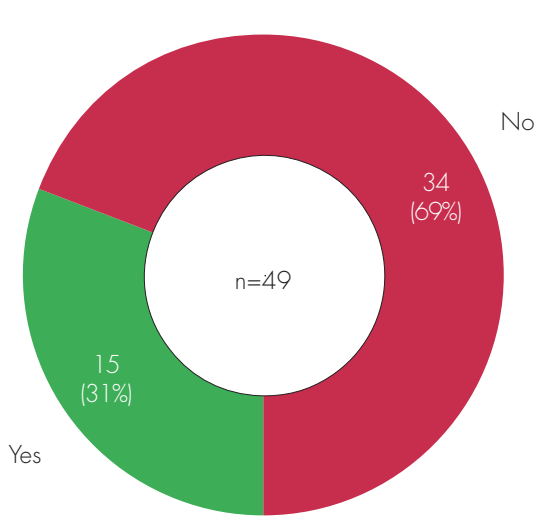
Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 27. WOULD YOU BE INTERESTED IN PARTICIPATING OF MECHANISMS TO COMPENSATE FARMERS WHO CONSERVE NATURAL AREAS?



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 28. DO YOU KNOW ABOUT THE NATIONAL FUND FOR THE ENRICHMENT AND CONSERVATION OF INDIGENOUS FORESTS?

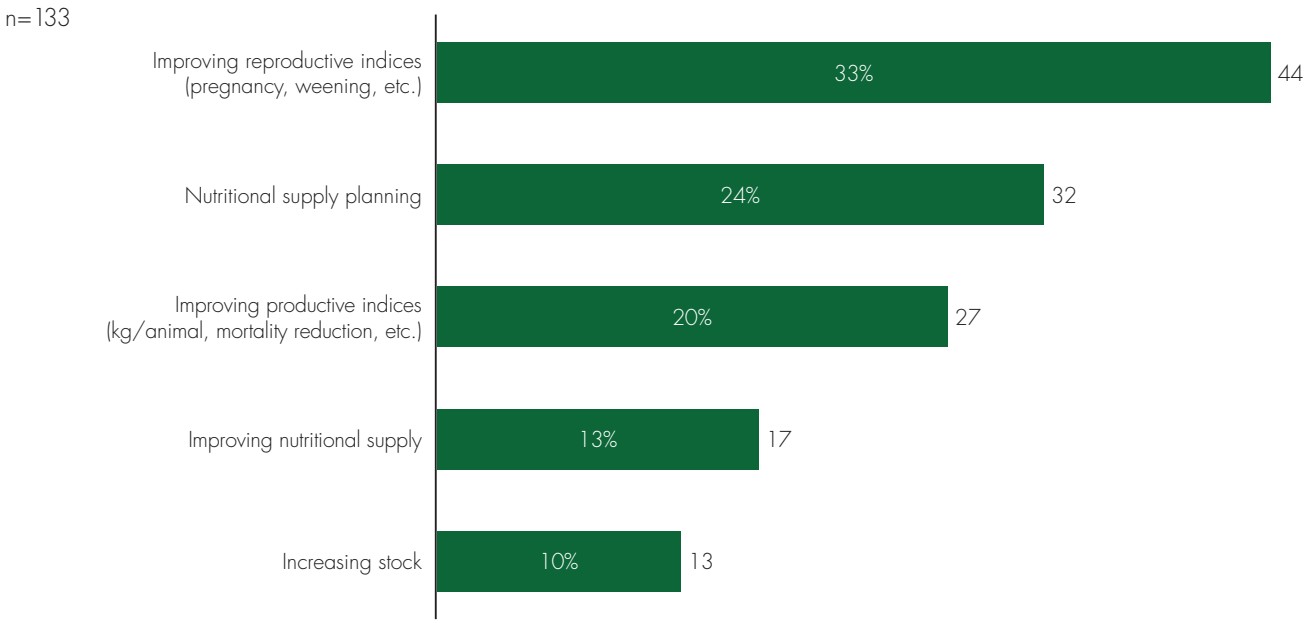


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

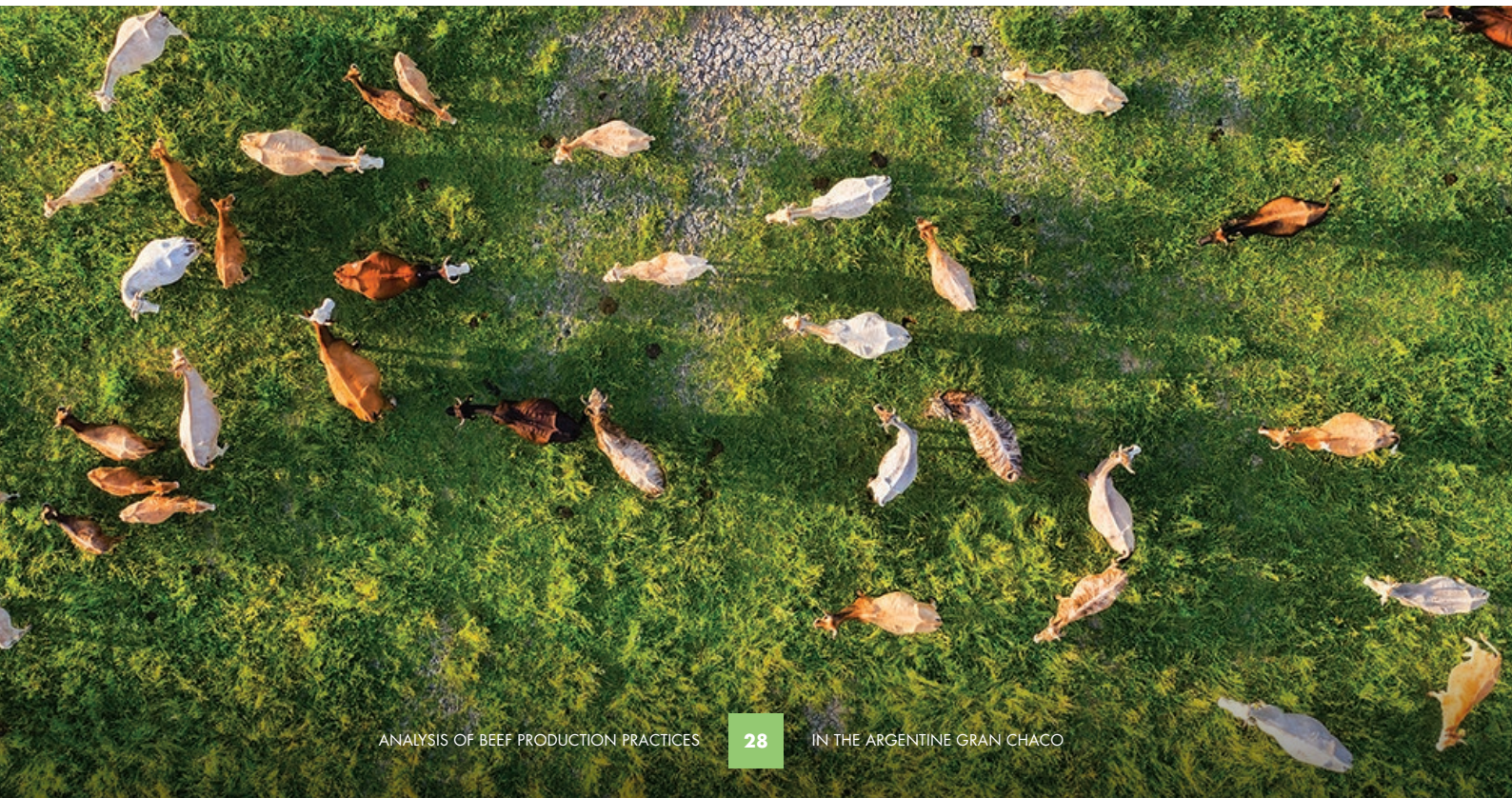
In terms of the proposals to improve production within the framework of the Forest Law, the improvement of the reproductive indices dominated with a third of the total mentions, followed by nutrition planning that added to 24%, the improvement of the productive indices, which added to 20%, the generation of more feed supply with 13% and the increase the stock with 10% of the total (**Graph 29**).

GRAPH 29. HOW WOULD YOU IMPROVE CATTLE PRODUCTION IN YOUR FARM(S) WITHIN THE FRAMEWORK OF THE NATIONAL FOREST LAW?

Number of mentions.



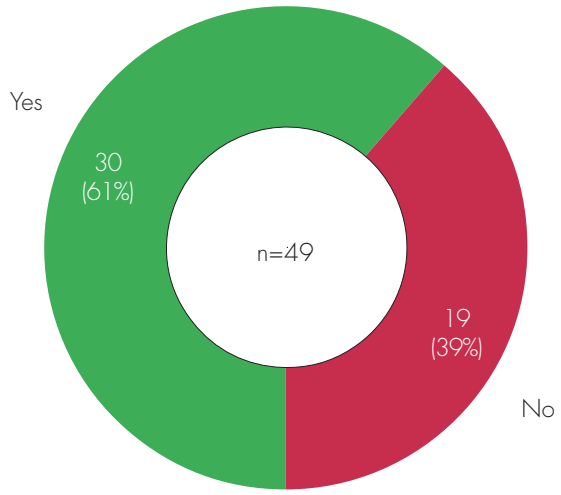
Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.



In terms of nutrition management, 23 interviewees (61%) state that they estimate the production of their forage resources (**Graph 30**), while 28 say they carry out an annual nutrition plan and budget (**Graph 31**). Only one of the interviewees does not carry out an annual health management plan designed by a veterinarian (**Graph 32**).

GRAPH 30. DO YOU HAVE AN ESTIMATION ON THE PRODUCTION OF NUTRITIONAL RESOURCES IN YOUR FARM(S)?

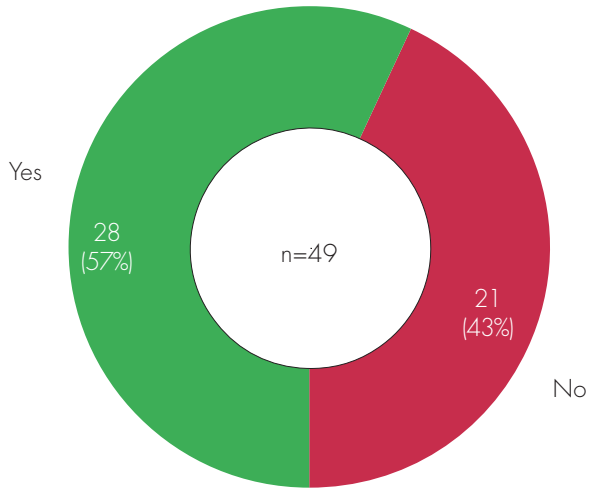
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 31. DO YOU CARRY OUT A PLANNING AND BUDGET FOR NUTRITIONAL RESOURCES FOR CATTLE IN YOUR FARM(S)?

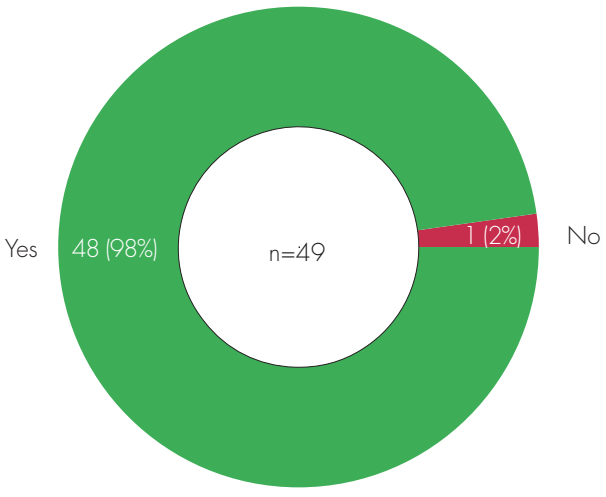
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 32. DO YOU CARRY OUT AN ANNUAL HEALTH MANAGEMENT PLAN DESIGNED BY A VETERINARIAN?

Number of interviewees.

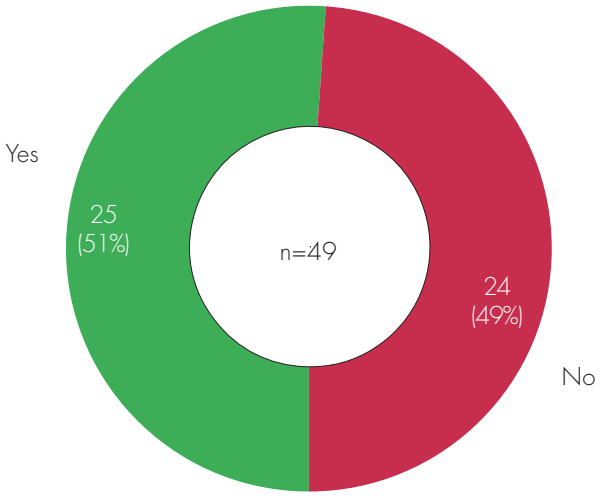


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Regarding access to water, 51% declare that the region where they operate is subject to access and supply problems (**Graph 33**), 96% have some method in place to store water on their farm (**Graph 34**), but only 20% carry out actions to avoid contamination and/or salinization of surface and/or underground water (**Graph 35**).

GRAPH 33. IS THE REGION SUBJECTED TO PROBLEMS RELATING TO WATARE ACCESS FOR ANIMAL OR HUMAN CONSUMPTION?

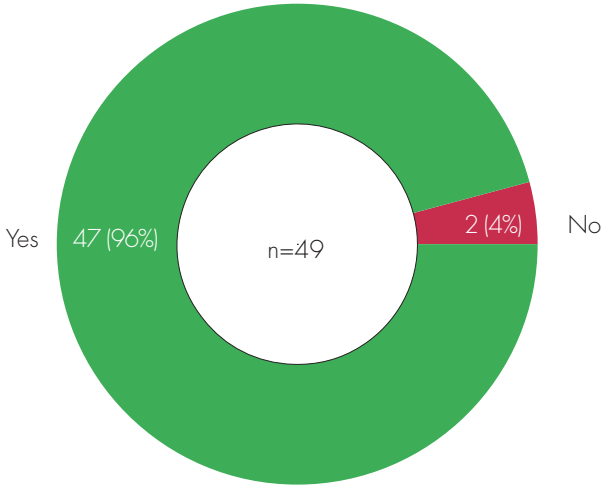
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 34. DO YOU HAVE MEANS/ INFRASTRUCTURE TO STORE WATER IN YOUR FARM(S)?

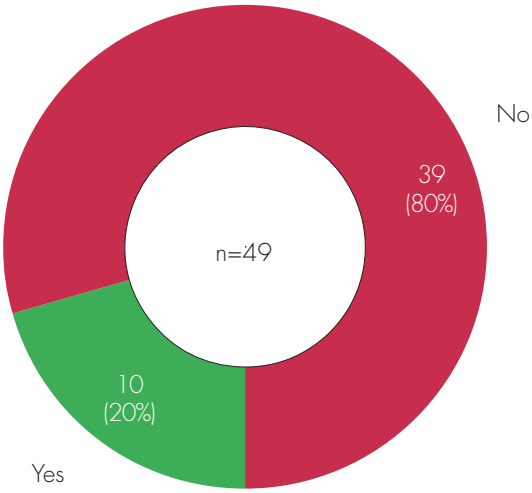
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 35. DO YOU CARRY OUT ACTIONS TO AVOID POLLUTION AND SALINIZATION OF SUPERFICIAL AND SUBTERRANEOUS WATER SOURCES?

Number of interviewees.

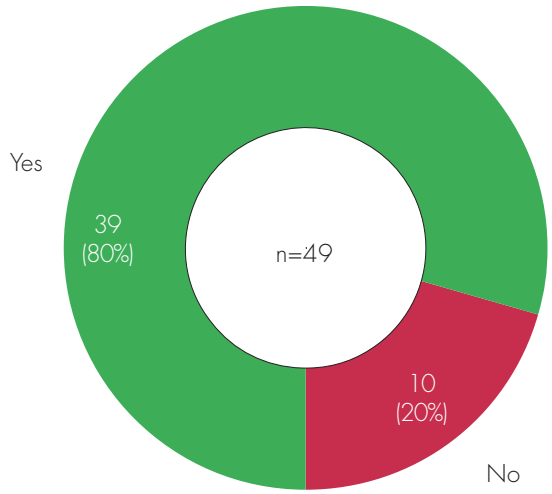


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Most of the interviewees (39 positive responses) say they are familiar with the concept of MBGI described above (**Graph 36**), but only 16 apply it (**Graph 37**).

GRAPH 36. DO YOU KNOW OF THE CONCEPT OF FOREST WITH INTEGRATED HUSBANDRY MANAGEMENT (MBGI)?

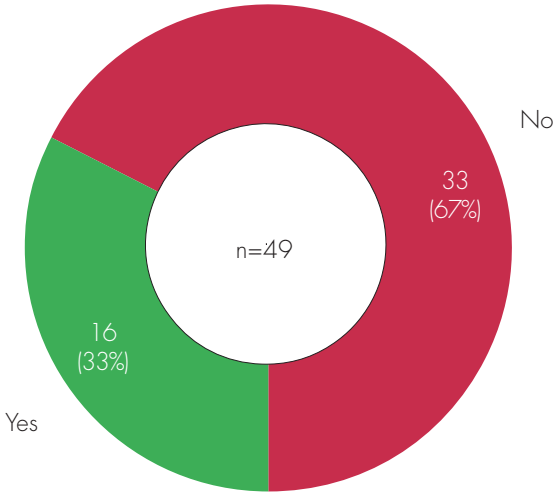
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 37. DO YOU APPLY FOREST WITH INTEGRATED HUSBANDRY MANAGEMENT (MBGI)?

Number of interviewees.

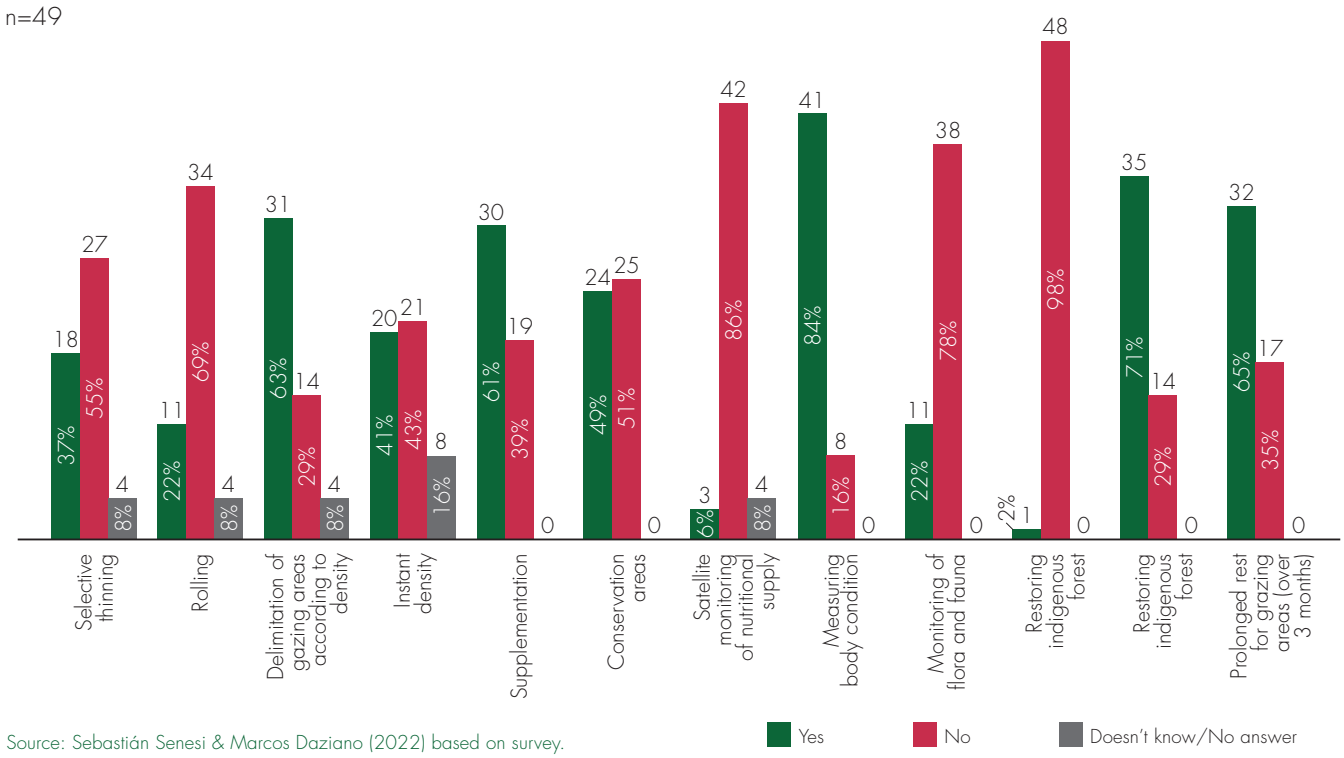


Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Graph 38 shows the management practices applied by the interviewees in their farms. In this graph it is easy to observe that there are widely spread practices, such as body condition assessment, prolonged rest given to grazing areas, fire management and delimitation of grazing areas based on animal load. On the contrary, there is a very low incidence of practices, such as indigenous forest restoration, satellite tracking or indigenous flora and fauna monitoring.

GRAPH 38. WHICH OF THE FOLLOWING PRACTICES DO YOU APPLY IN YOUR FARM(S)?

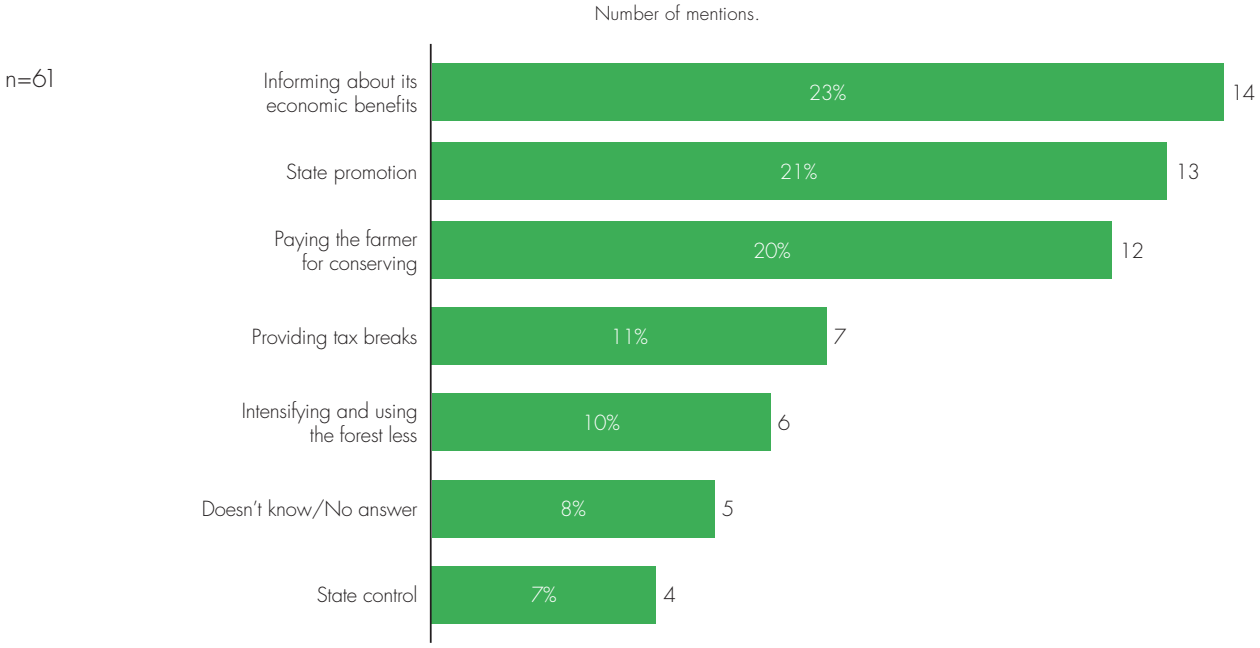
Response frequency.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

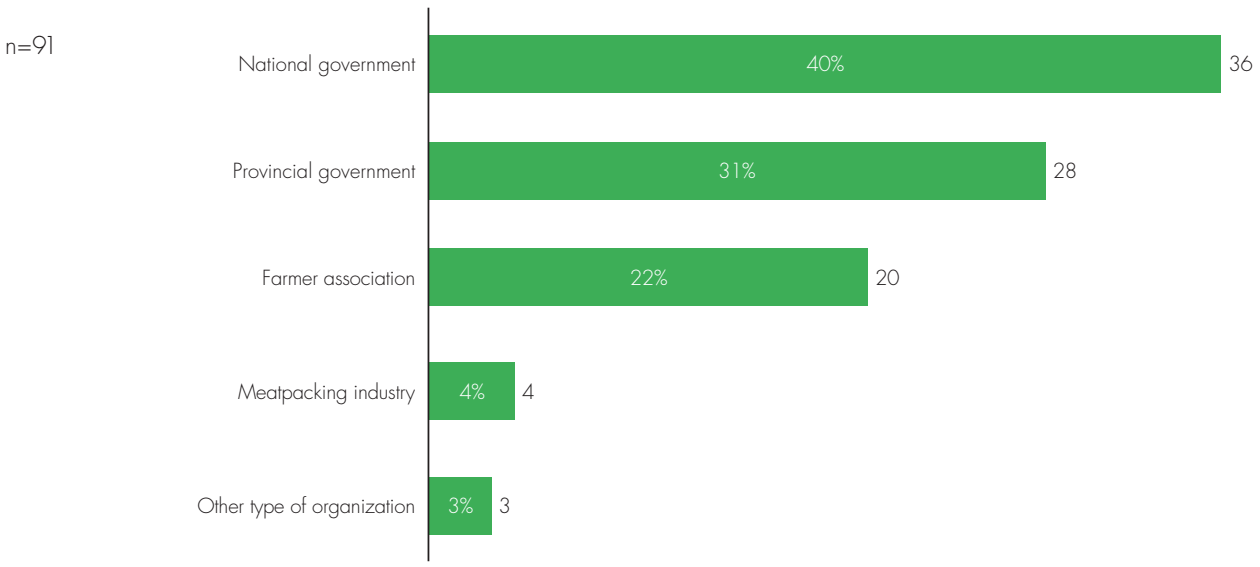
The vast majority of those interviewed sustain that there must be an economic benefit for the farmer for farmers to apply conservation practices like MBGI and for these practices to become widespread (**Graph 39**). These incentives include tax exemptions and benefits or direct payments to farmers, for example. On the other hand, **Graph 40** indicates that the interviewees are of the mind that the national and provincial governments should be in charge of leading the process of disseminating sustainable practices.

GRAPH 39. HOW DO YOU THINK THE APPLICATION OF CONSERVATION PRACTICES SUCH AS MBGI AND OTHERS COULD BE MORE MASSIVE?



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 40. IN YOUR OPINION, WHO SHOULD LEAD THE PROCESS OF DISSEMINATING THESE PRACTICES?



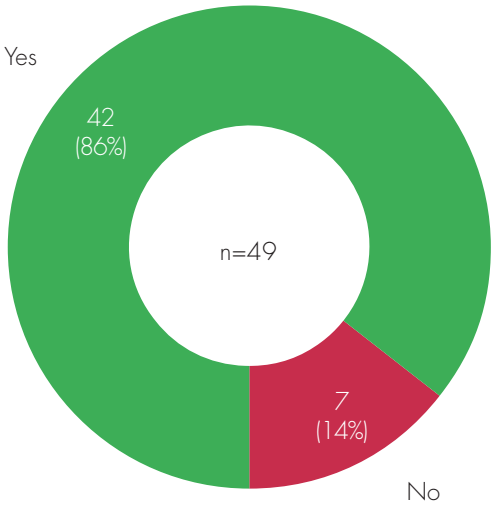
Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Most of the interviewees (30) stated that they would be willing to apply a traceability protocol that guarantees the sustainability of beef production from the Gran Chaco region (**Graph 41**).

Finally, it must be noted that 31 of the 49 interviewees belong to some group or farmer association where they exchange information on practices and technology (**Graph 42**).

GRAPH 41. WOULD YOU BE WILLING TO APPLY A TRACEABILITY PROTOCOL THAT WILL GUARANTEE PRODUCTION SUSTAINABILITY?

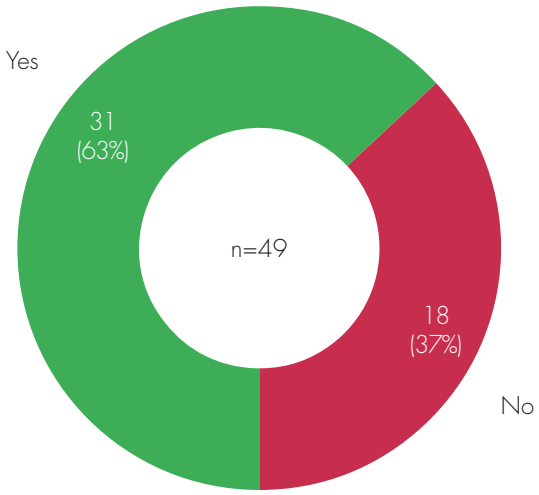
Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

GRAPH 42. DO YOU TAKE PART IN ANY FARMER GROUP OR ASSOCIATION WHERE YOU EXCHANGE INFORMATION ON PRACTICES AND TECHNOLOGY?

Number of interviewees.



Source: Sebastián Senesi & Marcos Daziano (2022) based on survey.

Although the survey carried out has a bias towards a larger size than the average farmer in the region, the results obtained are valid from the point of view that we are observing a compendium of the best practices applied. It would be expected that small-scale or even subsistence farmers have fewer resources to be able to meet sustainability demands.

5. CASES: FARMERS AND SUSTAINABLE PRACTICES IN SMALL-SCALE BEEF PRODUCTION IN GRAN CHACO (UNDER 100 HEADS PER FARM)

As mentioned in the previous section, the survey carried out has a bias since the respondents were predominantly medium and large farmers. That is why the following section is presented to explain the status in the application of livestock practices around sustainability in small farmers of less than 100 heads, through some specific cases.

As part of a multisectoral collaboration process that the NGO Solidaridad has been facilitating since 2018 to strengthen the application of the Forest Law in Salta, Asociación Civil Unión y Progreso was summoned in 2020 to pilot associated timber and husbandry production models that are economically sustainable and can be scaled in yellow zones[15].

The association is made up of farmers who have an average of 50 heads of cattle, who live in Coronel Juan Solá, an agricultural frontier area in the heart of Salta's Chaco. The pilots are being carried out with 37 families that add up to 15,808 hectares of indigenous forest with the presence of carob trees, duraznillos, mistoles, palo santo, quebracho and chañar. There, farmers usually see rabbits, roe deer and wild boar (which they usually hunt), and to a lesser extent foxes, vizcachas, quirquinchos, pumas, and charatas.

The group has some 2,200 heads of cattle for income and 2,600 goats for subsistence purposes, which graze in the bush with no limitations, aggravating the degradation of the ecosystem during the dry months. More than 80% do not have veterinary assistance or a perimeter fence, and their access to water is limited. Likewise, the sale of the animals is carried out in the informal market, where the farmer does not obtain more than ARS 80 (eighty Argentine pesos), less than half a US dollar, per kilogram of live calf. This is well below the market, which averages two dollars per live kilogram.

As a first step for the design of the pilots, during 2019, an agronomist and a veterinarian carried out an evaluation of the environmental impact of the livestock activity, and an analysis of the state of health and genetics of the herd. From an environmental point of view, the degradation of the ecosystem managed by these farmers was confirmed with loss of flora and fauna, and poor soil cover and organic matter.

From a productive standpoint, one of the main findings was the presence of reproductive diseases associated with the lack of sanitary plans and controls in the area that substantially affect productivity. This information is vital for the design of an improved management plan that provides a solution to this structural problem. The production efficiency of calves per cow in these farmers is close to 30% (one calf per cow every third year), when in a larger-scale farmer, with reasonable technical management, it is above 75%.

Among the activities agreed upon with the farmers to improve this sanitary situation, a proposal for a vaccination campaign, the construction of nutritional reserves and water wells for consumption can be mentioned. In addition, farmers are being trained so that they can recognize which animals are no longer productive and remove them from the herd, so that they invest more efficiently and reduce the pressure on the forest. In parallel, delimited grazing areas will be built to promote rotational grazing, protecting the soil, and an analysis on which animal density per hectare is sustainable in terms of forest conservation.

During 2022 Solidaridad carried out a survey of 197 small and medium farmers in the Province of Salta who, on average, operate 539 hectares each. Most of their fields are not delimited with fences, so animals graze freely with water sources as concentration factor, which coupled with farmers' patrolling, helps maintain some sort of delimitation. However, the average real area used by each one is 931 hectares. There is an overlapping of surfaces, since the land "belongs to everyone and belongs to no one", especially when there is no clear land titling. This leads to important degradation processes.

Most farmers raise cattle, with low productive efficiency indicators. On average, each farmer has 31 cows with 17 calves. It is important here to highlight the impact of goats as one of the most important degradation factors. Its production does not translate into a formal income that helps the development of the farmers; it is rather a subsistence factor. The goat takes advantage of forage resources that the cow does not, but this deepens the degradation of the forest. 94% of the 197 farmers interviewed use one of the following feed supplements: alfalfa bale, pasture roll, corn and sorghum. They are used as emergency supplements and, in some virtuous cases, to add a few kilos to the calves before sale.

Regarding soil, the interviewees do not know the type of soil on which they operate, nor the condition it is in. Neither do they have fertility remediation actions or the technological or financial capacity to do so.

Most of the farmers are not part of any initiative related to the capture of greenhouse gases. However, during 2022, Solidaridad began to work with some initiatives to explore trends in the carbon market for small farmers. An analysis of 3 plots, with implanted pastures, of farmers participating in the project was carried out. In one of them a positive carbon stock has been verified.

Solidaridad is currently developing biodiversity monitoring indicators, but it is still in an early stage and most farmers do not carry out any monitoring plans within the farms. Depending on the area, they recognize the presence of animals such as: wild boar, charata, rabbit, deer, iguana, cuña, puma, fox, quirquincho, yacaré, vizcacha, duck and suri. Regarding the vegetation, they recognize: ancoche, cardón, chañar, duraznillo, guayacán, mistol, palo cruz, palo santo, quebracho, quimil, tala, tusca, vinal and yuchán.

The totality of the surface of the farms is indigenous forest, with different degrees of degradation. Only 11% of 197 interviewees have cleared surface on their property. Even so, they are in yellow areas where clearing is prohibited. The surfaces that the farmers state are small patches and not mechanized clearings with diagramming and conversion purposes. Less than 1% of the farmers applied to access the National Fund for the Enrichment and Conservation of Indigenous Forests. The process is in the evaluation period.

As of 2022, the Province of Salta recognized registered holders (without title, unlike owners) as subjects with the right to access management plan funds. This action opens the possibility to a greater number of presentations. Without help from third parties (among them NGOs) it is difficult for farmers to start the process. Most of the farmers need pasture closures, conservation closures and the consequent access to water. They have an average of 4 hectares of pasture and 50% of those surveyed plant Gatton Panic. Most do not elaborate any estimate of forage resources, but within the framework of the project it is expected that farmers acquire this practice along with training and technical assistance.

Although 100% of the farmers have a health management plan, only 3% decide the health plan by technical recommendation, clinical examination of the cattle, and the mandatory vaccination schedule (foot-and-mouth disease, brucellosis). Most just do the mandatory calendar plan.

All the farmers live in a region with problems related to access to water for animal and human consumption, and 56% of the interviewees have access to a cistern and a dam to store water.

Most of the farmers do not apply MBGI directly. However, they are in the process of being applied, based on the training and technical assistance that will be provided within the framework of the Solidarity project. Respondents state that in order to incorporate MBGI practices they need external support of financial resources, infrastructure, and theoretical and practical knowledge.

Wiring one hectare costs between USD 1,000 and USD 1,600, a simple water retainer USD 2,000 and a water system with a tank and pump amounts to more than USD 19,000; that is to say that for a minimum management unit the budget adds up to approximately USD 20,000 (about 10 hectares). This happens with a land value of USD 150 per hectare at best. The financing capacity for this transformation is not currently feasible for the small farmer. There is great expectation about public actions and a permanent claim to the national and provincial governments and farmers associations.

Mostly, farmers do not apply management practices that have a positive impact on the sustainability of livestock production:

Mostly, farmers do not apply management practices that have a positive impact on the sustainability of livestock production:

- Selective rolling/thinning: No
- Rolling: No. Only in some cases was it implemented. Positive: it allowed for better implantation of pastures. Negative: it eliminated the duraznillo, which was a very important resource source and more resistant than grass
- Grazing areas based on animal density: No.
- Instant density: No. Only in some cases do they lock up the calves in the pastures to fatten them before sale
- Supplementation: Yes
- Conservation areas: Yes
- Satellite tracking of nutritional resources: No
- Measurement of body condition: No
- Monitoring of indigenous flora and fauna: In the process of developing biodiversity indicators
- Restoration of indigenous forest: Yes, in process
- Fire management: No

- Prolonged rest for grazing areas (more than 3 months): Yes, for pastures, not for the large area that does not have delimitation

Farmers, for the most part, would be willing to apply a traceability protocol, as long as they see some economic return that allows them to increase their income and increase their productivity.

In 2015, The Nature Conservancy (TNC) began working with local farmers and larger farms in the Gran Chaco region to introduce the concept of regenerative agriculture, a nature-based solution that had been used by indigenous communities in the Gran Chaco region centuries ago. It is based on the principle of returning to nature the resources necessary to produce food (healthy soil, water, biodiversity), so that it can continue producing year after year. This regenerative approach maintains yields and helps avoid deforestation through a productive landscape approach that includes habitat conservation and restoration[16].

Ranchers in the Gran Chaco region are also discovering how to harness the benefits of natural ecosystems to improve livestock production. Based on guidelines from Argentina's National Institute of Agricultural Technology (INTA), ranchers have begun letting cattle graze in the forests instead of clearing more land to open grazing fields. This approach does not work for all ranchers, but it is a viable alternative for small to medium-sized ranches. Forest grazing provides a wider range of feeding options for livestock, as well as shade and shelter from intense heat. In return, the cattle fertilize the ecosystem and even help spread the seeds of the carob trees, a vital species for the conservation of the forests of the Gran Chaco region.

Over the years that TNC has been working with small farmers, it has learned that implementing regenerative practices is challenging, and working with farmers in a systems approach is key. One successful practice has been to foster a closer relationship between farmers, connecting farmers who are already using regenerative practices with those who have not yet started, so that they can share best practices and advice "on the ground", from "neighbor to neighbor".

In 2019, TNC carried out a business model through the implementation of associated timber and husbandry production systems according to the specific conditions of the arid region of Gran Chaco to make way for a sustainable production of beef and generate changes in land use in this sector.

During 2017, the Fundación Vida Silvestre Argentina (FVSA) prepared, based on practical cases with farmers, a booklet of good husbandry practices, compatible with the MBGI guidelines. Its objective was to demonstrate, on the field, that it is possible to conserve the indigenous forest while reaching high standards of beef production and to do it profitably (for large, medium and small farmers alike)[17].

MBGI functions as an umbrella to incorporate different proposals for associated timber and husbandry production model management in Indigenous forest, ensuring its conservation for present and future generations. Thus, the guidelines also contain experiences of management of the shrub layer by hand without the need for rolling, indigenous forest and grass management, without implanting pastures; and the variants that could arise and be experimented in the future.

One of the cases took place in an establishment of 720 hectares and 80 cows in production in the Province of Santiago del Estero. The forest was intensively exploited 60 years ago. There are few large trees but about 300 individuals per hectare that are less than 35 cm in diameter at breast height (DBH). Species and ecosystem functions are present. Over time, the forest will recover the number of large trees.

The farm received financial aid from the Forest Law to implement the management plan. This allowed it to be able to implement the number of delimited grazing areas and reduce the percentage of rolling. However, the management plan did not contemplate the possibility of managing a "fuse herd", that removes a certain number of heads of cattle from the system during dry years. Feeding management contemplates supplementation and introduction of species such as Gatton Panic. The property has a reservoir that collects rainwater. Likewise, the entry of goats to delimited grazing areas with MBGI management is prevented. The use of electric fences constitutes very important barriers towards assuring the effectiveness of the proposed management.

As proposals for improvement, it would be important to have a separate reserve area without grazing and to design a herd that to be used as "fuse herd", which would not only prevent forest and pasture degradation during dry years, but also avoid drops in production and mortality.

6. RESULTS ANALYSIS

The Gran Chaco Region occupies most of the Northern part of Argentina (Map 1), stretching across the provinces of Chaco, Santiago del Estero, Formosa, North of Santa Fe, Córdoba, and San Luis, East of Salta, Tucumán, La Rioja, Catamarca, West of Corrientes and areas in Jujuy and San Juan.

This region has been gaining importance in beef production over the past 3 decades as the Pampas have shifted towards more crop production.

For Gran Chaco region, figures indicate that there are almost 100 thousand beef farmers, while in the focus area of the provinces of Chaco, Formosa, Salta and Santiago del Estero there are 36,860 registered cattle ranches. From 2012 to 2022 beef cattle stock in the Gran Chaco region has grown by 53% to over 18 million heads.

Beef production in Argentina, conserving the Gran Chaco region, will have to at least leverage itself on four pillars: the institutional framework and its application; the incorporation of a compendium of practices and technologies that will allow for greater sustainability in economic, social and environmental terms; the management and evaluation parting from indicators; and the complementarity of this activity with other income sources (timber and forestry, honey, etc.).

Argentina presents a formal legal scheme in terms of environmental preservation (with a series of specific national laws that promote the care of Indigenous forests, land use planning, and climate change, among others).

Highlights are the National Environmental Law, the law for cultivated forests, the law for climate change adaptation and mitigation (article 41 in the Argentine National Constitution) and that for the protection of indigenous forests. Also, the National Husbandry Plan (GANAR) must be noted.

This legal framework has developed public bodies for the application, control and management of the issues in question, such as the creation of the Federal Environmental Council (COFEMA) in 1993.

FVSA mentions that the General Budget Bill by the National Administration for the Fiscal Year 2022 assigned to the National Fund for the Enrichment and Conservation of Indigenous

Forests an amount of ARS 1,212,415,000 (one billion two hundred twelve million four hundred fifteen thousand Argentine pesos) and to the National Program for the Protection of Indigenous Forests an amount of ARS 120,000,000 (one hundred and twenty million Argentine pesos). However, the stipulated budget barely corresponded to 3% of what should have been allocated for the protection of forests if the law were correctly complied with. Although the amount in Argentine pesos is the same as that assigned in 2021, the percentage decreases compared to the previous budget and is the lowest since the implementation of Law 26,331 in 2009[18], the country's current high inflation indices notwithstanding.

The total amount assigned to the Law was then distributed to the provinces in a proportional manner according to different factors, among which is the number of hectares of forests that each of them possesses. But according to the 2022 Budget project, only 3% of what would correspond to each province would be assigned if the law was correctly complied with. Without adequate financial stimulus, the provinces are unable to strengthen their inspection, control and surveillance capacity.

With respect to the forestry promotion law, the National State has invested since its creation in 1999 to date more than USD 250 million (two hundred and fifty million US dollars) reaching an area of 1,377,222 hectares (coniferous, eucalyptus, salicaceous, several others)[19]. It is important to mention that the law was regulated without the ordering of forest territories having been approved. In other words, the advance of afforestation on natural environments is being subsidized without environmental criteria.

Some weaknesses found and in need of modification in order to give greater scope to the impact of the law would be the lack of structure of the National Forestry Directorate, the lack of budgetary resources and excessive bureaucracy, while payment times must be reduced for the forestry plans and the financing of the regime with extra-budgetary funds must be guaranteed, since the Green Insurance Funds are no longer received, among others.

Another central point, in order to promote the production of beef and the preservation of the Gran Chaco region, is the updating by each province of its Territorial Ordering of Indigenous Forests (OTBN), within the stipulated deadlines, according to the criteria established by the Law and with the corresponding required citizen participation.

By 2022, provinces such as Salta and Chaco had not presented their new OTBN map. The Government of the Province of Chaco, in its updating process, introduced changes from green to yellow zones, causing rejection by local farmers who argue that the decision has no technical or environmental basis. In the same sense, NGOs publicly questioned the map approved by the Government, suggested by the Provincial Ministry of Environment. There is even a legal case initiated a few days after the sanction of the Decree that approves it, in which its annulment and declaration of illegitimacy and unconstitutionality are requested[20].

Most of the provinces that are within the Gran Chaco region present a provincial plan to improve livestock activity. Likewise, they all offer, in turn, strategic actions relevant to the objective of reducing deforestation and degradation in the Gran Chaco region, linked to: implantation of nutritional sources; access to water; efficiency and sustainability of breeding and rearing; financial and fiscal incentives to improve productivity; adoption of individual identification and traceability; normalization of land tenure; determination of environmental footprints; and identification of products with environmental and social differentiation for export markets, among others.

From a commercial standpoint, beef exports have been increasing slowly but steadily since the lowest point of 2011, exceeding 700 thousand tons in 2019 and 2020. The Gran Chaco region continues to transfer animals to the temperate zones of Argentina for fattening, although there are also exporting abattoirs. The main markets have also undergone a dramatic change with the emergence of China and Russia as major buyers. The EU remains the most important market for high-value products, with a growing share of the US market. It is worth mentioning that the new EU regulation and the Forest Act (in process in the United States), among others, will affect the entry of products related to production areas that are related to deforestation, slavery and other non-compliance with human rights.

Faced with these new demands and in order to be able to meet the requirements of buying markets, Argentina currently presents, from the mandatory institutional point of view, a Traceability System by cattle group. In addition, within the technological developments in Argentina, apps and platforms can be found that enhance the productivity of the sector, aimed at specific tasks on the field, as well as activities carried out throughout the production chain: traceability, financing, logistics and marketing, among others.

However, in Argentina there is no specific sustainability protocol for beef to date. Defining the criteria that must be considered to establish the sustainability indicators of the beef agribusiness system would imply dialogue between the various actors in the public and private sectors.

To date, these are the protocols and public and private initiatives of differential attributes in cattle farming in Argentina (Annex II). After the pandemic, the public sector has not yet developed a new specific protocol for quality attributes for beef that responds to this possible acceleration of consumer trends linked to the reduction of greenhouse gas emissions, deforestation-free production, regenerative agriculture or environmental management. However, it is observed that private initiatives (MACS) and the Institute for the Promotion of Argentine Beef (IPCVA in Spanish) together with research institutes continue to deepen the analysis of sustainability indicators and the life-cycle of the product and its environmental impact.

Argentina's main competitors are making progress on various certification schemes for beef quality attributes, such as: environmental management/reduced emissions, deforestation-free protocols and regenerative husbandry/ agriculture; as well as the creation of sustainability indicators.

As previously mentioned, grass-based beef production systems are the most extensive use of land in the Gran Chaco region, becoming a source of income and the de facto livelihood for thousands of people, especially in less favorable agroecological zones for agricultural production. However, some trade-offs can potentially emerge with the existence of this activity, such as deforestation, misuse of resources, or loss of biodiversity. Understanding the role of practices in different livestock systems, from extensive grazing on natural grasslands, pastures and forests to feed lots, at regional scales is challenging. This is due not only to the difficulty of demonstrating which practices have a positive impact in terms of sustainability, but also of verifying which practices each producer actually uses.

By virtue of the survey carried out, we can observe in the segment of professional establishments (medium/large) with more than 500 heads of cattle that the diet is predominantly grass with 55% of the total (almost 2/3 of the respondents have implanted pastures), while 47% grass feed with some supplementation. In this sense, a high percentage states that they have knowledge of the types of soils that are present in their establishments, the condition in which they are found, and carry out agricultural practices for the conservation of soil resources.

MBGI is one of the approaches proposed to attack sustainability problems in beef production in the Gran Chaco region. MBGI is a technology of voluntary adoption by farmers, which offers the opportunity to transform production to a higher level of sustainability, constituting a viable alternative from the economic, social and environmental point of view to the usual practices of replacement or unsustainable use of forests. Most of the respondents (39) say they are familiar with the concept of MBGI, but only 16 apply it.

The vast majority of those interviewed maintain that there must be an economic benefit for the farmer so that he applies conservation practices like MBGI and for these practices to become massive. Those benefits could be linked to tax exemptions and benefits or direct payments to producers, for example. In this sense, they state that the national and provincial governments should oversee the process of dissemination of sustainable practices.

Practices such as selective thinning, rolling, the delimitation of grazing areas based on the expected (planned) stock with corresponding rest periods for grazing areas, the use of fuse herds, which allow adjusting the demand to the nutritional supply, strategic supplementation to compensate in moments of lower nutritional supply without the need to reduce the number of animals, the measurement of the body state of the animals through predetermined parameters that allow objective decision-making, the conservation of virgin areas, the restoration of indigenous forests and grasslands, indigenous flora and fauna monitoring and fire management should see widespread adoption in order to meet the conservation objective specified above. These types of practices are compatible with the economic objectives of livestock production, although they are not widely spread.

The most widely disseminated management practices applied by the interviewees on their farms are the measurement of body condition, prolonged rest in grazing areas, fire management, and delimitation of grazing areas based on the number of heads. On the contrary, there is a very low incidence of practices such as indigenous forest restoration, satellite monitoring of grass resources, monitoring of indigenous flora and fauna, the capture of greenhouse gases, or some biodiversity monitoring plan.

Almost 60% of those surveyed mentioned the existence of converted areas in their establishments, where category III areas had a higher level of intervention, although categories I and II generated 19 responses of the type "Don't know/No answer". 78% have never presented an intervention project on indigenous forests before the local application authorities, while the remaining 22% (only five interviewees) stated that they had an approved project. This does not mean that there have been situations of increase in the productive area without a formal presentation before the corresponding authorities.

Approximately half of the interviewees know of mechanisms that compensate producers for maintaining forests that could be legally converted, more than two thirds of the total

would be interested in participating in mechanisms that compensate them, although only fifteen interviewees know of the national fund for enrichment and conservation of native forests.

In terms of the proposals to improve production within the framework of the Forest Law, the improvement of the reproductive indices dominated with a third of the total mentions, followed by nutrition planning that added to 24%, the improvement of the productive indices, which added to 20%, the generation of more feed supply with 13% and the increase the stock with 10% of the total.

Regarding access to water, 51% declare that the region where they operate is subject to problems, which means that the vast majority have some method to store water in their establishment.

Although the survey carried out has a bias towards a larger size than the average farmer in the region, the results obtained are valid from the point of view that we are observing a compendium of the best practices applied.

However, the situation of lower segment producers who lack the resources to be able to meet sustainability demands is different.

Various initiatives, in large numbers led by NGOs, have been developed in order to assist the segment of small producers.

The activities resulting from this support are linked to strengthening the application of the Forest Law, piloting associated timber and husbandry production models that are economically sustainable and can be scaled up in yellow zones, professional assistance from agronomists and veterinarians, fiscal formalization of the activity, trade agreements for cattle sale, incorporation of lost flora species, soil cover, increase in organic matter, vaccination campaigns, construction of nutritional reserves, and water supply and storage for consumption, construction of delimited grazing areas to promote rotational grazing, protecting the soil , and adjustment of the animal density per hectare for a sustainable use and conservation of the forest, forest grazing, farmer-farmer rapprochement, development of booklets of good husbandry practices, compatible with MBGI guidelines or other management mechanisms, and use of electric fences, among other.

The application of all these actions must also be harmonized with other productive activities that allow compliance with those related to livestock activity, for example, non-timber forestry productions.

The indigenous forest represents, for the provinces and the communities, a very important socioeconomic value because many communities carry out their lives directly and indirectly through the use of the forest.

The set of public policies applied in the forestry sector has tried to counteract the adverse effects of the use of indigenous forests both for the extraction and marketing of wood and for the change in land use in sectors with high degrees of conservation. Livestock activity (meat production) and forestry (regeneration, thinning, rolling etc.) should be complementary in sustainable certification schemes.

7. CONSIDERACIONES FINALES

- The production of beef and the conservation of the Gran Chaco region must coexist with a systemic view (region, ecoregion, etc.) and micro view at the same time. The local institutional framework establishes a federal legal perspective, with provincial application and impact at the level of each farm, which must ensure compliance.

- It is essential to develop intervention projects with their respective economic contributions (public and private) in order to increase the percentage of farming/husbandry practices that give sustainability to the cattle and beef system in the Gran Chaco region. In the case of small farmers, the support of the State and/or NGOs is essential given the lack of training and economic restrictions.

- For this great challenge to be met, it is essential to implement effective monitoring systems that generate instant and reliable information on the variables studied and the objectives to be met, which today, from a technological perspective, are widely available for the most part.

- Public-private traceability systems are not today a barrier to be able to certify sustainable cattle raising processes in Argentina with the concept from the field to the plate. In this sense, in the cattle and beef system, a custody chain could be generated to ensure that the animals produced and subsequently slaughtered do not come from fields that have been deforested in accordance with local and/or international laws.

- The surveyed producers, whether large, medium or small, demonstrate the need to substantially improve a series of actions already described.

- Although the MBGI management model has a prominent position as a sustainable management system, even since the creation of COFEMA, it has a low level of adoption. Likewise, the husbandry model can be complemented with other activities related to the forest.

- Deepening and defining sustainability indicators under the 3 axes (economic, social and environmental) and developing a certification scheme could be an opportunity for differentiation for the Beef Agribusiness System in Argentina.

8. SOURCES

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9. ANNEXES

Annex I

The resolutions that create the "Bovine Cattle Identification System for Export" are described below, which must be applied in a mandatory manner in all the farms registered in the "Registry of Cattle Supplying Rural Establishments for Slaughter for Exporting" and by farms that are registered in the "Register of Feed lot fattening Cattle Supplying Establishments for slaughter for exporting".

• Resolution 15/2003

The "Bovine Cattle Identification System for Export", which must be applied in a mandatory manner in all the registered farms in the "Registry of Cattle Supplying Rural Establishments for Slaughter for Exporting" and by farms that are registered in the "Register of Feed lot fattening Cattle Supplying Establishments for slaughter for exporting" are created.

Provisions:

1. The system is based on the identification of the animals by means of a button to be placed in their left ear, which will contain a non-repeatable code on the front, and on the back the NATIONAL SANITARY REGISTRY OF AGRICULTURAL PRODUCERS (RENSPA) number of the farmer that registers the animal, button that will be complemented with an independent button with the acronym "EC" to apply in those animals that enter or leave the Livestock Farms from Fattening to Corral reached by this Resolution.

2. The caravan will be mandatory for

a. Every animal that enters the farm and that has not been previously identified with said elements;
b. animals born after the entry into force of this standard, within a period not exceeding their weaning;
c. the remaining stock of unidentified animals within the HUNDRED EIGHTY (180) subsequent days;
d. before sending any animal to other fields or slaughterhouses for slaughter.

3. In the event that an animal loses its identification, it must be replaced by a new button, and this fact must be recorded in the corresponding Movement and Stock Registration Book, for the purpose of calculating the minimum periods of permanence for shipment. to export work.

4. The establishments covered by this resolution must:

a. Identify by their button code each of the animals that leave the farm, regardless of their destination, registering them on the Individual Cattle Group Registration Card (TRI),

b. Produce a Folder, as required by article 7 of SENASA Resolution No. 115/2002, where a copy of the Individual Cattle Group Registration Cards (TRI) issued will be filed, sequentially, for each discharge, and for each reception, Documents for the Transit of Animals (DTA) with their respective Transfer Guides and Individual Cattle Group Registration Cards (TRI), if applicable. Likewise, originals or copies of the receipts issued by suppliers for the acquisition of the caravans must be filed in said folder.

• Resolution 391/2003

Registration of "Rural Establishments of Origin", which provide bovines born and raised in them destined for " Cattle Supplying Rural Establishments for Slaughter for Exporting ".

Provisions:

1. The owner of the farm must be registered in the RENSPA.

2. Animals that have not been treated with hormones, thyrostatic substances or any other with active principles that have an anabolic effect or that are prohibited by EU legislation.

3. Animals must be fattened in establishments registered for slaughter destined for the EU.

4. Prevention of Transmissible Bovine Spongiform Encephalopathies (BSE) type diseases

5. Individual identification of cattle in breeding fields and for all animals.

6. Sworn statement by breeding, rearing and wintering producers of non-use of the substances defined in 1.

7. Keep a record book of movements and stocks (Annex I of SENASA Resolution No. 15/2003).

8. All " Cattle Supplying Rural Establishments for Slaughter for Exporting " must exclusively supply themselves with animals from their own production or from "Rural Establishments of Origin", either directly or through a fair auction.

9. The cattle group that makes up the Individual Registration Card (TRI) will be indivisible, and cannot be fragmented, and must be re-dispatched with the TRI of origin to the "Cattle Supplying Rural Establishments for Slaughter for Exporting ", recording in said TRI the new number that corresponds to the Document for Electronic Transit (DTE) from the fair.

- Resolution 1698/2019

It indicates that the Integrated Animal Health Management System (SIGSA) has been created by Resolution No. 356 of October 17, 2008 of the former SECRETARIAT OF AGRICULTURE, LIVESTOCK, FISHERIES AND FOOD and represents a substantial tool for the control of the animal health and public health, allowing to know the origin of all bovines or buffaloes that are mobilized or marketed at the national level and also establishes the bases for the development of more precise and far-reaching traceability systems in these and other species.

1. The National Electronic Animal Identification System is created within the scope of the National Directorate of Animal Health of SENASA.

2. The National Electronic Animal Identification System is implemented according to the following scheme:

Subsection a) Voluntary: producers or human or legal persons holding bovines, buffaloes, deer, sheep, goats, camelids, canines, felines and pigs who wish to use electronic identification devices as an official identification system.

Subsection b) Obligatory: it will be obligatory for the producers or holders of equines, in accordance with the provisions of Resolutions Nos. 471 of July 27, 2015 of the then MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES and 893 of November 27, 2018 of the NATIONAL SERVICE OF AGRI-FOOD HEALTH AND QUALITY.

3. Agricultural producers or animal keepers must acquire electronic identification devices through providers of animal identification devices duly registered in accordance with current regulations and their distribution network.

4. The owners or holders of animals who wish to use the electronic identification to which this refers, must apply the devices in accordance with the official regulations in force for each animal species. In case of opting for the use of the electronic identification system, it will replace any other type of previously approved identification device coding system.

5. Electronic Identification Device. It is considered as such any device comprised of a radio frequency transponder, Passive Radio Frequency Identification (RFID), inserted in a "button-button" type plastic caravan or as an injectable transponder containing a unique and unrepeatable number that corresponds to with a national code and whose technical characteristics, numbering system and form of presentation by species are established in this standard.

Annex I I

Table 1: Protocols and initiatives (private and public) for differential attributes in beef in Argentina

Tendencia		Organismo	Protocolo
Product with intrinsic superior quality characteristics	Angus beef	SENASA	Argentina Angus Beef, Black Angus and Red Angus
	Hereford beef	SENASA	Hereford beef
	High quality	SENASA	High quality beef to Switzerland
		SENASA	High quality beef to Chile
		MAGyP	Protocol for quality schilled and packed beef
		MAGyP	Hilton & 481 Quotas
Safe and secure product	No use of growth promoters	MAGyP	Hilton & 481 Quotas
Produced in an environmentally friendly way	Fed on natural grassland	SENASA	Grassland beef
	Organic	SENASA	Organic beef
	Reduced emissions	—	—
	Environmental management	—	—
	Deforestation-free	—	—
	Life-cycle analysis of the product	IPCVA/INTI/ INTA	Evaluation of environmental performance
	Regenerative farming and husbandry	—	—
Produced ethically	Animal welfare	SENASA	Animal welfare (Manuals not approved)
		OIA	Animal welfare
Produced sustainably	Sustainability Indicators: environmental, econmic & social	Mesa Argentina de Carne Sustentable	Developing indicators
		AAPRESID	Ganadería Sustentable Certificada