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Analysis of incentives in the agricultural sector impacting biodiversity in Colombia

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List of acronyms and abbreviations

BIOFIN	Biodiversity Finance Initiative
GAP	Good Agricultural Practices
GLP	Good Livestock Practices
CBD	Convention on Biological Diversity
CFA	Agricultural and Rural Development Credit
CIF	Forestry Incentive Certificate
CNA	National Agricultural Census
CNCA	National Agricultural Credit Commission
CONPES	National Council for Economic and Social Policy
ENA	National Agricultural Survey
EVA	Municipal Agricultural Evaluations
FAG	Agricultural Guarantee Fund
FMR	Rural Microfinance Fund
FNA	National Agrarian Fund
GIBSE	Integrated Management of Biodiversity and its Ecosystem Services
ICR	Rural Capitalization Incentive
ISA	Agricultural Insurance Incentive
JAC	Community Action Board
LEC	Special lines of credit
OSPR	Social management of rural property
BAP	Biodiversity Action Plan
PESL	Strategic Plan for the Colombian Dairy Sector
PNGIBSE	National Policy for the Integral Management of Biodiversity and its Ecosystem Services
PNMGB	National Bovine Genetic Improvement Programme
POP	Productive Management Plan
POSPR	Social Management Plan for Rural Property
PTP	Productive Transformation Programme
ESs	Ecosystem Services
SESLM	Socio-Ecological System of La Mojana
SESs	Socio-Ecological Systems
SNCA	National Agricultural Credit System
UAF	Family Agricultural Unit
EEZ	Ecological-Economic Zoning
FRZ	Forest Reserve Zone

Introduction

Since 2015, the Biodiversity Finance Initiative (BIOFIN) has been implemented in Colombia. BIOFIN is a global partnership that seeks to comprehensively address the challenge of financing actions to conserve and sustain biodiversity.

One of the results of the implementation of the BIOFIN methodology in Colombia is related to the Policy and Institutional Review (PIR) carried out in 2016, which identified a regulatory framework that promotes the development of the productive sectors without considering the conservation, management and sustainable use of biodiversity. For example, some policy, economic and financial instruments in the agricultural sector have stimulated production, expansion and growth at the expense of the good condition of ecosystems and, consequently, biodiversity (BIOFIN UNDP, 2016).

In 2021, with financial support provided by the Swedish International Development Cooperation Agency - SIDA through BIOFIN, a study was carried out in Colombia to evaluate incentives and subsidies in the agricultural sector, particularly those related to basic products, which have a potential impact on biodiversity; and based on this study, possible routes to reform some of these harmful incentives and subsidies were identified, including recommendations for their gradual elimination, reduction, reorientation or greening.

Subsequently, in 2022 BIOFIN carried out a study to evaluate the management instruments of the agricultural sector in Colombia that have the greatest impact on biodiversity, this time based on the historical reconstruction of the agricultural socio-ecological system for La Mojana, an area of more than one million hectares, which has been classified as being of regional importance in Latin America and the Caribbean, due to the large number of aquatic, terrestrial and transitional habitats that also act as a biological corridor connecting different protected areas and natural regions of Colombia, making it a strategic area for biodiversity conservation and the maintenance of key ecological processes.

Concerning international commitments, it is important to bear in mind that during the Tenth Conference of the Parties to the Convention on Biological Diversity (CBD) held in Aichi, Japan, in 2010, the signatory countries adopted the Aichi Targets with the aim of achieving global objectives to halt the loss of biodiversity worldwide by 2020. Part of these global efforts focused on eliminating or reforming incentives that are harmful to biological diversity (Target 3).

During the fifteenth Conference of the Parties to the Convention on Biological Diversity, held in December 2022 in Montreal, Canada, the Kunming-Montreal Global Biodiversity Framework was adopted after the Aichi Targets set for the decade 2010–2020 were not met. The signatory countries of the CBD, including Colombia, agreed that in order to stop drivers of biodiversity loss, urgent policy measures are needed at the global, regional and national levels to transform economic, social and financial models in a way that the trends that have exacerbated biodiversity loss stabilize by 2030 and allow for a recovery of natural ecosystems by 2030, achieving net improvements by 2050 in order to "live in harmony with nature". The new framework also recognizes that mobilizing new resources and organizing funding sources in accordance with the needs of each country is required in order to meet the targets (Target 19), as well as reducing the harmful effects on biodiversity (Target 18).

This document serves as an initial analysis of the perverse incentives impacting biodiversity in Colombia, laying the groundwork for discussions that will support the fulfillment of international environmental commitments. This document presents the results in two phases: first, at the national level, based on the analysis of bibliographic, statistical and cartographic information to identify incentives with potential negative impacts on biodiversity and generate recommendations for the implementation of a reform roadmap; and second, an analysis of the impact of incentives on ecosystem services in La Mojana region, which considered technical, statistical and cartographic information, complemented after gathering information in the field based on workshops and structured and semi-structured interviews with local communities, farmer's associations, producers and public institutions present in the territory in order to learn about their views on changes in key ecosystem services essential for carrying out their activities.

To develop this analysis, the UNDP, through its BIOFIN initiative in Colombia, received technical advice from the Latin American Center for Rural Development (Rimisp) in a strategic alliance with the Colombia Rural and the Center for Research in Agrifood Systems at the University of the Andes. In addition, this edition included technical analyses provided by the "*Mojana Clima y Vida*" Programme, which the UNDP has been implementing with resources from the Green Climate Fund and the national government in Colombia.

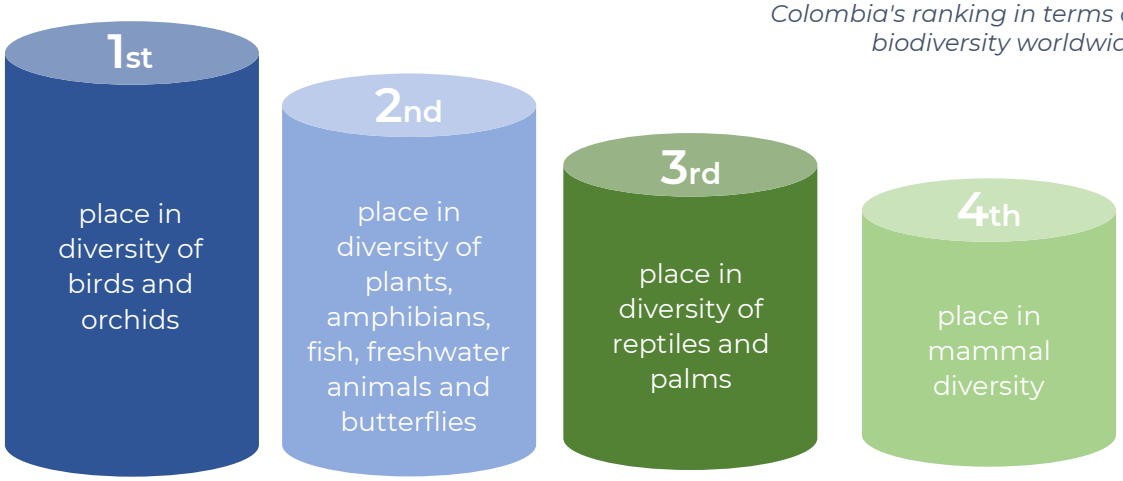
CHAPTER 1

Analysis of agricultural sector incentives at the national level

1. Status of biodiversity policies in Colombia

Colombia is the most biodiverse country in the world per square kilometer (WWF, 2022) (Figure 1), with 75,947 species recorded in the territory (SIB 2023); this biological heritage is the driving force that has prompted the country to develop different national and international strategies for the conservation of biodiversity. An increasingly relevant strategy consists of addressing policies in sectors other than the environmental sector.

Figure 1.
Colombia's ranking in terms of biodiversity worldwide



Source: UNDP 2021 based on data from the Ministry of the Environment (2017).

At a general level, four important decisions can be highlighted in terms of public policy for the conservation of biodiversity. Firstly, Law 165/1994, whereby Colombia ratified the Convention on Biological Diversity (CBD), the objective of which is to manage the nation's biological diversity in a sustainable manner, designing and implementing public policies, strategies, plans and specific mechanisms for its protection.

At the United Nations Conference on Biological Diversity - COP 15 held in 2022, the Kunming-Montreal Global Biodiversity Framework – GBF was adopted, after the Aichi Targets[1] set for the decade 2010-2020 were not met. In light of this failed outcome, the international community unanimously agreed that a new framework was needed, with ambitious goals to reverse the loss of biodiversity and with the enabling conditions and means of implementation to achieve true compliance. Among these and in relation to perverse incentives, Target number 18 was established:

"*Identify by 2025, and eliminate, phase out or reform incentives, including subsidies, harmful for biodiversity, in a proportionate, just, fair, effective and equitable way, while substantially and progressively reducing them by at least $500 billion per year by 2030, starting with the most harmful incentives, and scale up positive incentives for the conservation and sustainable use of biodiversity.*"

Secondly, the Biodiversity Action Plan - BAP 2016-2030, whereby Colombia draws up a concrete plan for the development of the national commitments established in the National Policy for the Integral Management of Biodiversity and its Ecosystem Services - PNGIBSE, and international commitments agreed before the CBD through the 2010-2020 Aichi Biodiversity Targets; and established, in axis III.

Biodiversity, economic development, competitiveness and quality of life, which is goal III, states that "The country will have an impact and efficiency evaluation on the tax incentives associated with GIBSE and a proposal for the reform of tax incentives that are ineffective, inefficient or contradictory" and where by 2025 and 2030 they will have been eliminated entirely in a gradual process that goes from 50% to 100% (Ministry of the Environment, 2017).

Meanwhile, the National Planning Department (DNP) published the National Climate Finance Strategy (2022), whereby the following was established: "*Eliminate or modify those economic and financial instruments that generate impacts contrary to environmental and climate objectives; at the same time as promoting those instruments that contribute to climate resilience and carbon neutrality*" (DNP, 2022).

[1] Aichi Target 3 stated that " By 2020, at the latest, incentives, including subsidies, harmful to biodiversity will be eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity will be developed and applied, in accordance with and in harmony with the Convention and other relevant international obligations, taking into account national socioeconomic conditions.

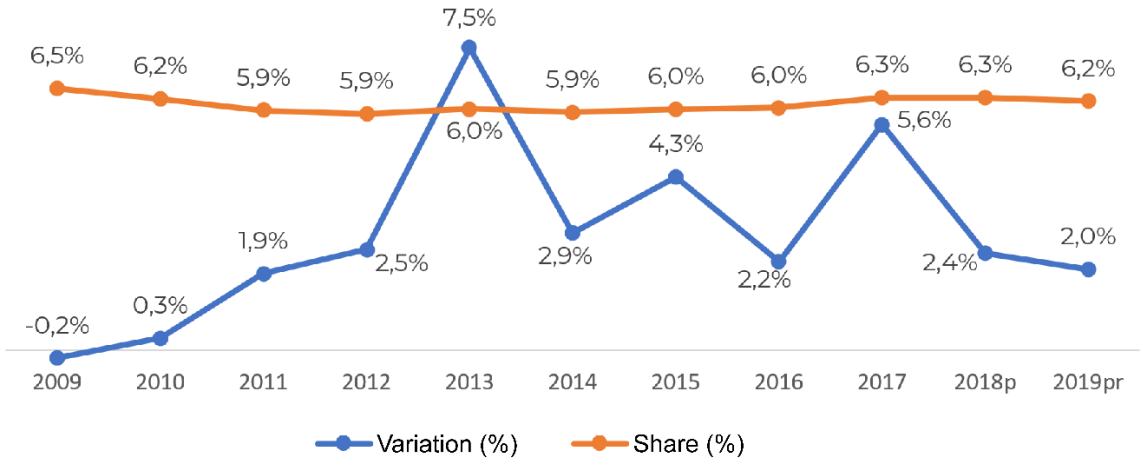
Lastly, the National Development Plan - NDP 2022 - 2026, "Colombia, world power of life" in axis 4: "*Productive transformation, internationalization and climate action*", in catalyst E. "*Financing development as an enabling mechanism for a productive economy*", in paragraph a. "*Net climate finance as a driver for sustainable development" establishes the following: "In order to bring the sum of positive financial flows and negative financial flows to zero, instruments that favor investment in actions that reduce GHG emissions or promote adaptation will be promoted, while at the same time eliminating or modifying incentives for activities that generate more emissions, loss of biodiversity or go against adaptation to climate change*" (DNP 2022b).

2. The agricultural sector in Colombia

Agricultural policy incentives, with both positive and negative effects on biodiversity, are part of the consolidation and current state of this sector in Colombia, which is why it is vital to understand its productive dynamics, its contribution to national economic development and how it depends on and is interrelated with ecosystem goods and services.

This sector has played a key role in the country's productive development, in the generation of employment, growth and income with a share of between 5.4% and 7.5% of the national Gross Domestic Product (GDP) in recent years (**¡Error! No se encuentra el origen de la referencia.**) and in food supply for the whole nation; Colombia being a country with a natural agricultural production identity (MADR, 2019).

Figure 2. Annual growth rate and share of the added value of the agricultural sector in GDP



Source: DANE, National Accounts

Prospectively, this sector must ensure the country's agricultural supply in the face of growing demand and constant population growth; to this end, the sector has a high-yield model, rather than opting to expand the areas sown, but with the need to implement and ensure elements to make its model environmentally sustainable.

The agricultural sector, like other economic sectors, makes use of management tools designed to promote or discourage certain behaviors among economic agents in order to generate growth and sectoral stability. However, these tools can have unintended negative effects on biodiversity and the environment, changing their name to “perverse incentives”.

In Colombia, the growth and stability of the agricultural sector have developed mainly following two strategies. On the one hand, the expansion of agricultural land in natural ecosystems, which is known as the **expansion of the agricultural frontier** and whose traditional method of growth is achieved through the colonization of new lands, and therefore a change in land use. On the other hand, the growth of **high-performance intensive production systems**, which consists of increased productivity in response to the limited availability of land for agricultural use and technological development. This strategy entails serious risks for biodiversity, as it favors genetic uniformity and the degradation of soil, water and the atmosphere through the intensive use of synthetic agrochemicals.

Therefore, the ecosystemic relationships between the agricultural sector and the various ecosystem services are direct and can be classified according to the subsector (Figure 3). The V National Biodiversity Report of Colombia to the CBD drafted by the UNDP and the Ministry of Environment and Sustainable Development (Ruiz et al., 2014) provides the following breakdown:

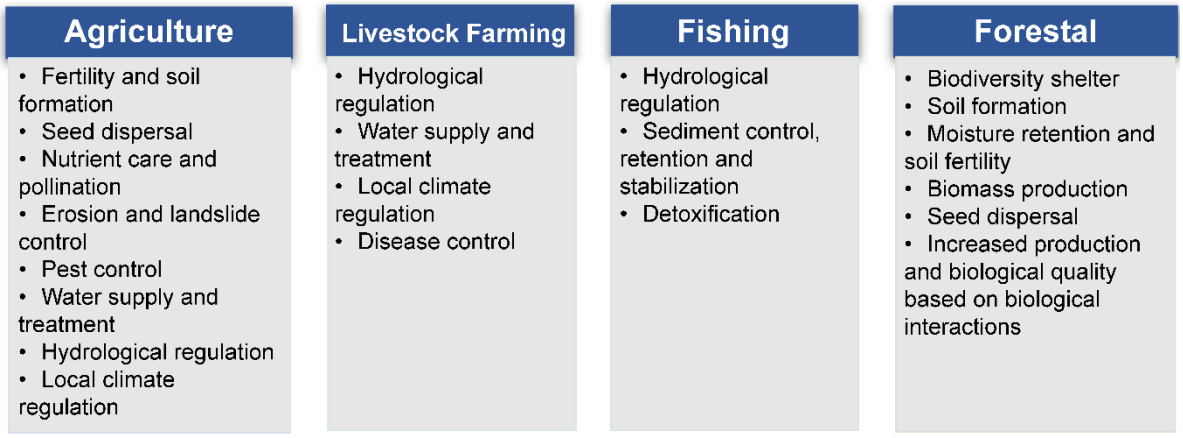


Figure 3. Main ecosystem services essential to the agricultural sector.

Source: UNDP 2021 based on data from the Ministry of the Environment, UNDP (2014) and Ruiz et al. (2014)

3. Financial incentives for the agricultural sector

Overall, policy instruments are designed to promote or discourage certain behaviors or activities. The CBD, for instance, defines the concept of incentive as an "*economic or legal instrument designed to favor beneficial activities (positive incentives) or to discourage activities that affect the conservation and sustainable use of biological diversity (negative incentives)*" (CONAM, 2001).

According to the specialized literature, no policy instrument is explicitly designed to have a detrimental effect on any given area. Nevertheless, in the quest to promote their specific aims, whether these are expressed in economic, social or even environmental terms, a particular instrument can, at the same time, generate involuntary negative effects on biodiversity and its ecosystemic environment, becoming a ***perverse incentive***. These unintended effects tend to occur either when the instrument causes the reduction of the cost of one or more environmentally harmful activities, generating an increase in their scale and volume of damage (UNDP, 2018), or when it inhibits technological changes that enable more efficient processes based on good environmental practices (OECD, 2020).

The PIR (BIOFIN UNDP, 2016), in line with the CBD, points out that the country has various sectoral policy instruments that generate or have the potential to harm the country's biological wealth and the resilience of the ecosystems in which they are located. These factors represent a double burden for national governments, as they represent higher expenditure and/or lower tax revenue, while at the same time imposing high costs on the nation derived from environmental degradation and its impact on the economy (UBA, 2017).

3.1 Review of international experiences

At an international level, the starting point for successful experiences in reforms to perverse incentives that have direct impacts on biodiversity and ecosystem services begins with the approach developed by the Institute for European Environmental Policy (IEEP), which defines the impact on biodiversity and ecosystems via the application of sectoral policy instruments as the result of a government action that grants an advantage to consumers or producers, but in doing so discriminates against positive environmental practices (IEEP et al., 2007).

Regarding the agricultural sector, the review of reform experiences indicates that the effects on the environment and biodiversity encouraged by policy measures in this sector were mainly associated with processes of intensification of land use through the implementation of intensive agricultural production systems. These situations cannot be extrapolated to the national reality, as the country has a different territorial landscape, with a high percentage of natural cover and high

rates of deforestation. The most relevant successful cases of reforming a perverse incentive are briefly described below.

- Water overexploitation (input subsidies)

Czech Republic: This country subsidized a fraction of the cost of recovering water supplies, both in households and in agricultural production units, which became a subsidy for the extraction, treatment and distribution of this resource, leading to the overexploitation of water sources; however, since the 1990s this subsidy has been gradually removed, resulting in a reduction in the consumption of water resources (IEEP et al., 2007).

- Overuse of fertilizers and agrochemicals (input subsidies)

Indonesia: Due to the decline in oil prices in 1984, the government made several tax cuts, including the elimination of subsidies for the sale of pesticides, together with a ban on the import of these types of products. In addition, the subsidy elimination was accompanied by training for farmers in crop protection practices along with information on pests and diseases. The benefit to biodiversity became evident through the reduction in the use of pesticides, which lowered the level of toxins in the soil, water sources, natural ecosystems and the environment in general. Thus, one of the lessons learned was that subsidy reforms, carried out together with well-executed programmes and institutional support measures, are more likely to succeed (de Moor & Calamai, 1997).

- Comprehensive agricultural subsidy reforms

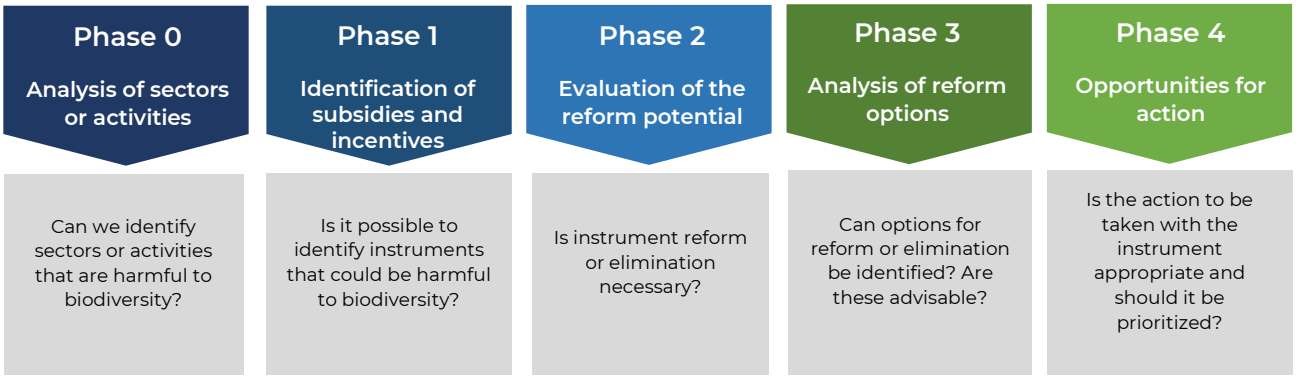
New Zealand: In the 1990s, the agricultural sector was highly protected, which caused market distortions, overproduction and land degradation. In 1986, a fiscal crisis struck the country, and the government started a programme to eliminate all agricultural subsidies (support for the prices of wool, beef, lamb, dairy products, subsidies for fertilizers, irrigation, transportation, etc.).

As a result, changes were seen that contributed to improving biodiversity. On the one hand, the decrease in the use of fertilizers and pesticides helped to reduce pollution levels in rivers and on the land and, on the other hand, the excess of livestock, which had been one of the main causes of the high levels of soil erosion, was stopped. The livestock industry opted for a system based on suitable land, instead of using hills prone to erosion, which were reforested.

4. Analysis of agricultural sector incentives

In order to have relevant, accurate and comprehensive information for the selection of instruments susceptible to modification, the methodology known as the "Toolbox for the Reform of Environmentally Harmful Subsidies and Incentives" (IEEP, 2017) was implemented, consisting of a series of steps to obtain key inputs and elements for the development of a viable reform (Figure 4).

Figure 4. Conceptualization of the methodology to identify the reform route for Perverse Incentives



Source: UNDP 2021 based on IEEP 2017.

4.1 Agricultural sector instruments with potential negative effects on biodiversity and ecosystem services

Near the end of the last century, the CBD established that, despite the significance of biodiversity and ecosystem services in agricultural production, the associated advances in this sector occurred without greater consideration for the negative effects caused to biological diversity (CBD, 2008).

Some examples of this situation are modern practices aimed at intensifying production, many of which involve a simplification of biotic components derived from the use of monocultures and high-yield varieties (at the expense of traditional or local varieties), as well as the increasing need for inorganic fertilizers with a high nutrient load, among other factors.

At a national level, the benchmark is the National Policy for the Integral Management of Biodiversity and Ecosystem Services (PNGIBSE) (2012), which states that the loss and transformation of vegetation cover is the main factor affecting biodiversity and the provision of ecosystem services in the country (Ministry of the Environment, 2012). This statement was corroborated in 2016 by the Alexander von Humboldt Institute for Research on Biological Resources (IAvH) in its report on the status and trends of biodiversity in Colombia, which

indicated that land use change is the main factor in the loss and transformation of the composition and diversity of national ecosystems (Andrade et al., 2016).

4.2 Identification of the drivers of biodiversity loss and transformation in the agricultural sector according to the PNGIBSE

Successful reform or the gradual elimination of perverse incentives depends to a large extent on the appropriate identification of those policy instruments that, unintentionally, encourage anthropic activities that generate major impacts on biodiversity. A global classification of the five main direct drivers of biodiversity transformation and loss is currently available, which is presented by the PNGIBSE according to the analysis adapted for the country. Therefore, analyzing the potential impacts that can be attributed to the agricultural sector in light of the drivers of biodiversity loss is a priority.

Identification begins with the two types of agricultural growth: by extension of the cultivated area (extensive) and by increased yields and productivity (intensive). Subsequently, in each of these modalities, the particular activities or processes that cause a loss or deterioration of biodiversity (including associated biodiversity) at any of its levels are identified.

In this way, each of the five drivers of transformation or loss of biodiversity within the agricultural sector was specifically characterized (**¡Error! No se encuentra el origen de la referencia.**), to enable the identification, classification and prioritization of policy instruments so that their negative impact can be mitigated, inhibited or eliminated.

Table 1. Drivers and variables of biodiversity loss and transformation identified for the agricultural sector

Drivers of transformation and loss of biodiversity - national scale	Drivers and factors of transformation and loss of biodiversity identified in the agricultural sector
Driver 1: Changes in land use (continental or aquatic), land occupation and the fragmentation of ecosystems	**Driver 1: Extension of agricultural land into new areas (land use change)**
	1.1 Colonization in tropical rainforest areas
	1.2 Transformation of tropical savannas due to livestock and agro-industrial activities
	1.3 Transformation of wetlands and páramos
	1.4 Expansion of illegal crops in forest areas
	1.5 Impact on water bodies
Driver 2: Pollution and toxification	**Driver 2: Growth of intensive production systems**
	2.1 Standardization and genetic simplification of high-yield agricultural and animal production systems
	2.2 Vanishing of crops and animal systems of native and creole species and breeds
	2.3 Disappearance of crop rotation, succession and intercropping practices, including forest barriers
	2.4 Deterioration and loss of soil and water sources due to pollution caused by the inappropriate use of fossil fuels and agricultural inputs
	2.5 Loss of pollinator populations due to habitat loss and the use of agricultural inputs
	2.6 Loss of insect and microorganism populations, associated with biological pest control and soil fertility, due to habitat loss and the use of agricultural inputs
Driver 3: Introduction and transplantation of species	**Driver 3: Introduction of exotic species and reproductive material**
	3.1 Impact on biodiversity through predation, competition, hybridization, habitat use, reproduction, breeding and disease transmission.
	3.2 Alteration or destruction of the balance of local ecosystems and their effect on the provision of ecosystem services
Driver 4: Decrease, loss or degradation of elements of native ecosystems and agro-ecosystems	**Driver 4: Overexploitation of wildlife**
	4.1 Legal and illegal logging
	4.2 Exploitation of wildlife for subsistence
	4.3 Legal and illegal fishing, for commercial activities and subsistence
Driver 5: Climate change	**Driver 5: Greenhouse gas emissions (GHG)**
	5.1 Methane emissions from livestock populations
	5.2 Release of nitrous oxide (N2O) due to the use of nitrogen fertilizers

Source: UNDP 2021 based on PNGIBSE.

4.3 Transformation of land use for agricultural activities in Colombia

The stage of identifying the effects on biodiversity focused on the geographical analysis of the behavior of agricultural production systems at the national level. As indicated previously, the development of this sector has historically been based on a pattern of expansion and intensification of production. Consequently, the following drivers of biodiversity loss and transformation were prioritized:

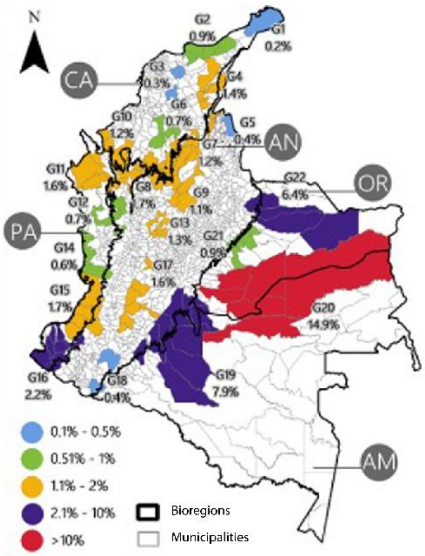
Driver 1: Extension of agricultural land to new areas

Driver 2: Growth of intensive production systems

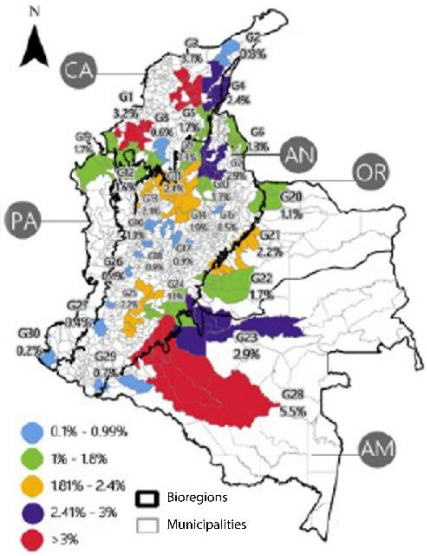
The geographical analysis was carried out for two periods, the first between 2001 and 2011 and the second between 2010 and 2018[2], in order to show how the two prioritized drivers behaved and the extent to which they affected the municipalities and natural bioregions.

The maps resulting from the analysis are as follows:

Map 1. Expansion of the agricultural frontier 2001-2011



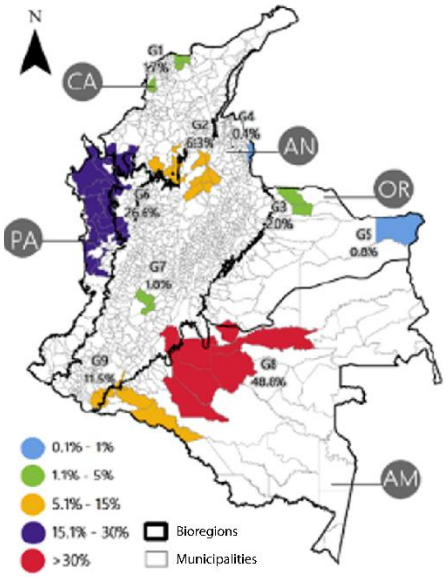
Map 2. Intensification due to improved yields 2001 – 2011



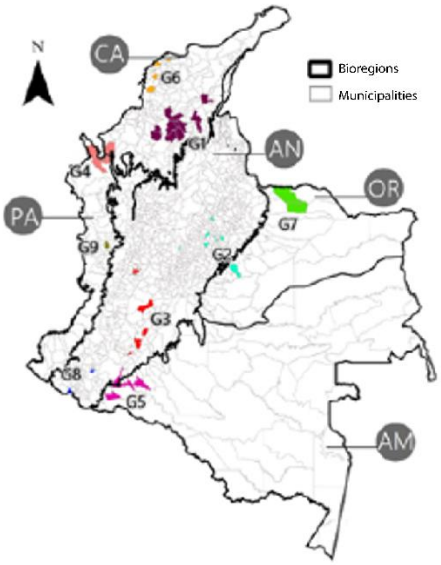
Source: UNDP 2021

[2] The geographical analysis was carried out using information from the land cover layer (land use) and the geographical layer of forest and non-forest cover produced by IDEAM (1:100,000) and data contained in the 2014 National Agricultural Census (CNA), the National Agricultural Survey (ENA) and the Municipal Agricultural Evaluations (EVA).

Map 3. Changes in forest cover between 2010 - 2018



Map 4. Expansion of the agricultural frontier in municipalities with high rates of relative deforestation 2010 - 2018



Source: UNDP 2021

Note: *The legend shows the change (%) in natural forest cover to non-forest cover at the municipal level associated with the Municipal Agricultural Evaluations.*

The 2001 – 2011 analysis focused on two scenarios:

- The first scenario (Map 1) corresponds to the variation in natural cover due to the expansion of the agricultural frontier. This shows that at least 50% of the total hectares of transformed forest cover (Driver 1) are concentrated in 96 municipalities, located in the Amazon (AM), Pacific (PA) and Orinoquía (OR) bioregions. Furthermore, it is shown that during this period the greatest expansion occurred in municipalities of the Orinoquía and the Amazon regions with a range between 2.1% and 10% increase in the expansion of agricultural production systems; similarly, both at the national and bioregional level, permanent palm and banana crops and temporary rice and corn crops were the most recurrent production systems.

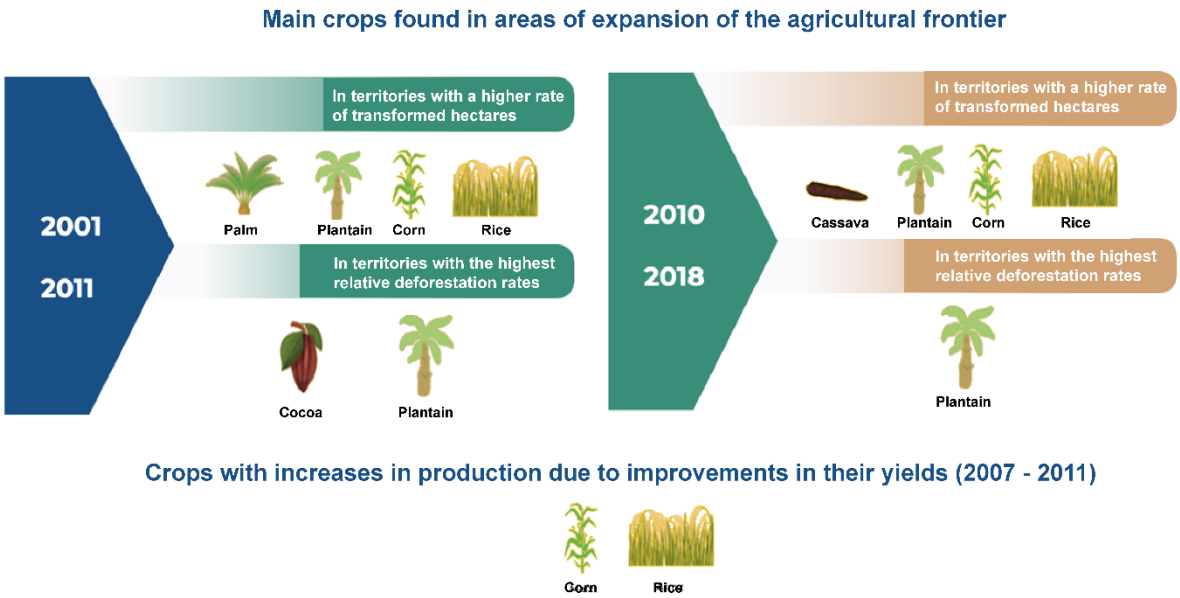
- The second scenario (Map 2), was focused on the analysis of crops that show increases in their yield. According to this, at least 50% of the total hectares of forest cover were transformed into other agricultural systems within the agricultural frontier, especially the transitional crops of rice and corn (Motive 2). In this case, the Caribbean region and the north of the Andean region show a greater number of municipalities where intensification was in the range between 2.41% and 3%.

Meanwhile, the analysis for the 2010 – 2018 period shows the following:

- The third map shows that 75% of the loss of forest cover is accounted for by 54 municipalities (Map 3), where the greatest changes in forest cover occurred in the Amazon region. In addition, it displays the changes in forest cover in the north of the Chocó biogeographic region with figures between 15.1% and 30% and more than 30% for the Amazon region (Driver 1). During this period, the predominant production systems were pasture for livestock, banana, corn, rice and cassava.
- Furthermore, the fourth map shows the loss of forest cover due to the increase in the agricultural frontier with respect to the total area of forest due to deforestation processes[3], in at least 48 municipalities that show this behavior (Driver 1) (Map 4).

On the other hand, regarding the driver of biodiversity loss due to land use change, caused by the expansion of the agricultural frontier, between 2010 and 2018 there is a notable link with livestock production, permanent crops of bananas, palms and cocoa, and transitional crops of rice and corn (Figure 5). Concerning the driver of biodiversity loss due to the intensification of production systems within the agricultural frontier, the presence of transitional rice and corn crops stands out.

Figure 5. Agricultural crops identified in the most affected areas



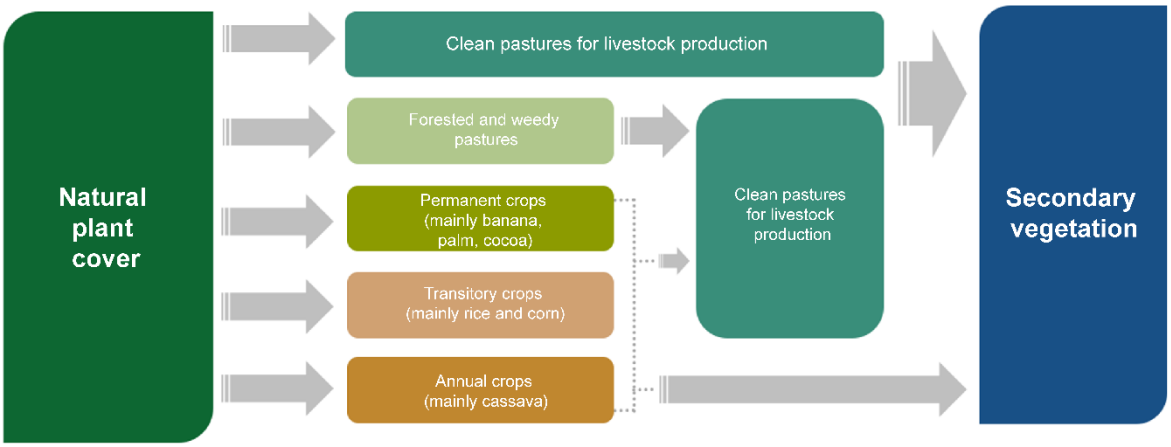
Source: UNDP 2021

[3] Deforestation is not entirely caused by the expansion of the agricultural frontier; there are other environmental stressors associated with the model of land occupation that were not disaggregated in this analysis.

Moreover, the pattern of land use was identified as having recurring changes that are repeated in most cases at the national level with crops associated with the change in land cover (Figure 6).

The natural plant cover was mainly used for the cultivation of bananas, African palm, cocoa, rice and corn. Subsequently, this transformed land was used for livestock production, and later some of this land was changed to secondary vegetation.

Figure 6. Estimated pattern of change in land use



Source: UNDP 2021

4.4 Use of instruments for land use management and transformation Case study: Department of Caquetá

In order to gain a comprehensive understanding of the chain of transformations generated by human intervention at the departmental level, this study included a geographical analysis of land use management for the department of Caquetá.

This process begins with the occupation of the territory through polygons that later become known as land plots and/or properties. The aim was therefore to identify how the plots of land that later gave rise to economic practices of exploitation and land use change associated with potential impacts on biodiversity were consolidated.

The analysis of the management instruments of the rural land use management was carried out with the available cadastral maps for 2009 and 2020 and comparable over time with the period cuts of the IDEAM natural coverage maps: 2001–2007–2011 and 2010–2018.

Additionally, they were cross-referenced with the areas susceptible to flooding according to the IDEAM mapping and a thematic analysis was carried out with the reserves layer of Law 2/ 1959, through which it was identified which lands were formed during this time in these areas of special environmental interest.

The superimposition of the different layers makes it possible to identify how many properties (property units) were registered in the department during this period, their size and the changes they underwent in the area where there was variation in forest cover or in the cover that persisted between the period 2000 and 2018[4].

It must be emphasized that the analysis did not establish causality. However, the methodology attempted to analyze how the management of the territory, or the lack thereof, enables the occupation of the territory to be made viable, consolidated, facilitated and/or intensified, thus activating the identified drivers of biodiversity loss.

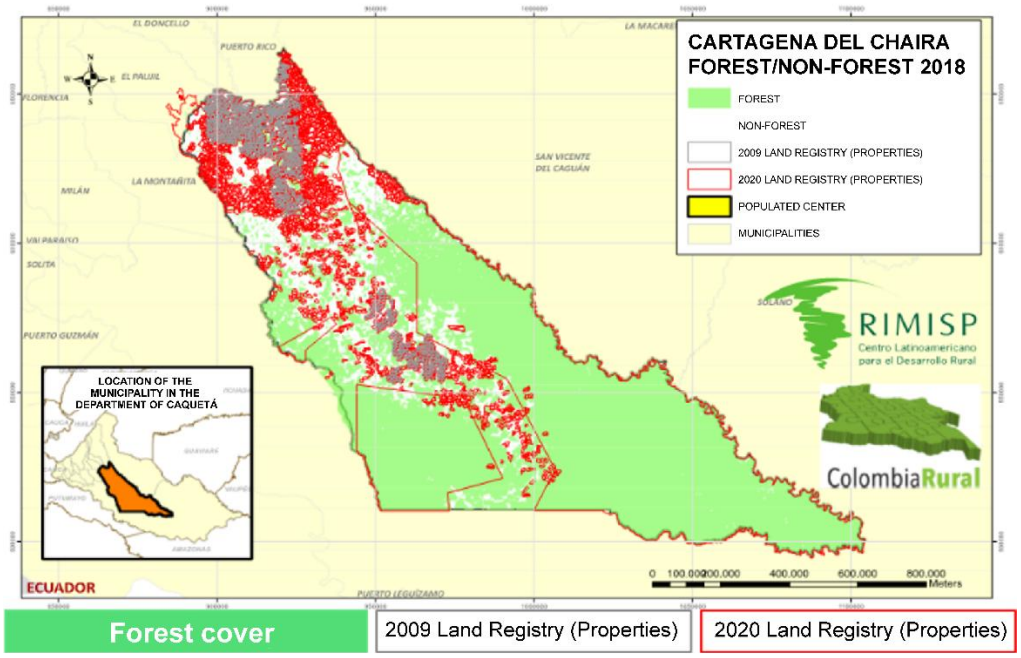
Main findings of the Caquetá case study

- The superimposition of the cadastral maps from 2009 and 2020 shows a 57% increase in the number of properties in the department, from 26,593 to 42,787. All municipalities, without exception, experienced an increase in the number of properties registered in the land registry. Both the growth in the number of properties and the growth in the area of properties in Cartagena del Chairá, Florencia, Solano and San Vicente del Caguán are noteworthy.

- A link was established between the growth in the number of plots (property units) and the areas with changes in plant cover (Map 5). Seven (7) of the 16 municipalities showed that more than 50% of the growth in landholdings occurred in areas with transformation of natural cover from small properties that are spreading into zones without ownership titles[5].

[4] Considering that the Corine Land Cover and Forest - Non Forest coverages cover different periods and different land cover mapping methodologies, the analysis was carried out considering the balance of the variation of coverage in the aggregate period.
[5] This analysis did not seek to identify the number of land registry transactions, but rather property registry entries for new properties in the areas of greatest intervention in the coverage.

Map 5. Landholding growth in the municipality of Cartagena del Chairá, Department of Caquetá, between 2009 and 2020.



Source: UNDP 2021.

- About landholding growth in areas susceptible to flooding: except for Florencia and San José del Fragua, all the municipalities experience landholding growth in their areas that are susceptible to flooding. Although the occupation of floodable areas by people varies according to the dynamics of periods of drought and flooding, there is no evidence of adequate delimitation of the waterways or of the areas adjacent to riparian buffers.
- Changes in forest cover between 2009 and 2020 in the area made up of the indigenous reservations and the [6]El Pato-Balsillas[7] Peasant Reserve Zone, located in the northwest of Caquetá, and its relationship with forest/non-forest cover for the period 2010–2018. In both types of areas, the conservation of forest cover during this period was evident, and even in the municipalities of Montañita and Solano, where the indigenous reserves are located, an increase in forest cover was recorded.
- Regarding the relationship between the property dynamics and the areas subtracted from the Forest Reserve Zones (FRZ): In this case, the number of properties with forest cover in the areas subtracted in 2009 and 2020 was analyzed with the forest/non-forest cover between 2010 and 2018. The municipality of Belén de los Andaquíes stands out as the area with

[6] Bearing in mind that the reservations were established over time and in different areas, the first and last dates of establishment of the reservation and the Peasant Reserve Zone were taken as a reference.
[7] Only the El Pato Balsillas Peasant Reserve Zone is included as it is the only one formally constituted.

forest cover in the areas subtracted by Law 2/1959 increased between 2009 and 2020. In the remaining 15 municipalities there was a loss of forest cover that did not exceed 35% of the initial cover found in 2010 in the areas subtracted.

Based on the cartographic results and by way of conclusion, the findings showed a link between the increase in the number of properties/land plots (property units) and the growth of the agricultural frontier expansion in areas of special interest for biodiversity, which denotes gaps or deficiencies either due to the operation or omission of public policy instruments that, theoretically, are designed to socially and environmentally organize the territory without negative impacts on biodiversity.

4.5 Inventory and analysis of the instruments of the agricultural sector and land use management

For the agricultural sector, a total of 42 current instruments were identified, including sanitary regulations, financial instruments, price and market regulation, some with a focus on the differentiated rural population and specific by sector (Annex 1). The following is a brief summary of the most relevant instruments in the agricultural sector, broken down into different groups, detailing their relationship with biodiversity and ecosystem services.

4.5.1 Financial instruments

Incentive for Rural Capitalization (ICR), Special Lines of Credit (LEC) and Agricultural and Rural Development Credit (CFA)

The Special Lines of Credit (LEC) and the Rural Capitalization Incentive (ICR) are the instruments with the greatest strategic relevance, as they are two of the most important lines of financing of FINAGRO (Table 2). The Special Lines of Credit with subsidized rates are instruments to support the competitiveness of the agricultural sector, they are provided through the subsidy of the credit rate in differentiated lines according to the investment and the type of population, while the ICR is an incentive that is granted to those who formulate an agricultural investment project that has been financed by a credit, and that covers part of the cost of said investment.

The Agricultural and Rural Development Credit (CFA) is a financing instrument created alongside the national agricultural credit system (FINAGRO) by Law 16/1990, aimed at boosting agricultural production in its different phases. This instrument has mainly focused on small and medium-sized producers.

The analysis of the subsidies granted by the LEC has identified rice and livestock activities as the production chains that receive the most funding, accounting for 29% of the resources granted.

Between 2016 and 2018, the rice production chain benefited from COP$302.949 billion in LEC credits, as well as COP$9.614 billion in interest rate subsidies, corresponding respectively to 23.3% of the total amount of credits granted, 7.3% of the total amount of subsidized rates and 29.7% of the total amount of investments made throughout the country through this instrument.

Meanwhile, the livestock production chain has received COP$180.203 billion in credit and COP$31.788 billion in interest rate subsidies in the same period, which has catalyzed COP$221.403 billion in investment, which correspond respectively to 13.8%, 24.1% and 11.9% of the total amounts at the national level (**¡Error! No se encuentra el origen de la referencia.**) (Finagro, 2021).

In the case of the ICR, the UPRA (2019) points out that this incentive has helped to leverage practically all the investment needed in the different links of the rice production chain to improve the sector's productivity, including the adaptation of land, provision of irrigation, drainage and flood control, as well as investment in machinery, among other things (UPRA, 2020).

Table 2: Share of rice and livestock production chains in the total resources granted at the national level via LEC and ICR

	Rice production chain	Livestock production chain	Livestock + Rice
LEC	*(total % from 2016 to 2018)*		Total
Number of LECs granted	6%	4%	**10%**
Credits granted	23.3%	13.8%	**37.1%**
Interest subsidy	7.3%	24.1%	**31.4%**
Investments made	29.7%	11.9%	**41.6%**
ICR	*(total % from 2014 to 2018)*		Total
Number of incentives granted	0.8%	1%	**1.8%**
Value of projects	5.1%	3%	**8.1%**
Value of incentives paid	4.6%	5%	**9.6%**

Source: UNDP 2021 based on FINAGRO (2021), UPRA (2019 and 2020).

Although the ICR and the LEC have benefited agricultural production chains that may be related to the loss of biodiversity, the limitation regarding the availability of information on production chains at the municipal level means that it is not possible to establish a direct causal relationship between the incentives and

subsidies provided by these instruments, and the municipalities with the highest rates of relative deforestation and change in forest cover identified for the period 2010-2018, as a more exhaustive analysis would be required to trace the investment leveraged through financial instruments and its relationship to the development of agricultural activities and the state of vegetation cover before or during the granting of the incentive.

Nevertheless, based on the available information and the qualitative analysis carried out, it is hypothesized that the decision to develop these production systems in the transition zones of the municipalities with the greatest impact due to the processes of loss and transformation of natural cover may be related to the expectations that producers in these zones have regarding access to the benefits granted by both the ICR and the LEC, once they become landowners. According to this hypothesis, the inclusion of environmental guidelines is neither sufficient nor explicit in these instruments, since they are limited to the UPRA zoning instruments, which are based on productive criteria. This is the case for the LEC, in the case of the CFA no environmental guidelines are contemplated.

Note that 33% of the resources granted for LEC between 2017 and 2020 have been allocated to agricultural intensification processes, and 39.2% have been allocated to strategic sectors corresponding to livestock production systems, corn and rice that have the greatest impact on the planet's carrying capacity (Finagro, 2020). This, added to the fact that these instruments do not contemplate environmental sustainability guidelines, can lead to the overuse and inappropriate use of agrochemical inputs, with devastating consequences for the biodiversity found within the agricultural frontier.

Agricultural Insurance Incentive - ISA, Agricultural Guarantee Fund - FAG and the Rural Microfinance Fund - FMR

The Agricultural Guarantee Fund (FAG) and the Rural Microfinance Fund (FMR) are to support the financial operations of producers when they do not have sufficient credit guarantees to improve their performance and competitiveness. For both FAG and FMR, beneficiaries must be approached through financial institutions, which in the specific case of FMR must have specialized microfinance technologies in place. The primary financial support provided by the FAG is focused on peasant units, which by 2020 guaranteed 14.3% of credits and financial operations, followed by coffee with 9.1%, and the livestock sector with support of up to 12% of credits for meat and dairy cattle farming[8].

The Agricultural Insurance Incentive (ISA) is a capitalization provided to producers to encourage the insurance of agricultural production against possible climatic or health risks. The majority of the incentives granted by this instrument

[8] There is no information available on the implementation of the Rural Microfinance Fund.

go to large producers (Table 3). Although the design proposes favorable access and operating conditions for small producers, it does not specify a maximum share by size. Even though the ISA is related to possible climatic and environmental risks, it does not include a verification measure in terms of sustainability for the insurance companies that provide it (Finagro, 2020).

There are other risks related to agricultural activities that are also not taken into account in the FAG and ISA instruments. These include changes in land use and intensive irrigation practices that salinize the soil, leading to a decline in agricultural production and, consequently, in the quality of ecosystem services.

Table 3. Percentages of shares granted for the FAG and ISA in 2020

	Total	Total crop share	Corn	Rice	Livestock	Plantain	Cocoa	Palm
FAG								
Total value of credit	3,262,478 *	40.3%	NA	5%	28%	4%	3%	NA
Total certified value	2,389,173 *	41.0%	NA	5%	29%	5%	3%	NA
Total number of certificates	280,686	30.6%	NA	1%	22%	5%	3%	NA
ISA								
Insured units (ha)	217,228	44.5%	8%	20%		14%	1%	2%
Insured units (animals)	26,923	99.6%			100%			
Insured Value	1,479,347 *	56.1%	5%	11%	3%	32%	3%	2%

* Figures in millions of Colombian pesos (COP)
Source: FINAGRO 2021

Analysis of sanitary and agricultural inputs market regulations

Sanitary and agricultural input market regulations consist of instruments that regulate access to both the national and international markets through compliance with technical regulations, which can be classified according to where they are applied in the production chain, as follows:

I. Those related to the regulation of seeds, cultivars[9] and genetic material, both genetically modified, native and improved varieties;
II. Inputs such as fertilizers, pesticides and manure, and all the machinery and infrastructure required for the operation;
III. Those related to the suitability of land for agricultural production;
IV. Livestock regulations;

[9] Cultivars: cultivated plant varieties that have been selected or developed using agricultural improvement techniques to possess specific desirable traits. Martin, F.W. and Ruberte, R.M. (2009). Vegetable Production: Principles and Practices

V. Good agricultural and livestock practices.

Sanitary regulations and regulations on seeds, cultivars and agricultural genetic material refer almost exclusively to the genetic, physical and physiological quality of the seed concerning its productive capacity, as they do not contemplate any environmental criteria for its use and commercialization beyond those related to possible phytosanitary risks. Note that the production chains for rice, corn, soy and cotton have different regulations for the use, production and access to seeds, as well as the farmer privilege that allows them to use the results of their own harvest for replanting as they are protected varieties. On the other hand, seed regulation for other types of crops favors homogenization and limits diversity in food production, which has a negative impact in terms of biodiversity.

In the case of Good Agricultural Practices (GAP) and Good Livestock Practices (GLP), both relate to conditions for improving sanitary status. GAP covers the whole process between sowing the seeds and harvesting the products, intending to ensure that all fruit and vegetable farms in the country are certified and, in this way, guarantee food safety by preventing the risks associated with primary production. GLP consists of an assurance system for quality and safety in primary production, the purpose of which is to obtain healthy and safe food on farms (ICA, 2021). Failure to include environmental sustainability criteria in sanitary assessments can be counterproductive in the long term, as it does not involve the sanitary risks related to the loss of biodiversity and natural biological control.

Policies related to the agricultural operation link tied to the use, production and commercialization of fertilizers, pesticides and other inputs do not consider environmental conditions of either access or use, they only regulate parameters related to the quality of the products, without taking into account their use. Failure to consider sustainability guidelines in the regulation of the use of and access to these inputs can be related to processes of crop intensification based on their overuse, which has an impact on biodiversity and agricultural production. This is relevant for Colombia, which is the country that uses the most fertilizers in Latin America (OECD, 2014).

Analysis of sector-based and focalized instruments

The production chains for cocoa, rice, cereals and livestock are the ones that have the most differentiated instruments to promote their competitiveness. Neither of the instruments includes environmental conditions or sustainability guidelines for access or operation, and most of them aim to provide economic protection for the specific sector. These sectors also coincide with most of the LECs, Agricultural Insurance Incentives, and FAGs granted between 2019 and 2020 according to FINAGRO (Geoportal - Finagro, 2021). Moreover, note that there are inter-institutional governance systems and cooperation between producers' associations for the development of policies related to improvement, such as the

Rice Promotion Commission, the Cereal Promotion Commission and the Cocoa Promotion Commission; the environmental sector does not participate in any of these bodies. This explains why none of the instruments analyzed include principles related to environmental sustainability, even though they have a significant impact as stressors of ecological limits.

A highly homogenized social-ecological system is a less resilient system because it reduces the number of flows and variables, which means that, in situations of high environmental stress, they are more likely to collapse and have less regenerative capacity (Holling et al., 2002). When the instruments they promote have criteria that encourage the growth of a single particular sector, they favor this homogenization of socio-ecological systems, leading to the ecological collapse of the region and affecting the future sustainability of these agricultural activities (Holling et al., 2002).

Upon reviewing the policies focused on a specific population, be it peasant, *Raizal*, Afro, *Palenquera* and/or indigenous populations, for the promotion of income generation, access to markets and commercialization, defined as Family and Community Peasant Economy (ECFC), and the Promotion Fund for Rural Women, it was concluded that these instruments include, in their design, some guidelines related to the sustainable management and protection of natural resources, and operating and access conditions related to the environmental sustainability of the related projects. Nevertheless, these environmental guidelines are neither exclusive nor obligatory, they are only advisable, and they do not include any differentiated benefits for access or operation, which means that they have practically no relevance.

4.5.2 Productive instruments

National policy to improve the competitiveness of the dairy sector in Colombia

The dairy sector is of economic and social significance for the country and is important in terms of food security, making it a strategic sector within the agricultural sphere.

Furthermore, due to its high nutritional value, milk is considered a priority product when it comes to guaranteeing food security, particularly for infants and young children.

In order to overcome the low competitiveness of the dairy sector and to face the eventual competition resulting from the entry of dairy products into the country under free trade agreements, as well as to take advantage of the comparative advantages offered by the sector to compete in other markets, the National

Council for Economic and Social Policy issued the National Policy to Improve the Competitiveness of the Colombian Dairy Sector, through document CONPES 3675/2010 (DNP, 2010a). This policy seeks to generate strategies and instruments that will reduce costs and increase productivity in the dairy industry.

CONPES 3675/2018 states that this sector represented 10.2% of agricultural GDP in 2008 and generated 578,000 jobs, 468,000 in dual-purpose livestock activities and 110,000 in specialized livestock (Fedegan, 2009, as cited in DNP, 2010a).

By 2019, almost a decade later, the sector's share of the economy had increased to 11.7%, and it had also generated 937,000 jobs, 677,000 in dual-purpose livestock farming and 260,000 in specialized livestock farming (UPRA, 2020).

Additionally, as part of the policy guidelines for the dairy chain, a series of complementary policy initiatives and instruments have been formulated and implemented, which also seek to improve the competitiveness of the sector.

The following is a list of the policy initiatives and instruments identified that are currently in force:

- CONPES 3675/2010 - National policy to improve the competitiveness of the Colombian dairy sector.
- CONPES 3676/2010 - Consolidation of health and safety policy for the dairy and meat chains of production.
- Strategic Plan for the Colombian Dairy Sector - PESL.
- Pact for the growth of the dairy sector.
- National Bovine Genetic Improvement Programme - PNMGB
- Colombian Livestock Plan - Roadmap 2018-22.
- Dairy chain in the Productive Transformation Programme - PTP.
- Production Management Plan - POP for the Dairy Chain 2020-23.

Of all the instruments and initiatives listed, only the POP for the Dairy Chain includes guidelines and criteria that reflect a commitment to the protection of the environment, biodiversity and resilience processes in agroecosystems and their environments, mainly through climate risk management, the use of alternative technologies throughout the chain, and the environmental management of water resources, soils and forest cover, as well as comprehensive waste management (TNC, 2019)(Gutiérrez et al., 2021).

The analysis of the regulatory framework and/or the design that regulates the instruments and initiatives that make up this policy, with the exception of the dairy POP, highlights the absence of environmental criteria and guidelines for access and operation that prevent or reduce the damage to ecosystems and

biodiversity derived from the expansion of the agricultural frontier or the intensification of production systems.

Concerning location criteria, except for the lines of credit created by the National Agricultural Credit Commission (CNCA), the incorporation of conditions or restrictions derived from land use management is not identified either.

4.5.3 Land policy and land use management instruments

The analysis of the social management of rural property was carried out by prioritizing ten (10) instruments (Table 4) with potential impacts on the conservation and loss of biodiversity.

Therefore, a summary of this technical relationship is shown below, which, together with the results of the analysis and cartographic exercise carried out for the department of Caquetá, are the main input for the prioritization phase of the instruments.

Table 4. OSPR instruments with a high impact on biodiversity

#	Instrument
1	Allocation of vacant lands
2	Collective land titling
3	Demarcation, recovery and administration of community savannas and floodplains
4	Reversion, asset forfeiture and expiration
5	Comprehensive Property Survey for OSPR purposes
6	Awarding of rights of use over vacant land ineligible for allocation
7	Subtraction of Forest Reserve Zone
8	Establishment of the Peasant Reserve Zone
9	Administration of environmentally protected areas
10	Calculation for the Family Agricultural Unit (UAF) extensions

Source: UNDP 2021

- **Allocation of vacant lands:** The land titling processes for vacant lands have historically been associated with colonization and the expansion of the agricultural frontier. This has led to the process of allocating vacant land via property rights constituting one of the major driving forces behind the expansion of agricultural land through the direct promotion of colonization.

- **Collective land titling:** The objective of collective land titling in favor of indigenous and Afro-Colombian communities is to guarantee their settlement, the protection of their cultural identity and their development, and a positive trend has been recognized in favoring sustainable use and conservation.
- **Demarcation, recovery and administration of communal savannas and floodplains:** The exploitation of communal savannas and floodplains is specially regulated due to the social and ecological particularities of these ecosystems. Environmental authorities exercise this power together with the agricultural authorities and contribute to better management, management and regulation of ecosystems by establishing restrictions on their use and exploitation that favor conservation through the establishment of management plans.
- **Reversion, asset forfeiture and expiration:** Agricultural regulations establish administrative mechanisms and instruments that allow the National Land Agency to sanction the exercise of property when it is exercised in a way that is not in line with the inherent social and ecological functions of the property. Therefore, it turns out to be a potentially positive incentive when imposing limits on the use and exploitation of the land, as well as contemplating sanctions and measures oriented towards the recovery of state ownership.
- **Comprehensive Property Survey for OSPR purposes:** The comprehensive property survey, carried out by the National Land Agency, is a way of addressing land issues and includes variables and dimensions not previously considered by the agrarian authority. Thus, the intervention will guarantee the resolution of all informal and irregular issues associated with the land on a large scale and, as such, the investments made for its development shall have an impact on biodiversity.
- **Allocation of rights of use over vacant land ineligible for allocation:** Agreement 058/2018 of the National Land Agency establishes how vacant land can be ineligible for allocation from an environmental perspective in order to preserve biodiversity. On the one hand, properties located within areas identified as Forest Reserves (defined in Law 2a/1959), and on the other hand, vacant land ineligible for allocation derived from the clear delimitation of communal savannas and floodplains. However, this group of properties is the one that has historically been under high anthropic pressure.
- **Subtraction of Forest Reserve Zone:** This tool has been consolidated as a way of legally enabling land for agricultural exploitation, to the point that the lands resulting from these subtractions are included in the final agreement for the termination of the conflict, as one of the sources that feeds the land fund of 3 million hectares.

- **Establishment of a Peasant Reserve Zone:** The concept of peasant reserve zones, as set out in Law 160/1994, includes special characteristics of great relevance for the definition of territorial and productive development models. Although this figure does not imply automatic restrictions on property, the truth is that its creation goes hand in hand with the idea of promoting stronger and more participatory local development and with restrictions oriented by a model based on the peasant family economy and a distribution of land more associated with this model.

- **Administration of environmentally protected areas:** The creation or expansion of protected areas goes hand in hand with restrictions and management regulations that improve the environmental management of the territories and prevent environmental degradation. Although this is a tool used in the environmental sector, this type of decision has an enormous impact on the social management of rural property, on the one hand, by imposing strong restrictions on the possibility of consolidating property rights in these areas and, on the other hand, by imposing limits on the use and exploitation of the land.

- **Calculation for Family Agricultural Unit (UAF) extensions:** The Family Agricultural Unit was one of the new features of Law 160/1994. This is used at different times when exercising authority over rural land, from the recognition or awarding of rights, to more punitive measures such as the recovery of improperly occupied vacant land, and even more general management scenarios such as the establishment of particular UAFs in some cases. In all these cases the UAF plays a technical role that contributes by imposing limits on the exploitation of the land and in this way materializing the social function of property.

4.6 Identification of prioritized instruments – SMEs Group

A set of prioritization criteria was developed using the technical inputs, the agricultural sector analysis and the forty-two (42) sector instruments, in order to identify the sector's reform potential.

These criteria are as follows:

a) Current conditions for access and location
b) Current operating conditions
c) Possibility of including environmental criteria for access
d) Possibility to modify the governance regime
e) Reform potential
f) Opportunities for action

This proposal allowed a group of experts specialized in the formulation and management of management instruments in the agricultural sector at a national level to identify instruments that have a causal relationship with the drivers of biodiversity loss and, therefore, critical elements for an eventual reform route, resulting in the prioritization of the following instruments:

Financial and productive instruments:

1. Financial instruments – Special Lines of Credit (LEC) and Agricultural Development Credit (CFA).
2. National policy to improve the competitiveness of the dairy sector in Colombia.

Land policy and land use management instruments:

3. Demarcation, recovery and administration of communal floodplains.
4. Allocation of vacant land to natural persons.

4.7 Recommendations for a possible reform route

The general recommendations for the design of agricultural policy instruments, considering their probable detrimental impact on biodiversity, in addition to providing a theoretical basis for the development of the opportunities for improvement presented, constitute a framework of reference for future analysis of policy instruments in the agricultural sector that are to be reformed. As a result of the analysis, the following were identified:

a) **Identify and visualize probable losses**: Analyze and quantify the risks of real or potential loss or damage caused to biodiversity through projects benefiting from the instrument.

b) **Assess the losses and evaluate their probable negative impact**: Analyze and assess the negative impact, without limiting oneself exclusively to a monetary valuation. Estimating its real or potential value, both at a biological and environmental level, as well as at an economic and social level.

c) **Define the level of protection (precaution) necessary to prevent the loss or deterioration of biodiversity**: Define the preventive measures that can be adopted, applying a precautionary approach, to prevent the loss or deterioration of biodiversity that could be caused as a consequence of the expansion or growth of the production systems benefiting from agricultural policy instruments.

d) **Determine the regulatory conditions for access to and use of the incentive in projects submitted for approval**: Incorporate the relevant regulations to prevent the loss or deterioration of biodiversity into the design and implementation systems of policy instruments, based on established levels of protection and in accordance with the territorial context.

e) **Monitor compliance with the conditions of access and use**: Evaluate the effectiveness of the instrument periodically, and make the necessary adjustments and improvements based on these results.

f) **Organize an appropriate system of governance for the instrument**: Organize a system of governance for the instrument, to guarantee control and management bodies.

4.7.1 Room for improvement in a reform route involving the selected instruments

Based on the analyses that served as technical input to identify the critical elements for each of the prioritized instruments, the following section outlines a series of guidelines that include sustainability criteria, environmental focus and governance that would facilitate the implementation of a reform path for the 4 prioritized instruments.

4.7.1.1 Financial instruments: LEC and CFA

The authors who refer to the incorporation of sustainability criteria in agricultural financial systems recommend the creation of risk management systems for "sustainable" agricultural credit, that is, systems that include short-, medium- and long-term access and operation criteria in terms of environmental sustainability (Zeidan et al., 2015) (FAO, 2015) (Razak, et al., 2020) (Souza et al., 2020).

On the other hand, credit risk assessment for agricultural credit in Colombia is currently carried out by the intermediary financial institutions, who tend to limit it to the field of financial risk.

These assessments carried out in the context of a sector such as agriculture, which is highly dependent on the ecological environments in which it carries out its activities, can be considered, at the very least, limited (Souza et al., 2020).

Agricultural activities can favor possible effects on biodiversity and seriously affect production in the long run. This context further emphasizes the relevance of being able to implement an agricultural credit risk management system in Colombia based on sustainability criteria in the following manner:

Use of existing criteria and practices

1. Extend the zoning criteria by environmental suitability developed by the UPRA to the entire credit system focused on primary production.

Sustainable Agricultural Credit Risk Management System.

1. Establish and issue criteria for the evaluation of agricultural credit, including elements related to the management of biodiversity for its location and access.

2. Link the results for food production obtained from the Vulnerability and Risk Analysis due to Climate Change in Colombia, as variables for climate risk assessment in the agricultural risk management system.

3. Implementation of systems and management plans specific to productive activities as a result of the risk assessment aimed at promoting the resilience of agricultural production systems.

4. Generate a system to monitor and verify the risk management objectives for each project in terms of sustainability.

4.7.1.2 Policy to improve the competitiveness of the dairy sector

Following on from the identification of the critical elements to be considered in a possible reform of this policy and the instruments that comprise it, the guidelines given in this section focus on two essential elements:

Development of the National Bovine Genetic Improvement Programme

Genetic improvement is fundamental for increasing the adaptive capacity, resistance and tolerance of productive systems. However, despite the fact that there is institutional awareness that various regions dedicated to milk production in Colombia have a genetic potential whose most relevant characteristic is precisely its adaptability to the environment, this potential is being wasted (González, 2021). Part of the reason for this is the lack of research and development agendas for genetic improvement that incorporate adaptability criteria.

Complementary opportunities for improvement that can be executed in different time horizons:

1. Incorporate guidelines for the establishment and/or strengthening of research and development programmes on native breeds adapted to current and future climatic conditions in the regulatory framework of the National Bovine Genetic Improvement Programme (PNMGB).

2. Deepen research into native breeds that are not currently used for commercial purposes but are associated with traditional, indigenous or small-scale farming methods and that are better adapted to natural systems.

Incorporation of environmental criteria for localization, access and operation

3. Update the prioritized areas to focus the sectoral policy on improving competitiveness, under the criteria and guidelines of the instruments developed as part of the implementation of the dairy POP.

4. Complement the current policy guidelines for the dairy chain with access and operation criteria that favor the conservation and restoration of soil and water resources, as well as the implementation of sustainable natural resource management practices.

At the very least, the operating criteria should guarantee the following:

1. Linking socio-ecosystemic criteria defined by the UPRA, associated with the change in coverage, the appropriation of water and the ecological integrity of the agro-ecosystem, in the productive systems developed by the beneficiaries of the policy.

2. Establishing a monitoring and follow-up system to evaluate the implementation of the proposed criteria in the environmental and ecosystem services spheres.

In addition to the above, a life cycle analysis of dairy production at the regional level would be very useful, as it would allow for better management of the environmental impacts associated with the different stages of production.

4.7.1.3 Land policy and land use management instrument

Land demarcation

State land administration activities geared towards the full identification and recovery of vacant land are tools that can bring benefits in terms of biodiversity conservation. Particularly in the case of vacant plots of land which, due to certain characteristics, cannot be allocated (communal savannas and floodplains) and over which the State has eminent domain through the protection or regulation of their use and tenure.

The regulations to make this identification and subsequent recovery effective are generally adequate and take environmental criteria into consideration. Specifically, in terms of demarcation, the National Land Agency (ANT) is interested in protecting the national strategic areas, including beaches, low tide areas, riverbanks and riparian zones, deserted coasts, lakes, lagoons, swamps, floodplains and forests, among others[10].

Thus, three specific opportunities for improvement were identified:

1. The creation of channels of communication between the environmental and agricultural sectors for the implementation of the land demarcation process can contribute to the acceleration and precision of the procedure.
2. Promoting land use regimes based on acquired rights that overlap with areas of environmental interest can contribute to the maintenance of strategic areas for biodiversity.
3. Supply-driven management, both for the Social Management Plan for Rural Property (POSPR) and the identification of areas that, due to environmental criteria, should belong to the Nation.

Allocation of vacant land to natural persons

Among the different forms and mechanisms for accessing land, those that may have the greatest impact on biodiversity are the ones that, by their very nature,

[10] Decree 1465/2013, article 42.

lead to the colonization of previously unexploited areas, or that are incorporated into the agricultural frontier through allocation.

The proposed improvement is to make the implementation of the instrument subject to the availability of land for its implementation, in accordance with environmental zoning, the agricultural frontier and other usage limitations.

This conditioning is expected to establish a finite horizon for the implementation of the instrument and to convey the message of the limit that, for environmental reasons (specifically, the need to stop the expansion of the agricultural frontier), must be established for the implementation of land allocation by the state as part of the land access policy.

5. Conclusions

Some instruments in the agricultural sector have been found to have achieved a degree of consolidation and continuity as a result of their high production results. Nevertheless, there are several unanswered questions associated with the negative externalities that are generated directly on biodiversity. Therefore, there is confirmation that in Colombia there is a regulatory framework that "promotes the development of the productive sectors without taking into consideration factors associated with the conservation, management and sustainable use of biodiversity," as indicated in the Policy and Institutional Review (PIR) prepared by the UNDP in 2016.

Colombia has several agricultural policy instruments that unintentionally generate or have the potential to generate damage to the country's biological wealth and the resilience of its ecosystems. Furthermore, due to the territorial dynamics, the analysis of incentives and subsidies cannot be limited solely to the production process but must be extended to incentives related to land tenure and use, especially in countries that are making progress in updating or creating an agrarian reform.

Incentives and subsidies were found to include location criteria, which are related to some form of restriction or regulation on their location within the agricultural frontier and/or restrictions relating to environmental zoning. Nevertheless, there is no evidence in the design of access criteria related to environmental or conservation guidelines, restrictions on the use of natural resources or good environmental practices. Furthermore, the disconnection between the agricultural and environmental sectors within the incentive governance scheme is recognizable.

Based on the arguments and technical findings, there is a clear need to move forward with proposals to restructure the instruments currently available in the

agricultural sector, so that they are adapted to a reality in which aspects such as biodiversity conservation and the mitigation of negative effects on ecosystems are internalized, becoming essential elements. In this way, a risk-free environment will be created, allowing economic efficiency to be increased, the tax burden to be reduced and positive externalities to be maximized.

Lastly, when analyzing the reform of perverse incentives, it is necessary to assess the risks of modifying the instrument so as not to generate a greater social and/or economic impact. For this reason, a gradual transition should be planned in order to evaluate its effectiveness on the production process, communities and nature. It is important to point out that the technical and research associations of the policy instruments that were analyzed and that could have possibly influenced the phenomena of change in coverage do not attempt to establish any type of causality and are limited to a descriptive exercise.

CHAPTER 2

Analysis of incentives in the agricultural sector at the regional level

Case study: La Mojana

In 2022, the BIOFIN initiative analyzed the perverse incentives in the agricultural sector with potential impact on biodiversity at the regional level, seeking to generate reform routes adapted to the territory with differentiated characteristics. This approach was taken for the region of La Mojana due to its ecological, hydrological, social, cultural, economic, historical and governance conditions[11].

The methodology was developed following the same route for the analyses addressed in the first phase:

1. Identification of the impact,
2. Zoning of the impact considering temporality,
3. Identification of instruments
4. Reform scenarios, and
5. Outlining the reform route.

In this analysis, the possible technical associations of relationships within the La Mojana Socio-Ecological System (SESLM) were characterized, based on the changes in ecosystem services derived from the drivers of transformation and loss of biodiversity, promoted by the management instruments of the agricultural sector. Identifying the status of ecosystem function, which enables ecosystem services to be provided, makes it possible to determine to a certain extent the degree of impact on biodiversity that an agricultural policy instrument could be causing. Therefore, by identifying the entire flow sequence it is possible to influence the design of what sustainable management of agricultural activity would be like. In this way, recommendations are generated to guarantee the responsible and sustainable use of natural resources, and to guarantee the provision of the ecosystem services necessary for human welfare and the health of the territories.

[11] La Mojana was selected as a key strategic area for the study, and has also been classified as an area of regional importance in Latin America and the Caribbean due to the large number of aquatic, terrestrial and transitional habitats that act as biological corridors, connecting different protected areas and natural regions of Colombia.

1. Characterization of the agricultural Socio-Ecological System in the region of La Mojana

The starting point for the territorial characterization of La Mojana was based on the identification, operation and relationship of the components of the Socio-Ecological System of La Mojana - (SESLM). The technical description of this system is shown below.

1.1 Socio-Ecological Systems - SESs

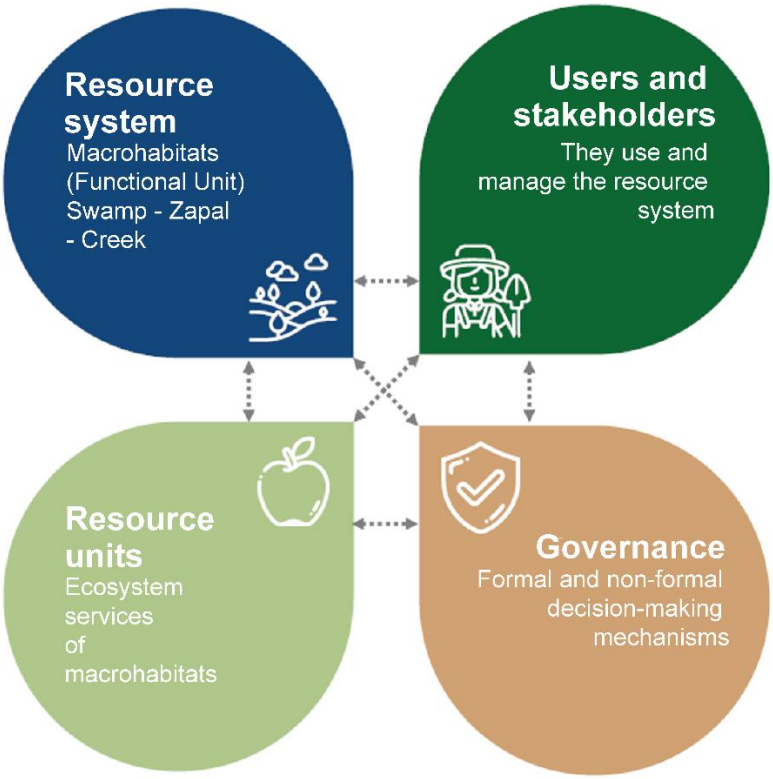
Socio-Ecological Systems (SES) is a concept that recognizes the complex relationships between the biophysical and social aspects of a territory, where it is not possible to delimit exactly the boundaries that exist between one and the other. This includes not only the components of humanity and nature as a sum of parts, but also the interdependence and continuous exchanges between these attributes that give it the characteristic of a complex system (García, 2006).

The process of identifying the SESs of La Mojana starts with the identification of the four (4) subsystems[12] (Figure 7) which are as follows:

1. **Resource system**: corresponds to the macrohabitats or landscape units that comprise the SES. A macrohabitat refers to a series of habitats[13] that share functional characteristics.
2. **Resource units**: this corresponds to the set of ecosystem services provided by the functionality of the macrohabitats.
3. **Governance system**: refers to the formal and informal decision-making mechanisms in the territory.
4. **Users and stakeholders:** are those who use, manage and/or interact with the resource system

[12] Framework to analyze Socio-Ecological Systems, their components and interactions, based on Ostrom 2009.
[13] A space within the ecosystem that has specific conditions for a particular organism or a population of a species to live (Lovelock, 1979)

Figure 7. Socio-Ecological system Components



Source: UNDP 2023. based on data from Ostrom (2009)

1.1.1 Resource system: macrohabitats

In order to identify the relationships between biodiversity loss and agricultural policy, macrohabitats were categorized according to their predominant landscape characteristics as units, whether natural or transformed.

Natural macrohabitats are defined as those resource systems that have limited human management or have not been severely modified. In La Mojana, the following were identified:

I. Natural *zapal*
II. Waterways
III. Swamps
IV. Creek / River

Meanwhile, modified macrohabitats are defined as ecosystems or parts of ecosystems that are transformed by human beings for their own use, especially to take advantage of an ecosystem service over others, as in the case of agroecosystems. In La Mojana, the following were identified:

I. *Zapal*-buffalo: an agro-system modified based on natural *zapal*, making use of its support and humidity conditions to facilitate buffalo farming.
II. *Zapal*-crop: an agro-system modified based on natural *zapal* to favor flood crops, mainly rice.
III. Swamp-crop: using the floodplains of natural swamps for crops, mainly rice.
IV. *Zapal*-pasture: a landscape predominantly made up of pastures with low forest cover, which takes advantage of the higher areas of the land to provide space for traditional livestock farming.

1.1.2 Ecosystems and biodiversity

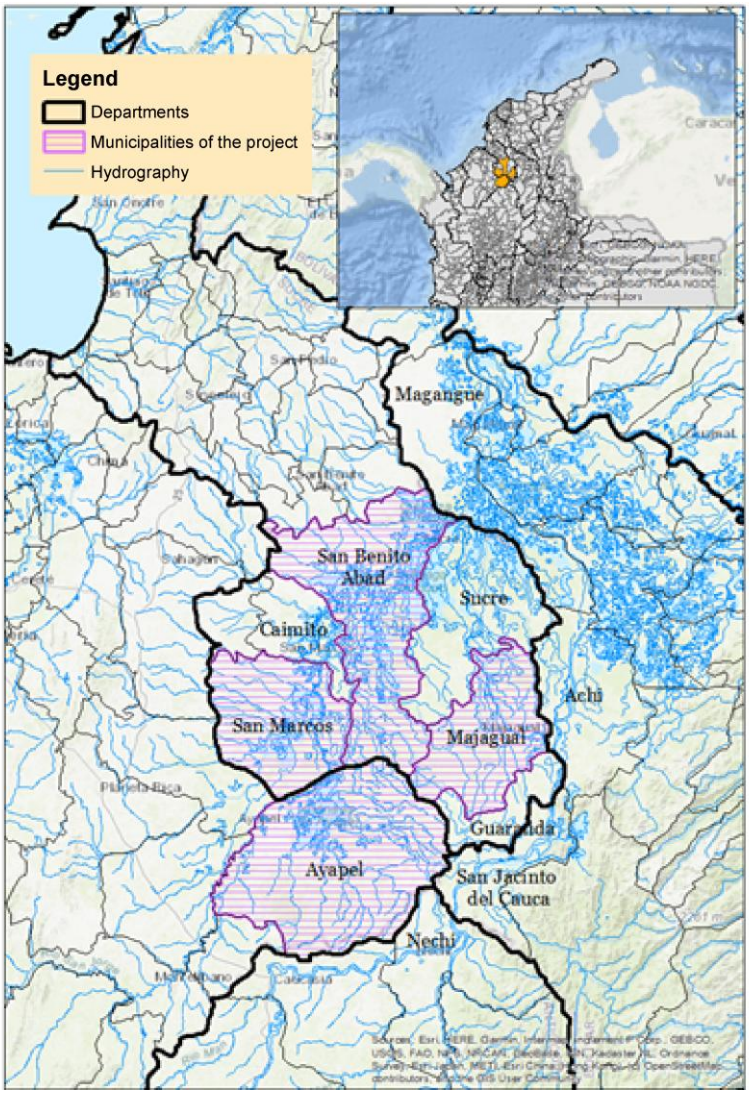
The wetland ecosystem of La Mojana is classified as an interior system and as an inter-Andean lowland subsystem (Map 6). This falls within the order of long-duration predictable flood pulses, covering large areas (hundreds of km2) and within the suborder of large flood monomodal pulses.

It belongs to the floodplain class of the Mompox depression hydrographic basin and to the subclass of varied vegetation between shrubland and low floodplain, with the capacity to adapt to anoxic soils with a high organic matter content.

Currently there is no precise information on the number of species of flora and fauna present, nor on the state of their populations, especially those that are endemic, have a restricted distribution or are threatened. However, there are mentions of threatened species of fauna, flora and other species. It counts with 22 species of amphibians and reptiles, among which the most endangered species are the *Morrocoy* and the *Hicotea* turtles.

In terms of birdlife, 141 species have been recorded, the most endangered being the parrots (Psittacidae). 30 species of mammals have been recorded, and of this group primates and carnivores are threatened by habitat destruction. Hunting and wildlife trafficking threaten carnivores, deer, iguanas, turtles and some bird species.

Map 6. La Mojana Region



Source: UNDP, 2023

The plant cover of natural and aquatic forests provides a habitat for resident and migratory fauna species and are spawning and breeding grounds for fish such as the *bocachico* and the striped catfish, which sustain the fisheries of the rivers in the upper, middle and lower parts (Corpomojana, 2016). In terms of flora, more than 130 families with 398 species have been reported (Fondo Adaptación et al., 2019).

In 2014, according to the Ministry of the Environment, 8 endangered species of flora were identified, as well as 21 species of fauna (2 amphibians, 4 reptiles, 2 birds, 9 mammals and 4 fish) (Fondo Adaptación et al., 2019).

Main impacts on biodiversity identified

La Mojana has suffered multiple anthropic alterations throughout history, such as the drying up of water bodies for agricultural activities, the construction of infrastructure that affects the natural water flow due to the dumping of waste and contaminated loads, among others. Among the identified milestones that impact the operation of ecosystems are the following:

1. **Climate change**: Between 1997-1998, 2010-2011 and 2015-2016 the region was influenced by phenomena characterized as "*meganiños*" and "*meganiñas*", a name given by the *El Niño* and *La Niña* phenomena.
2. **Changes in risk management policy**: The implementation of channels or dikes to reduce the risk of flooding associated with the practice of draining floodplains (Andrade-Pérezet et al., 2018).
3. **Promotion of financial instruments**: In 2014, the resources of the agricultural development credit requested for investment in land adaptation for rice increased by 48% in the region (Finagro, 2020). This indicates that the territory was going to experience a major transformation.
4. **Creation of irrigation districts**: As a result of Agreement 10/1968 of the Colombian Institute of Agrarian Reform (INCORA), there are currently two districts registered with the UPRA (2022) on a small scale in San Benito Abad and Magangué and identification of at least 10 areas with potential for land adaptation aimed at irrigation.

1.1.3 Resource units

Resource units come from the system of ecological functions offered and associated with the ecosystem unit. Along these lines, for La Mojana, the greatest supply of Ecosystem Services (ESs) (whether supporting, regulating, provisioning, cultural or spiritual services) was found in the natural *zapal* ecosystems, where the provision of 13 ESs associated with the ecological functions of regulation was identified. 12 ESs were identified in the swamps, while 9 ESs were identified in the rivers and creeks. Among agro-systems, the main ES group is associated with food supply, which is the ultimate goal of these transformations. Ranked in order, the services associated with the transformed macrohabitats (or agrosystems) are *zapal*-crop with 5 ES identified, followed by swamp-crop and *zapal*-pasture with 4 ES, and finally, *zapal*-buffalo with 3 ESs. These results show how different levels of ecosystem transformation lead to a loss of ESs.

1.1.4 Governance system, users and stakeholders

Formal and informal rules of use over the territory

The Socio-Ecological System of La Mojana (SESLM) is a combination of several subsystems that recognize the intrinsic relationship between the biophysical and social aspects of an amphibian ecosystem. The subsystems that make up the SESLM are the resource system; ecosystem services are the resource units; small, medium and large producers are the existing institutions and the users.

In this system, informal rules prevail over formal rules and in this way, the system of governance of the SESLM wetland ecosystem is developed.

These apparently independent subsystems comprise a relationship that determines the responses of the SESLM as a whole and the rules of use that users apply to natural resources define, to a large extent, the abundance and quality of resources, the supply of ecosystem services, the resilience capacity and the vulnerability of the SES.

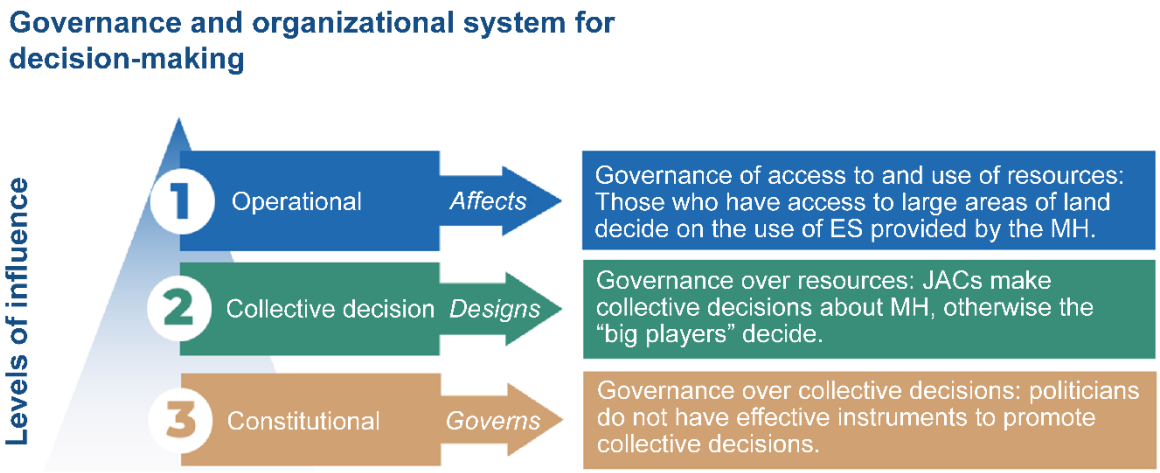
In order to describe the influence of the rules of use, the framework for the study of Socio-Ecological Systems (Ostrom 2009) and the extended Institutional Analysis and Development framework (IAD) (Ostrom E., 2015) provide a multilevel structure for these rules (**¡Error! No se encuentra el origen de la referencia.**), which is composed of three levels.

1. The first level is the operational level: It focuses on how people interact and make decisions that affect access to and use of resources, and therefore on decisions that have an impact on overexploitation and direct conflicts of use, as well as the management of natural resources.

2. The second level is the collective decision-making level: This focuses on the rules, regulations and policies that govern collective actions, designing the rules that govern a resource system or the macrohabitats in the case of La Mojana.

3. The last level is the constitutional or “meta-rules” level: It looks at the underlying values and principles that influence the creation and evolution of rules and policies.

Figure 8. Organization of the formal and informal rules in the region of La Mojana



Source: UNDP 2023 based on Ostrom 2009 and Ostrom 2015.

For La Mojana, the suitability of the rules of use depends on the biophysical conditions that characterize the wetland, meaning the structuring elements[14], and the characteristics of the communities or stakeholders that manage the ecosystem's resource systems. Therefore, a characterization of each of the levels could be done as follows:

1. At the operational level, actions are mostly concentrated in large producers who have greater access to land and decide on the use of and access to ecosystem services in each macrohabitat. The flood zones of the macrohabitats, which respond to the flood pulses and support the provision of ecosystem services, are the most suitable areas for agriculture and livestock; large tracts of land distributed among few owners and it is them, the "landholders", who decide on the access and use of the resources.
2. At the level of collective decisions, evidence has shown better sustainable management in wetlands, as it has a greater capacity to influence operational actions when they are carried out by a Community Action Board (JAC) organized with certain governance capacities among small and medium producers. Other studies have shown that collective values, "community culture" or the level of common understanding about an ecosystem has a great impact on the management of natural resources (Ostrom E., 2015) (Cairnay, 2012).

[14] Structural elements are the biotic and abiotic components that make up a functional ecological unit, with biophysical and chemical interactions.

3. Lastly, at the constitutional level, there are all the institutions whose duty it is to generate policy instruments for access to and use of natural resources to be implemented by different territorial productive stakeholders, such as mayors' offices and governors' offices through their land use management, social property plans and development plans, and the four environmental authorities: La Mojana and San Jorge Sustainable Development Corporation (Corpomojana), Sinú and San Jorge Valleys Regional Autonomous Corporation (CVS), Southern Bolívar Regional Autonomous Corporation (CBS), and Central Antioquia Regional Autonomous Corporation (Corantioquia). At the national level, ministries act as governing bodies.

Social and cultural dynamics

The region of La Mojana is located in a political-administrative division between four departments and eleven municipalities. These political-administrative boundaries become blurred in the region's swamps, waterways, rivers and *zapales*. This is also supported by the self-identification of the region's inhabitants as "*Mojaneros*" who were able to participate in the workshops, interviews and focal groups of this second phase.
This "*Mojanera*" identity, added to the territorial dynamics of an amphibious region, characterized by carrying out its productive and daily activities in between land and water, is related to an intricate dynamic ecosystemic unit, which does not differentiate aquatic elements from terrestrial elements within the greater ecosystem. These socio-cultural and productive dynamics were forged and rooted in the population that has historically settled by the water's edge, ever since pre-Columbian times, responding to the challenges posed by its dynamics and anthropic impacts. In addition to climate variability, the diversion of natural watercourses and flooding have made communities more vulnerable while reducing their resilience. Note that in this region different policy instruments have been implemented with potential impacts on biodiversity, such as the construction of infrastructure for housing, healthcare, education, protection of residents and means of production against possible flooding, which equates to investments of up to COP$960 billion (DNP, 2022a). A unifying factor in these interventions has been the difficulty in incorporating an approach that recognizes the particular characteristics of the territory. Thus, the various policy measures implemented would be ineffective in solving development problems, as demonstrated by the current situation of poverty, environmental deterioration and recurring natural disasters in the region.

Predominant agricultural production systems

Agricultural production in La Mojana has been consolidated as actions were implemented to adapt the territory in order to control flooding (IAvH, 2020). The region's agricultural production is concentrated in cattle and buffalo farming, fishing and short-cycle crops such as rice, corn, plantain and cassava (Fondo Adaptación, 2016) (Geografía Urbana, 2014). The predominant livestock activity is extensive cattle farming.

According to the Regional Environmental Management Plan 2016–2026 prepared by Corpomojana (2016), at the beginning of this century, livestock farming was underutilizing the potential of the soil, with a carrying capacity of 0.75 head/ha, lower than the national average (1.0), and much lower than that of the Caribbean Region (1.4); and a lower presence of buffalo, pigs and poultry.

Agricultural activity, meanwhile, is focused on the production of cereals, mainly rice (71% of the area sown with cereals), yellow corn (11.6%) and white corn (8.9%) (DANE, 2014). The predominant rice production system is mechanized dryland farming (33,019.2 ha, accounting for 71.3% of the area), as opposed to manual dryland farming (13,278 ha, equivalent to 28.7% of the area).

On the other hand, the predominant production system for corn is the traditional one associated with small extensions and non-certified seeds (7,689 ha, 78.0% of the area planted with corn), which coexists with the technified corn that is developed in large extensions with certified seeds and the use of agrochemicals (2,175 ha, 22.0%) (Geografía Urbana, 2017).

2. Trajectories of management, use and occupation of the agricultural Socio-Ecological system in the region of La Mojana.

This section compares and analyzes the behavior of the trajectories of management, use and occupation within the Social-Ecological System of La Mojana (SESLM) and the impacts on biodiversity triggered by drivers of transformation and loss of biodiversity activated by the use and management of the territory, based on consulted bibliographic information and the analysis of information collected from consultations, interviews and workshops with communities, entrepreneurs and entities in the region.

2.1 Characterization of the trajectories of management, use and occupation of the Socio-Ecological System.

The main ecosystem services (resource units) were analyzed in order to identify which are most important for the management and sustainability of the territory in relation to the four natural macrohabitats identified: the resource systems of the waterways, the *zapales*, the river/creek and the swamps.

For the inhabitants of La Mojana, the swamps, rivers and creeks, waterways and *zapales* are not only important in economic terms, but also provide the means of subsistence that allow them to establish social relations, symbolic constructions of identity and belonging to the territory. However, this contrasts with the fact that knowledge about the interactions between social and ecological systems is at an early stage. As well as the significance of biodiversity and the ecosystem services associated with flooding and the advantages they could obtain to improve their agricultural and fishing production practices. As a result, this translates into a lack of adaptive capacity of the socio-ecological system (Salas-Zapata et al., 2012).

In this sense, the ecosystem functions identified by the inhabitants and based on the review of the literature are as follows:

- **Hydrological regulation**

Regulating ecosystem services are of considerable importance as they contribute to the maintenance of La Mojana's ecosystem, focusing on the regulation of floods, climate and water flow; a central axis in the dynamics of the region, in the economy and in the development of the population. Nevertheless, during the fieldwork, some of the interviewees mentioned that the inhabitants of the region try to dry out the swamps to gain arable land from the water, trying to block the natural course of the river. This practice influences the course of the water, causing the blockage of waterways and blocking the hydrological flow of the swamps in La Mojana.

According to the assessment of ecosystem services for the region presented in CONPES 4084 “La Mojana: Resilient, Sustainable, Productive and Competitive Territory”, 57% of the inhabitants value as essential the regulatory services provided by the region's macrohabitats, because they facilitate fishing, timber use, hunting of wild species, groundwater recharge, flood protection and soil formation (DNP, 2022).

- **Habitat maintenance**

The ecosystem service of habitat maintenance refers to the conservation, protection and restoration that habitats require to prevent their extinction, fragmentation or reduction. Therefore, the workshop participants recognized its high value, since maintaining the habitat guarantees the space and conditions for carrying out other activities. Furthermore, they are vital areas for the conservation of species.

The range of microhabitats in the transition from lentic and lotic aquatic systems to terrestrial systems is influenced by the stratification of plant cover, due to the range of ecological services it provides (Ayazo-Toscano R., 2018). Thus, the transitional aquatic dynamics of La Mojana have structuring elements of vegetation and geomorphology that allow for areas without water and areas with permanent water, generating the conditions conducive to the life and development of biological groups such as amphibians, reptiles and fish, resulting in viable fishing (Ayazo-Toscano R., 2018).

- **Soil formation and retention**

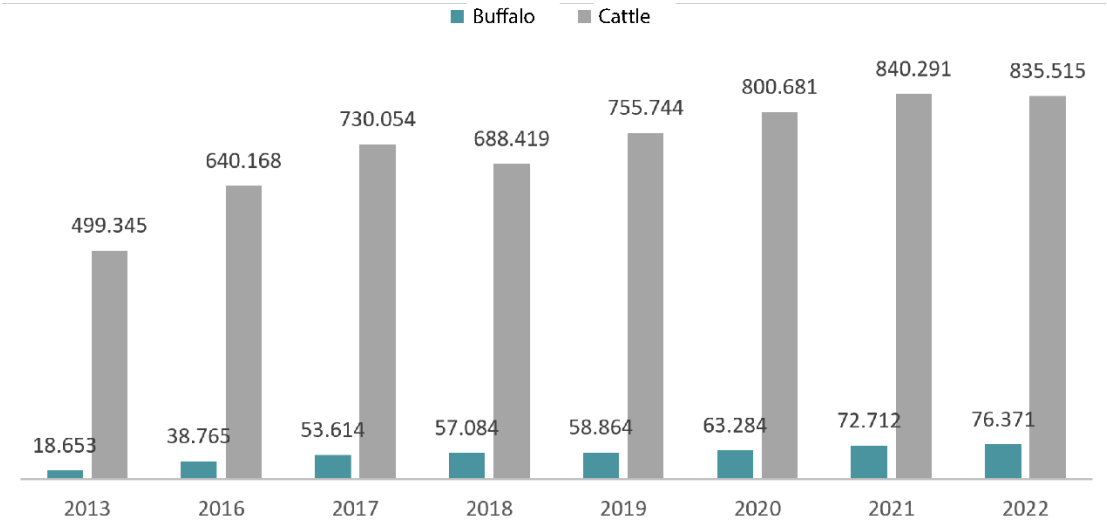
Soil formation and retention enable the maintenance of the biological structure and processes that are fundamental to ensuring water quality and soil fertility for agricultural production systems. In particular, the *zapales*, which play a very important role in sediment retention, erosion control and soil formation. *Zapales* contribute to the maintenance of the structure and processes that are the basis of the continuous fertility of the soil used for agricultural production at La Mojana. Amongst the productive dynamics of La Mojana, rice continues to be the predominant crop. For some of its inhabitants and for Fedearroz, rice is the main crop, as it adapts easily to the region's flooding processes. Rice farmers make use of the floodplains that are formed when the water level drops to sow and exploit the water flow for this crop.
Both the literature consulted and the fieldwork showed that the fertility of the soil for agricultural production is also due to the ecological function that the swamps have for sediment retention, erosion control, the formation and maintenance of soil structure and the nutrient cycle. Despite the impacts caused by the transformation of its use, the soil continues to fulfill its functions. However, the fact that it preserves these properties does not mean that it is doing so to the best of its ability.

2.2 Patterns in agricultural activity

Livestock farming: cattle and buffalo

Currently, La Mojana has approximately 900,000 head of cattle and 80,000 buffalos (Figure 9). Due to the transhumance activity, some 200,000[15] people enter La Mojana coming from other municipalities (ICA 2022) (CNA, 2014).

Figure 9. Number of head of cattle and buffalo livestock in La Mojana



Source: CNA (2014) and ICA (2016. 2017, 2018, 2019, 2020).

Although cattle fattening is still predominant in the region, there is a difference in growth above the baseline between buffalo (376%) compared to cattle (67%) in the region[16]. Among the reasons given by buffalo producer associations and livestock guilds is that buffaloes adapt better to the humid tropics, have a longer lifespan, adapt to different topographies and require less compensation in their diet with feed or cereals (Minervino et al., 2020).

However, according to conversations with producers in the region, there is opposition to the introduction of buffalo to La Mojana because of the potential impact on the wetlands and because of the connection between this type of livestock farming and large landowners and drug trafficking.

[15] The figure for animals entering La Mojana due to transhumance (200,000) is a general estimate for cattle and buffalo together. Due to the very nature of transhumance, it is difficult to provide an accurate figure.
[16] This value was calculated based on the geometric average of the growth in head of cattle between 2013 as the baseline and 2022, which is the last calculated value.

One of the main differences between cattle and buffalo farming is their location: the former requires preferably flat grazing areas, while the latter are amphibious species that move in flooded areas.

Considering that the macrohabitat with the greatest buffalo presence is the *zapal*, which, as mentioned above, is the system that provides the greatest amount of ESs. The increased buffalo numbers can have a direct impact on the biogeochemical cycles that support biodiversity in other macrohabitats.

In the case of cattle fattening, extensive livestock farming predominates with a very low carrying capacity in comparison with the rest of the country (Corpomojana, 2016).

It is important to point out that transhumance is carried out for cattle and buffalo livestock to take advantage of the complex swamps in communal areas which, due to their high sediment content, also allow for the growth of good quality pastures.

Influence of climatic patterns

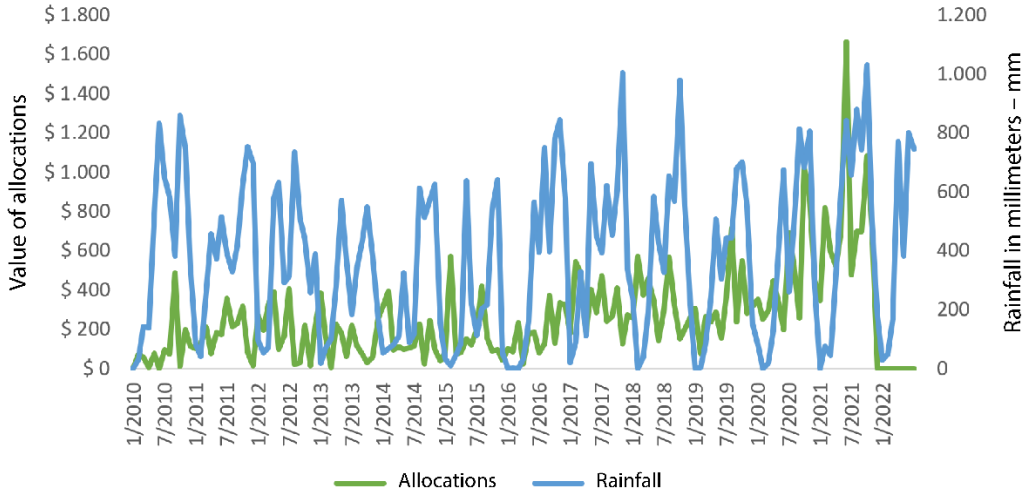
Agricultural uses in transitional ecosystems depend on weather patterns and water flows, a circumstance that means that activities in dry weather differ from those that can be carried out in seasons with increased rainfall.

The main agricultural uses for this ecosystem in dry seasons are transitory crops and silvopastoral systems, while in rainy seasons they are significantly limited to uses that withstand water saturation.

During this season, producers may be forced to remove their crops or suffer losses if they do not adapt the land to drain the water.

Therefore, the hypothesis that rainfall could influence the application and allocation of credits was explored, especially for land suitability, which has a direct impact on the physical characteristics of the soil and the geomorphology of the wetland.
For this reason, the information on quarterly rainfall (mm) and the value of the credits allocated (figures in millions of pesos, COP) to corn, rice and cattle producers (Figure 10) in La Mojana between 2010 and 2022 was analyzed.

Figure 10. Monthly credit allocations by value for cattle production in relation to monthly rainfall



Note: Value of allocations expressed in millions of pesos (COP) and rainfall in millimeters - mm.

Source: UNDP 2023 based on Finagro (2022) and IDEAM (2022).

The results do not show a clear correlation between these two attributes and, therefore, it cannot be said that there is a direct association between the level of rainfall and agricultural credit allocations. Despite this result, and regardless of the climatic period, credit is being invested in the intensification of the most predominant systems, which are rice, corn and livestock systems, with an asymmetrical distribution accessed by a few stakeholders, mostly large producers.

Out of the total number of Agricultural Production Units (UPAs) in La Mojana, 15.4% apply for a credit and only 5.9% are approved, the latter being mostly the larger areas, leaving very few opportunities for small producers. Those who do not manage to access these credits are left exposed to informal financing methods or are unable to make use of any type of external financing, due to the various barriers in the financial system.
As for the use of the funds acquired through credit, the predominant uses are the procurement of animals, the payment of labor for small producers and investments in improvements to production systems, machinery and equipment for large producers (Finagro, 2022).

2.3 Identification of the impacts on ecosystem functions caused by the drivers of biodiversity loss resulting from the use and management of the territory

The drivers of biodiversity transformation and loss from which the main impacts identified for La Mojana are derived were established based on the definitions of drivers and variables of loss and transformation identified for the agricultural sector (Table 5). For the analysis focused on La Mojana, the prioritized impacts were identified based on the evidence generated in the research work carried out by Vilardy et al. (2014) and Ricaurte et al. (2017), which study the effects and drivers of change in wetland ecosystems in Colombia, as well as the Millennium Ecosystem Assessment of wetlands and water (2005) and the work carried out by the Water Institute of the Javeriana University (2022).

As a result, the following classification was obtained:

Table 5. Main drivers and impacts identified affecting wetland ecosystems in Colombia

Drivers of transformation and loss of biodiversity identified for the agricultural sector	Main impacts identified affecting wetland ecosystems
Driver 1 **Changes in land use due to the expansion of agricultural and livestock farming into new areas.**	Loss of habitats and natural cover resulting from the transformation of wetlands (change of land use) affecting water bodies. These impacts are related to changes in the geography. Main causes identified: 1) Agriculture 2) Livestock farming 3) The development of infrastructure for connectivity or disaster prevention.
Driver 2 **Pollution and toxification due to the growth of intensive production systems.**	Deterioration and loss of soil and water sources, as well as loss of biodiversity due to the decrease in populations of insects and microorganisms, due to pollution caused by the inappropriate use of fossil fuels and agricultural inputs.
Driver 3 **Reduction, loss or degradation of elements of native ecosystems and agro-ecosystems due to overexploitation.**	Changes in water demand. In particular, this impact refers to changes in the distribution and demand for fresh water, which in turn changes surface and underground hydrological flows in the SES. This classification includes all the water infrastructure connected with surface and underground water and the patterns of water use for agricultural production.

Source: UNDP 2023

Driver 1

Changes in land use due to the expansion of agricultural and livestock farming into new areas

Among the causes that trigger this driver, it was identified that buffalo production affects the soil by eroding and compacting it, and brings with it deforestation to make space for calves in the pasturelands. This corresponds to the driving force behind changes in land use due to the expansion of agricultural and livestock production areas into new areas, which diminishes the function of formation, protection and decontamination of soils and sediments provided by the *zapal*.

According to the literature reviewed, the expansion of the agricultural frontier and transhumant livestock practices that take place in floodplains at times of low water destroy aquatic ecosystems. The introduction of exotic bovine species, such as buffalo, compacts the soil in flood zones such as the *zapales* and destroys amphibian habitats (POMCA, 2016). According to local producers, members of the institutional framework and local residents consulted, the buffalo production introduced in La Mojana during the 1990s has had a visible impact and has drastically modified the ecosystem and its biodiversity, damaging the *zapales*, a source of life and biodiversity for the communities.

Moreover, changes in land use due to the expansion of agricultural and livestock production into new areas could be disrupting the natural flow of water from waterways and swamps, compromising the ecosystem service of hydrological regulation. According to CONPES 4048, the permanent wetlands in La Mojana cover 226,000 hectares, 14% of which have been intervened (DNP, 2022a). In addition, the swamps are dried out to create pastureland for livestock or for the cultivation of agricultural products, for which, in some cases, dikes or *jarillones* are constructed to divert or dam the water, affecting its natural course.

Driver 2

Pollution and toxification due to the growth of intensive production systems

The regulatory ecosystem function provided by waterways, *zapales* and rivers allows the water and soil to be purified. According to the 2014 National Water Study, this function is affected by agriculture, livestock, municipal dumping and gold mining, which affect the average hydrological conditions of the Bajo San Jorge - La Mojana basin, as reflected in the Potential Water Alteration Index (IACAL) (an indicator of potential pressure on water quality from contaminating loads) which is in the high category, making it potentially one of the most stressed sub-zones (IDEAM, 2015). All of the above is a result of pollution and toxification due to the growth of intensive production systems, where livestock practices generate significant inputs of nutrients and pathogens into water

bodies. According to the 2014 National Water Study, the greatest pressures due to the pollutant load of organic matter, chemicals, suspended solids, nitrogen and total phosphorus are concentrated in the Bajo San Jorge-La Mojana sub-zone in both average and dry hydrological conditions. During the dry season, the threat of contamination is reduced because there is no transport of pollutants, unlike in the wet season when pollutants are carried along by the natural washing effect of the soil (IDEAM 2015).

In addition, according to the information gathered in the field, and despite the fact that the inhabitants of the area know that the dynamics of pests and their management is not the same in all macrohabitats, it was identified that the use of pesticides and herbicides has a great impact on soil and water. Furthermore, the inhabitants mentioned that rice plantations have an impact on water quality due to the indiscriminate use of agrochemicals, weed and pest control and inappropriate practices for preparing the soil for cultivation.

Driver 3

Reduction, loss or degradation of elements of native ecosystems and agro-ecosystems due to overexploitation

An abnormal decrease or increase in water flows caused by changes in demand from production systems affects the ecosystem function of formation, protection and decontamination of soils and sediments in *zapales* and waterways. Changes in the distribution and demand for fresh water, in turn, change the surface and underground hydrological flows in the SESLM, limiting the ecosystem service of soil formation and retention.

Changes in the geomorphology and vegetation of the waterways, *zapales* and swamps reduce the plant cover and change the distribution of some plant species (aquatic, terrestrial, flood forests, native palms, etc.) in these macrohabitats. The inhabitants of La Mojana indicated that this phenomenon began with the adaptation of land for extensive livestock farming and the reduction of mangroves due to flooding and water pollution. This results in the provision of the ecosystem service of habitat maintenance being affected; this service is vital for species that depend on these macrohabitats to develop their life cycle.

Based on the information gathered in the field, rice production has expanded the production frontier as it is sown in two seasons, the first season in April and harvested in August and the second season in September and harvested in December-January. Although rice has become a key crop in the region, it is currently a crop that, due to its monoculture nature, is a catalyst for many of the environmental problems faced by the region's inhabitants.

Concerning the effect of gold mining, the heavy metal levels recorded in sediments, water, fish and aquatic plants indicate that pollution from mining is the main limitation for the development of local hydrobiological resources and for the health of ecosystems and inhabitants in La Mojana (Ayazo-Toscano, 2018). The Bajo San Jorge-La Mojana hydrological sub-zone is one of the highest risk areas in the country due to the use of mercury in gold mining and other industrial activities, especially in the Nechí region and its neighboring municipalities (Camacho et al., 2017).

2.4 Land occupation model

In order to understand how land management and administration affect biodiversity, an analysis was made on the dynamics of land occupation in La Mojana based on a historical reconstruction of land policy instruments.

Land policy instruments 1960–2012

The analysis of official documents and figures showed that during this period land allocation in Colombia was concentrated in the colonization zones. At the departmental level, there was a high allocation of vacant land in some areas of Córdoba, Antioquia and Bolívar. However, at the country level, out of the 19,274,208 hectares allocated in this period, Antioquia had an approximate share of 9%, Bolívar 2%, Córdoba 2% and Sucre 15%.
Along these same lines, out of the 50,154 hectares of vacant land allocated to farmers nationwide by the National Agrarian Fund (FNA) for the period between 2004 and 2012, the departments of Bolívar and Sucre registered the largest areas, with approximately 17% and 16%, respectively.

In Antioquia and Córdoba, on the other hand, the share was reported to be 8.06% and 7.06% respectively[17].

Furthermore, through the direct purchase modality between 2002 and 2012, 48,192 hectares in Colombia were handed over to a total of 4,916 families. The share of the departments that comprise La Mojana is relatively low, accounting for less than 7% of the national total.

Based on this data for this period of analysis at the departmental level, the information does not allow us to infer the impact of the policy of allocating unused land in the region on biodiversity, since it is not possible to link the large areas of transformed ecosystems with these portions of allocated territory.

[17] Colombian Institute for Rural Development (INCODER), "Balance de la gestión para el ordenamiento social y productivo del territorio: Incoder 1960 – 2012", 2013, available at: https://es.calameo.com/read/0014472813a67b9595dd3

Recent institutional intervention

The National Land Agency (ANT) reports that as of October 2022 there are no administrative processes for the formalization of land to benefit ethnic communities[18] in progress, nor does it have areas subtracted from the forest reserve zone or requests currently in progress to this end in the municipalities of La Mojana region.

Regarding the allocation of vacant land[19], the ANT pointed out that in La Mojana, from 2000 to 2013, 1,155 plots of land[20] were allocated and between 2018 and 2022, 2, 446 plots of land in focalized areas, with Magangué standing out with 1324 properties, San Benito Abad with 702 and Ayapel with 271 properties.

Regarding the use of allocable vacant land, the ANT's Sub-Directorate of National Land Administration indicated that Resolution 14601/2019 specifies the regulations for the use and management of the communal area of Caño Palomo in the municipality of San Benito Abad in the department of Sucre. Said regulations establish the permitted uses based on the agro-ecological zoning of the communal land of the swamp.

As part of the rural land management policy, the ANT is authorized to carry out the Administrative Demarcation Procedure, with the objective of separating land owned by the Nation from privately owned land. As part of this process, La Mojana has registered a total of 160 cases, of which 117 are in Sucre, 40 in Bolívar and only 3 in Córdoba.

According to the ANT's Land Legal Management Department, a demarcation case on the land of El Aguacate Swamp, in the municipality of Guarandá (Sucre), is in a preliminary stage[21]. Some demarcation cases that have already been completed between 2000 and 2020 include Cispataca Swamp as a national vacant land by means of Resolution 334/1998, Los Negritos Swamp in the municipality of Sucre in the department of Sucre by means of Resolution 1435/2007 and La Hormiga Swamp in the same municipality by means of Resolution 2175/2012.

Land occupation dynamics in San Marcos, Ayapel and San Benito Abad

In order to analyze the dynamics of land occupation in La Mojana, a multi-temporal analysis of the last decade was carried out for three municipalities: San Marcos, Ayapel and San Benito Abad, so as to understand the formation of

[18] Agencia Nacional de Tierras (ANT), Response to file No. 20226200740212, October - 2022.
National Land Agency (ANT), Response to File No. 20226200808982, October - 2022.
[19] In order to show the distribution of the allocation of vacant land in the region.
[20] In order to show the distribution of the allocation of vacant land in the region.
[21] National Land Agency (ANT), Response to File No. 20226200808982, 2022.

polygons according to the land registry over time, and thus identify whether there have been changes in the agrarian structure and productive transformations of the rural landscape.

And if the occupation of the territory has been concentrated in areas of special environmental interest with a potential direct impact on biodiversity.

To this end, the property layer for the years 2011 and 2022 was superimposed with the flood zones of the municipalities available according to IDEAM for 2020, the layer of properties allocated by the National Land Agency and with the areas subject to agrarian processes aimed at delimiting and clarifying property rights.

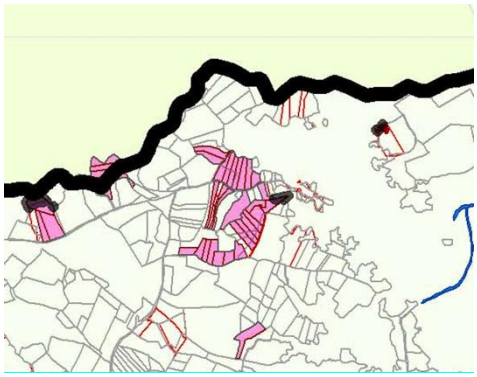
La Mojana's land registry has been updated from 1999 to 2016. Based on the consolidated information, the land registry conservation process allows the information to be maintained as of 2020 for all the municipalities analyzed.

The latest land registry information for all municipalities dates from 2011. Before this date, the municipalities of Ayapel and San Marcos have information from 2007. Achí, Sucre, Majagual, Guarandá and Caimito have information from 2008.

Generally speaking, La Mojana has a highly structured land tenure system. In spatial terms, the whole area is delimited. Therefore, the cartographic analysis showed that the growth of the property does not necessarily correspond to the expansion of the agricultural frontier or, in terms of the predominant ecosystems of the region, the expansion of the productive area over the floodable area (Map 9). The changes in the properties are explained by the subdivision of large properties into smaller properties (Map 7).

In other words, the number of properties is growing, dividing one property into several, but this does not mean that there is an increase in the appropriate natural area in the region of La Mojana.

Map 7. Subdivision of large properties into smaller properties. North zone of San Benito de Abad



Note: The subdivision of the property that took place between 2011 and 2022 is explained by the division of a fuchsia-colored property into small properties with red boundaries.

Source: UNDP 2023.

The opposite phenomenon is also found: There is a reduction in the number of plots due to the aggregation of two, three or more smaller plots into one larger plot. San Marcos shows this phenomenon in a characteristic way (**¡Error! No se encuentra el origen de la referencia.**).

Map 8. Grouping of several properties to form a larger area. San Marcos.

Note: The aggregation of properties that occurred between 2011 and 2022 can be explained by the addition of small properties with red property lines to a larger one in fuchsia.

Source: UNDP 2023.

In terms of the formalization of small and medium-sized rural properties, the Land Observatory of the National Land Agency (ANT) reports that in Nechí 76.53 hectares have been formalized, distributed over 31 properties. The following municipalities stand out: San Jacinto del Cauca, 77.82 hectares constitute the formalized area, which corresponds to 35 formalized properties.

The municipality of Magangué has 2,416 formalized hectares, that is, 727 properties. In the case of Achí, only 0.76 hectares have been formalized, that is, 8 properties. The municipality of Ayapel, in the department of Córdoba, has 76.62 formalized hectares for a total of 33 properties.

As for the allocation of vacant lands, in Nechí 15 plots of land have been allocated; in San Jacinto del Cauca 437; the municipality of Magangué has 8,735 vacant plots of land allocated; in Achí 623 have been allocated; in Ayapel 1,296; in Caimito 493; 1689 vacant plots of land allocated in San Benito Abad; 759 in Sucre; in San Marcos 489; in Majagual 415; and, finally, the municipality of Guarandá has 621 vacant plots of land allocated for a total of 1550 ownership titles and 1511 peasant families benefited.

For 2019, ANT reports that around 3,000 processes are pending for the titling of vacant lands, land formalization and agrarian processes[22], and a percentage of 69% in the informality index in the region's municipalities.

In terms of land restitution, as of December 2022, the Land Restitution Unit reported that in La Mojana they had received 1,086 applications for the restitution of properties by individual route, out of which 522 were not registered in the Register of Dispossessed Lands, 294 were registered and 203 are still pending[23].

Out of 294 entries, the courts have ruled on 102 lawsuits, ordering the restitution of or compensation for 2,036.83 hectares, benefiting 434 people.

It is also important to mention that in the region of La Mojana no rulings have been announced that would restore the territorial rights of ethnic communities.

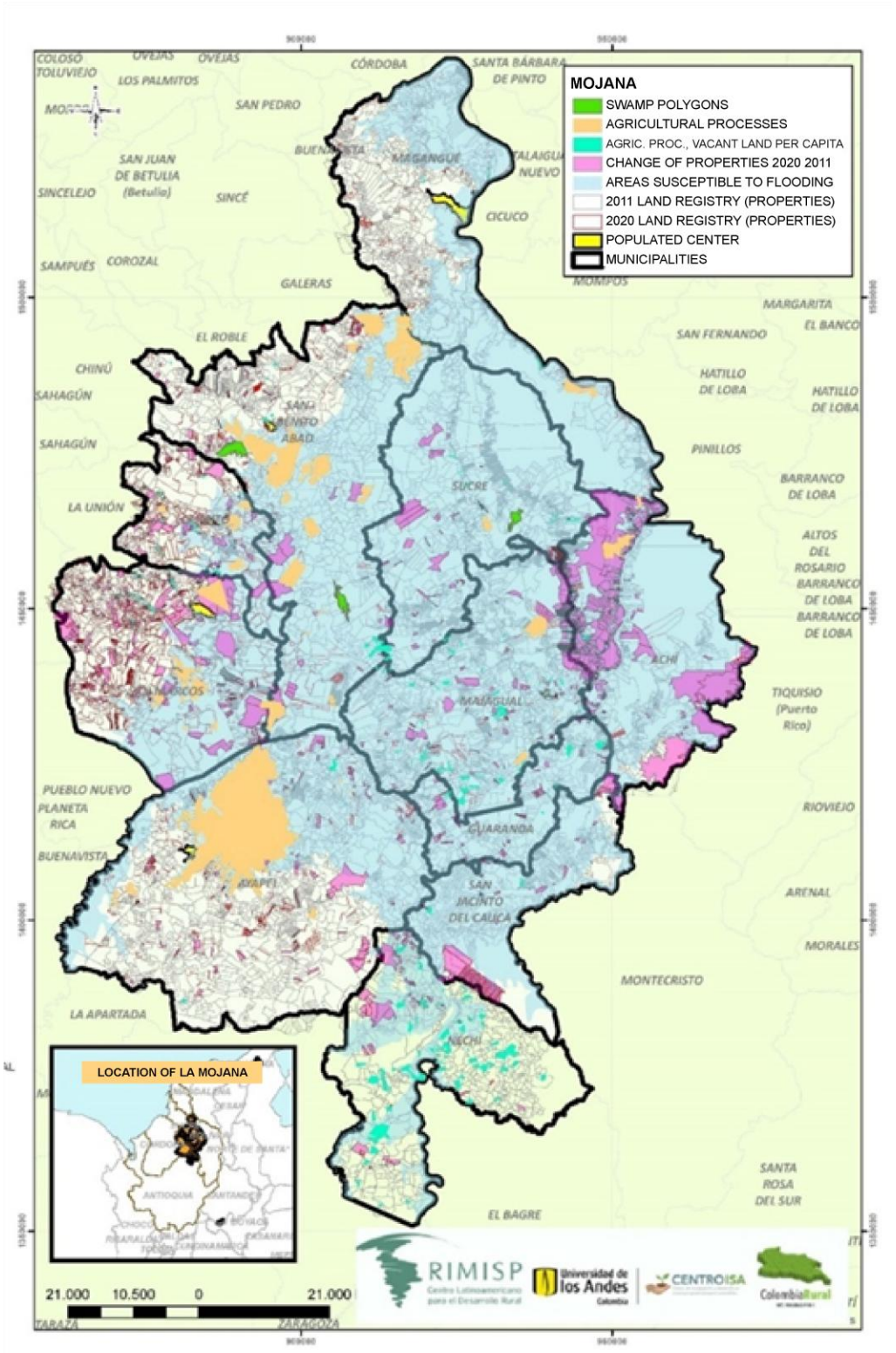
Lastly, concerning La Mojana properties under the administration of the Special Assets Society (SAE), the analysis of the information provided by that entity showed 192 properties, spread across the 4 departments, out of which 62 are located in rural areas.

All these results have led to the following territorial cartographic structure of the state of the dynamics of occupation.

[22] National Land Agency (ANT), EP-CONTRATO-715_1 "La Mojana, foco de políticas y estrategias regionales" (2019), https://www.ant.gov.co/wp-content/uploads/2019/09/EP-CONTRATO-715_1.pdf

[23] Upon analyzing the data published by the URT, a difference of 67 requests was observed between the total number of requests submitted to this entity and the status report of the process, which are presented as "not reported". There may be an error in the system, due to duplicate requests or outdated process status.

Map 9. Agricultural processes in relation to the floods in La Mojana.



Source UNDP 2023

2.5Timeline: Main milestones identified for La Mojana

The following timeline, which describes the most important environmental, social, productive and territorial milestones for the region of La Mojana, was created based on the information collected in the field.

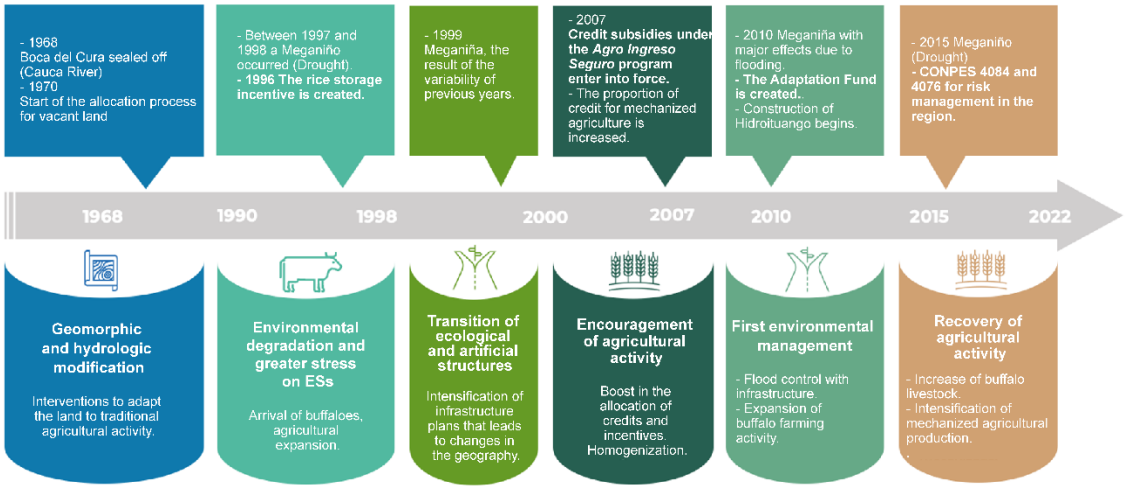
These can be organized into five stages (***¡Error! No se encuentra el origen de la referencia.***):

1. An initial period of modifications to the geomorphology and hydrology of the territory, which began in 1968 with the implementation of INCORA plans and lasted until 1990 with the first rupture of the Caregato dam. At this time, interventions are carried out to improve the suitability of land for traditional agricultural and livestock activities. During this same period, it is estimated that there was a major expansion in agriculture.
2. The second period runs from 1990 to 1998. This period was characterized by the arrival of buffalo herders and the expansion of the territory's large landowners' properties. Climatically, this period is characterized by having had a "*meganiño*" phenomenon between 1997 and 1998 which, due to the effects of the severe drought, caused the accumulation of land belonging to the modified swamps and the clogging of waterways. Similarly, during this period, the territory was under the influence of social factors that increased armed violence, which may have fueled the accumulation and concentration of large tracts of land in the hands of a few owners.
3. The third period, between 1999 and 2009, was a period of transition that began with *La Niña* climate phenomenon between 1999 and 2000, which led to a large increase in the accumulation of fresh water in the wetland of La Mojana, which could drastically change the composition of aquatic species. Land expansion in the previous period and poor maintenance of hydraulic works increased the sediment load in the highlands, which in turn carried minerals and saline components, transforming the physicochemical properties of the soil in the middle and lowlands. At the same time, mechanized agriculture, which had been implemented in the 1990s, was promoted with greater force.
4. The fourth period, between 2010 and 2014, can be considered the first with environmental management. The *Meganiña* phenomenon gives rise to different dynamics that, on the one hand, seek to control the flooding with infrastructure and hydraulic management works, while, on the other hand, the first ecological and environmental characterizations of the region are beginning to be made. Due to the flooding caused by this phenomenon, an environmental emergency was declared and the Fondo Adaptación was created.
   This period was characterized by 3 important events that had an impact on the region's strategic ecosystems: first, the massive loss of vegetation

cover, which was due to the high-water saturation of the vegetation and not to mercury contamination as some inhabitants believe.
Secondly, the expansion of buffalo production, which was better adapted to the flood pulses. Thirdly, the start of mega infrastructure projects such as the Hidroituango hydroelectric plant and the expansion of the road network. These mega-works impacted the flows previously recovered by the flood and reduced the ecological resilience of the region.

5. The fifth period is between 2015 and 2022, which was mainly marked by the beginning of drought, which mainly affected manual rice cultivation and traditional flood-adapted crops.
During this period, the buffalo population increased considerably, by almost 300%, exerting pressure on native species that are in the process of climate adaptation.
Bad practices, both economic and environmental, have led to a significant decline in native species such as the *hicotea* turtle, the *bocachico*, the tiger sorubim, the spectacled caiman, the striped catfish, the Bloch's catfish, the *pácora*, the areca, the blanquillo, among others.
The period ended with the pandemic, which created an apparent demand for products such as rice, driving up its price and thus providing a greater incentive to increase mechanized rice production.

Figure 11. Timeline of La Mojana with the main historical milestones and changes



Source UNDP 2023

3. Analysis of prioritized policy instruments

The policy instruments selected for analysis in the context of La Mojana in search of a roadmap for reform are as follows: The Agricultural Development Credit (CFA) through its special lines of credit, managed by Finagro, and the policy of demarcation of national lands and its use regulations managed by the ANT, in coordination with the competent environmental authorities, mainly the Regional Autonomous Corporations (CAR).

Nevertheless, note that the National Policy to improve the competitiveness of the Colombian dairy sector and the allocation of vacant land to individuals were not prioritized, as the former is prioritized for five areas of dairy excellence in the country[24], which do not include La Mojana, and the latter because the analysis carried out in section 2.4 "Territory occupation model" in chapter two (2), showed that in La Mojana it cannot be concluded that this instrument has had a direct relationship with the drivers of biodiversity loss, mainly due to the lack of relationship between the information available on landholding growth in the cadastral grid and the presence of ecosystems relevant to the analysis.

The following is a presentation of the operational framework and applicability of the two policy instruments, emphasizing the relationship with biodiversity as a starting point for the design of reform routes.

3.1 Agricultural Development Credit (CFA) through Special Lines of Credit (LEC)

The Agricultural Development Credit (CFA) is a financial instrument granted to individuals or legal entities that can be used in the production and/or commercialization stages of agricultural activities[25], for the financing of working capital, investment or expansions required in the indicated activities (Article 2. Law 16/1990)[26]. This can be used for the production, commercialization and improvement of infrastructure, the procurement of cattle, access to agricultural machinery, the construction or improvement of rural housing, the acquisition or exploitation of land, the adaptation of land, breeding farms to capture and transport fish and aquaculture products, the establishment of cold chains, the

[24] Two of the four management instruments were not prioritized for La Mojana, as the "National policy to improve the competitiveness of the Colombian dairy sector" is prioritized for five other macro-regions and the "Allocation of vacant land to the natural persons" was not shown to have any direct relationship with the drivers of biodiversity loss, mainly due to the lack of available information on landholding growth in the land registry and the presence of priority ecosystems.
[25] The areas of excellence in sanitary affairs and for dairy production prioritized by CONPES 3676/2010 are as follows: Northern Antioquia, the Bogotá Savanna, the central dairy region of Boyacá, Southern Nariño and the Sibundoy Valley, and Northern Cesar.
[26] "*Whereby the National Agricultural Credit System is constituted, the Fund for the Financing of the Agricultural Sector, FINAGRO, is created, and other provisions are issued*"

processing and conservation of agricultural products, feasibility studies for agro-industrial projects and research.

As part of the Agricultural Development Credit programme, Special Lines of Credit (LEC) are available as a financial instrument, which corresponds to an interest rate subsidy for the beneficiaries of credits from the National Agricultural Credit System granted with rediscount resources, through financial intermediaries (Article 8. Resolution 3/2016)[27]. Among the activities that can be financed the following should be mentioned: Planting of short-cycle crops, planting of perennial crops, activities to promote the competitiveness of dairy farmers, retention of cattle and buffalo fetal membranes, acquisition of animals and embryos to improve productivity, purchase of machinery, infrastructure and land adaptation, infrastructure for the transformation and/or commercialization of the different links in the production chains, the purchase of land for agricultural use and expenses related to the purchase of land (Article 10. Resolution 3/2016).

Colombian regulations offer guidelines concerning the allocation of resources, identification of beneficiaries, subsidy amounts and access to credit. Furthermore, it is defined in Article 1. Resolution 2/2022[28], the categorization of beneficiaries according to their income is defined through the budgetary term, as an example the lines of credit for 2023 are the Environmental Justice Lines, corresponding to the LEC - Green Economy, and Total Peace and Social Justice Lines, associated with LEC - Drying and Storage, LEC Productive Development; LEC Agricultural Reactivation; LEC Purchase of Agricultural Land; LEC Financial Inclusion; LEC NARP (Black, Afro-Colombian, *Raizal* and *Palenquero* communities); LEC Rural Woman; and LEC Rural Youth (Article 11. Resolution 6/2022). For La Mojana, it was found that, for the categories of land suitability, land formalization, livestock infrastructure, and the palm oil and aquaculture chains, there are very few credit allocations, for a value that represents less than 1% of the total allocated between 2010 and the first half of 2022. Most of the credits were given to rice production, for the preparation of crops in dry seasons, for corn in working capital and for livestock production, mainly bovine. Meanwhile, for the buffalo sector between 2010 and 2022, the credits were worth COP$47.6 billion[29], and the allocations were 737 distributed among 97 stakeholders *(**¡Error! No se encuentra el origen de la referencia.**)* (Finagro, 2022).

[27] "Whereby the regulation of incentives and subsidies through agricultural and rural credit is compiled and modified"
[28] *"Whereby Resolution 4/2021 is amended; 'Whereby the regulations on the allocation of agricultural and rural credit are amended and compiled, its beneficiaries and financial conditions are defined, and other provisions are adopted' and the amendments made by Resolution 7/2021".*
[29] The total amount is given in constant pesos (COP).

Table 6. Number and value of credit allocations according to the most relevant chains in La Mojana.

Year	Cattle			Rice			Corn		
	Quant.	Value (thousands of pesos, COP)	Average value per allocation	Quant.	Value (thousands of pesos, COP)	Average value per allocation	Quant.	Value (thousands of pesos, COP)	Average value per allocation
2010	524	25,940	49.5	308	11,134	36.1	13	86	6.6
2011	944	36,605	38.8	4,490	31,412	7.0	84	282	3.4
2012	1,422	43,608	30.7	1,316	11,373	8.6	11	53	4.8
2013	1,695	40.852	24.1	1,334	18,369	13.8	34	243	7.2
2014	1,357	34,853	25.7	604	11,039	18.3	13	104	8.0
2015	1,324	36,528	27.6	528	12,289	23.3	10	93	9.3
2016	1,575	41,172	26.1	524	15,056	28.7	36	292	8.1
2017	1,992	44,026	22.1	500	14,556	29.1	30	257	8.6
2018	2,159	72,198	33.4	422	12,196	28.9	32	296	9.3
2019	2,098	66,349	31.6	370	12,641	34.2	28	305	10.9
2020	3,685	86,926	23.6	1,076	26,625	24.7	48	489	10.2
2021	3,341	90,500	27.1	1,384	32,179	23.3	126	1,142	9.1
2022	2,936	80,277	27.3	1,764	40,130	22.7	166	1,211	7.3

Source: UNDP 2023 based on ISA 2022 and Finagro 2022.

Consequently, despite the few credit allocations, these were invested in the intensification of the systems with the greatest predominance in the region, namely rice, corn and livestock systems, and are being distributed among a few stakeholders, who according to Finagro (2022) are mostly large producers.

For the buffalo sector, the allocations are concentrated between 1 and 9 recipients, with the exception of San Marcos and Ayapel, where they are distributed among 13 and 56 credit recipients respectively (Finagro, 2022). According to the Third National Agricultural Census, in the region of La Mojana only 10.7% of the UPAs apply for credits. Out of these applications, only 6.6% (equivalent to about 1,200 applications) are approved. The UPAs that obtain credits are mostly those whose size is between 5 and 50 hectares.

The special lines of credit (LEC) and agricultural development credits do not have access criteria that include environmental guidelines or restrictions on the use of natural resources, nor do they have operating conditions related to any measure of sustainable use of biodiversity, good agricultural, livestock or environmental practices, or verification of sustainability results. This means that most of the credits granted in La Mojana are aimed at agricultural mechanization and technification without taking into account the characteristics of wetland ecosystem soils.

Even though the LECs have a restriction on agricultural and livestock use provided by the UPRA, there is uncertainty as to whether it contains environmental criteria beyond the delimitation of riparian buffers defined by the National Land Cover Classification - Corine Land Cover. As mentioned above, this classification is insufficient for wetland ecosystems such as La Mojana, which are large in size and contain a multiplicity of macrohabitats and vegetation.

3.2 Policy on the demarcation of national lands and regulation of their use

Analyzing the behavior of the mechanisms regulating land tenure is essential to understand the dynamics of territorial occupation. Given that the land is the setting for the development of rural life and agricultural production, the way in which rural territories have been occupied, and especially the way in which the State and communities have regulated and administered their use and tenure, are key to understanding the effects that agricultural public policy instruments and their application can have on biodiversity.

In Colombia, the impact of policies on agrarian reform and the management of rural property has varied from region to region, with marked historical trends, which have had a significant influence on the definition of the country's agricultural frontier. During this development, vacant plots of land have played a predominant role as a tool for the occupation of new territories, the development of colonization processes and, more recently, for the progressive guarantee of access to land for peasant communities. However, the development of a policy based on the allocation of rights over state-owned land has faced major challenges such as legal uncertainty, and informality and irregularity in tenure and, more specifically, the absence of a land registry inventory that would allow the clear identification of vacant land and its attributes.

In order to address the drawbacks inherent in the development of the policy for the allocation and administration of rights over vacant land, a whole legal system has been constructed aimed at clarifying the legal status of rural land and, on this basis, carrying out activities for its proper administration, highlighting the allocation, the recovery of land that is unduly occupied and its proper demarcation. The country has an institutional and regulatory framework aimed at the proper management of rural land issues, in which the role of vacant land is fundamental and aims to materialize what the Constitutional Court has called the constitutional programmatic mandate in this area (guaranteeing progressive access to rural property), which in turn is guided by postulates such as the social and ecological function of property.

Along these lines, the instruments available to the agricultural sector for the proper administration of the land constitute a comprehensive system that, together with environmental regulations, govern the allocation and recognition of rights, duties and restrictions, and have the potential to be decisive in defining the forms and scope of land exploitation and use. One of the most complex aspects of this issue is the delimitation of the different categories that are fundamental to the social and environmental management of property, that is to say, the identification of the legal circumstances of property ownership that to a large extent define the use and allocation of rights over the land.

The agrarian process of demarcating national lands has been applied particularly in relation to water bodies, especially lakes, lagoons and swamps. Accordingly, the identification of the physical boundaries of such areas (the high tide line or permanent watercourse) and a parallel strip of up to 30 meters, which, as noted, legally corresponds to the environmental authorities, largely define the technical component of the demarcation and its implications regarding the limit of state property ineligible for allocation. In a complementary manner, the definition of the high tide line or permanent watercourse allows for the technical establishment of the designated afferent protection zone which, together with the parallel strip, constitutes the riparian buffer. This afferent zone, although it does not restrict the constitution of property rights, does imply the establishment of a conservation regime that has the potential to regulate and restrict land use.

Furthermore, the technical criteria established by the Ministry of Environment through its “Technical guide to demarcation criteria for riparian buffers in Colombia” give the technical definition of a permanent watercourse and a strip running parallel to the watercourse (maximum 30 meters), which constitute vacant land ineligible for allocation, and the establishment of an afferent protection or conservation area that does not imply ineligibility for allocation but does imply restrictions on use.

Therefore, based on the definition of the perennial stream, the parallel strip, the public good and the protection area are specified, thus enabling the identification of what constitutes vacant land ineligible for allocation, in respect of which it is possible to assign only rights of use under the conditions described by Agreement 058/2018 issued by the National Land Agency, and a protected area in respect of which it is possible to demonstrate private ownership but whose use will be restricted to that established by the environmental authority.

Significantly, there is a disconnection between existing policies, the instruments and their appropriation in the territory, resulting in a lack of control over the management and use of the macrohabitats of La Mojana. In other words, in terms of management, it is not the absence of suitable policies for La Mojana that is the problem, but their effectiveness.

For instance, the environmental sector is one of those with the most policy formulation, and there are also regulations such as ANT agreement 058/2018, whereby the regulations for the granting of rights of use over allocable vacant land are established, or regulatory decree 1465/2013, on the demarcation or delimitation of national lands.

Both cases are exercises with possible positive effects, but not implementing them in the territory means that the policy operates by default rather than by design.

A second element found in the management system is that flooding is always seen as a problem, but not as an intrinsic ecological characteristic, and it is almost always managed with infrastructure devoid of biodiversity criteria.

This results in direct effects on geomorphological and hydrological structural elements, which impacts biodiversity by breaking the flows necessary for the sustainability of the Socio-Ecological System.

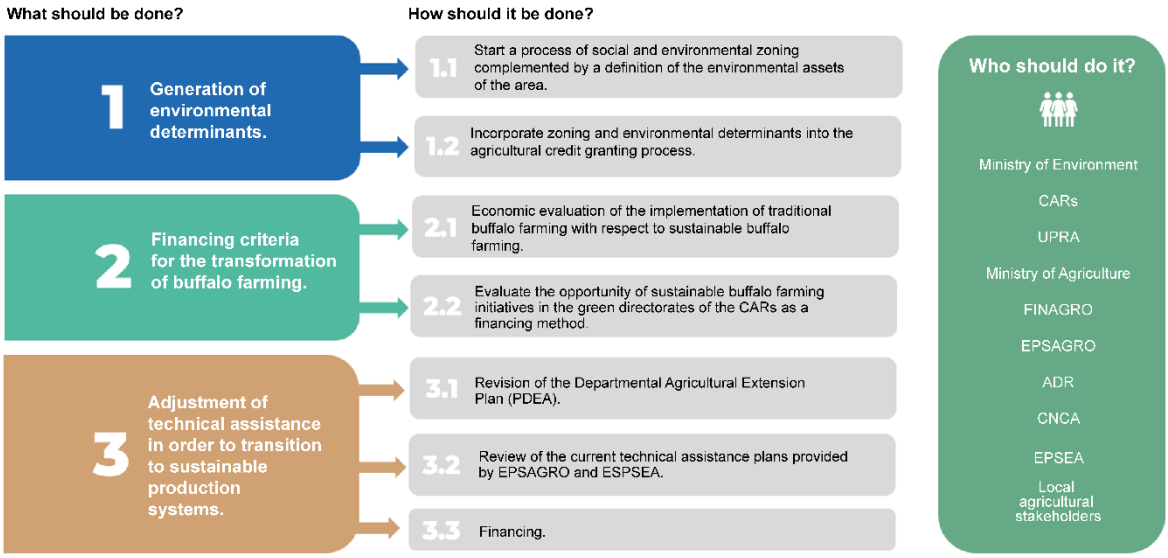
4. Roadmap of recommendations generated in the first and second phase of the study

This section presents the roadmap with actions aimed at improving the existing relationship between the aforementioned agricultural policy instruments and biodiversity in the context of La Mojana.

The design of this roadmap includes the recommendations generated in the first and second phases of the study, priority actions and those responsible for the proposed adjustments (Figure 12 and Figure 13).

4.1 Promotion of agricultural credits - Special Lines of Credit (LEC).

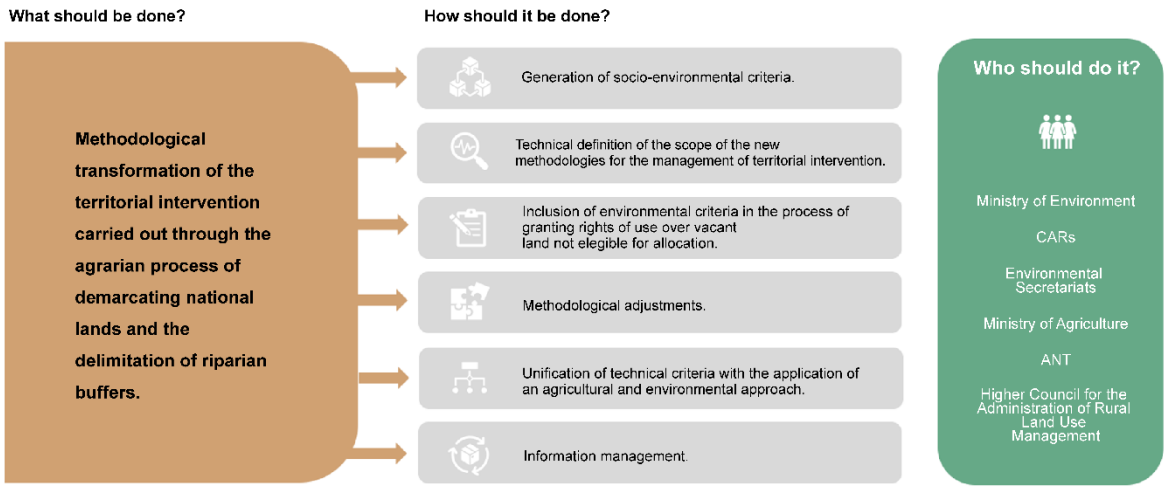
Figure 12. Reform route for the Agricultural Development Credit Line - Special Lines of Credit (LEC).



Source: UNDP 2023

4.2 Reform route for national land demarcation

Figure 13. Reform route for national land demarcation



Source: UNDP 2023

5. Recommendations and conclusions

The predominance of environmental management over productive management is regulated in Colombia by Law 388/1997, which establishes that the determinants related to the conservation and protection of the environment must be considered in the preparation of the Territorial Management Programmes (POT). As such, the agricultural production system must respond to the environmental conditions of the territory. Although having this regulatory framework represents progress in terms of environmental protection in the instruments of territorial planning and management, and is therefore identified as an advantage, progress still needs to be made at the national level in a dialogue between these two environmental and agricultural determinants, which takes into account the specific characteristics of each territory and is not limited to superimposing layers of geographic information systems, which in many cases are outdated.

In addition, the Rural Mission (2014) mentions that "Land use management must start by recognizing that there are functions of the territory that take precedence over others and that are protected by Colombian legislation (DNP. 2014). Therefore, environmental management must maintain its priority over productive management and, in the cases where there is private property within the areas delimited by the environmental management, these must fulfill the ecological function that is inherent to private property". However, not all local authorities have a definition or an update of these environmental determinants, nor do they have updated environmental and territorial management plans that delimit these areas. Updating this information and these planning instruments is a major challenge and would help mitigate the drivers of biodiversity loss through agricultural policy instruments.

At a national level, it is important to review the productive purpose defined by the UPRA, since, in the definition of these productive zoning criteria, productive criteria seem to take priority over environmental criteria. In La Mojana, the zoning of the region as highly suitable for buffalo production is being defined without taking into consideration the ecological sensitivity of this type of amphibian ecosystem. The UPRA zoning criteria are already included in the Special Lines of Credit (LEC), but they are insufficient for environmental and biodiversity protection. For example, according to these criteria, a large percentage (64% of the land in La Mojana has low, medium or high suitability for buffalo production, which contrasts with the results found in this study). Accordingly, it is recommended that the criteria of biodiversity and ecological resilience be included in the definition of these productive purposes, within the agricultural

frontier and the delimitation of ecosystems developed by the IAvH and the implementation of the Ecological-Economic Zoning (EEZ) of this region.

The Special Lines of Credit (LEC) and the Agricultural Development Credit (CFA) and the agrarian process of demarcating the national lands must involve environmental and social zoning criteria, which allows for coordination between the policies of the environment and agriculture sectors. In this way, these criteria would make it possible to identify the areas that should be protected, the production areas with special criteria for the protection of biodiversity and ecological resilience, and the areas suitable for agricultural production adapted to the ecosystems. The latter has been ratified by the Accord for the Termination of the Conflict and the Construction of a Stable and Lasting Peace, signed between the Government of Colombia and the FARC guerrillas in 2016, which undoubtedly constitutes an opportunity, in terms of environmental and agricultural policy guidelines for the whole country. Nonetheless, it also constitutes a risk, taking into account the slow progress in its implementation and the priority assigned to it by the respective national administrations.
A recurring issue in the implementation of policy instruments at the territorial level that involve more than one sector and that continues to be one of the main bottlenecks for their correct implementation is the difficulty of achieving intersectoral relationships and coordination at different levels, so that the entities that administer the policy instruments are well coordinated and respond to the needs of each context. Even though the regulatory framework for this coordination to take place has already been defined, which is highlighted as a positive aspect worth mentioning, the existing coordination bodies and possibilities have not yet been implemented in many cases.

For instance, there is the General Territorial Management Policy and the Rural Land Administration Council, which brings together the Agriculture and Environment sectors, and is led by the National Land Agency. Although **intersectoral coordination at the national level is very important, it must be translated into similar coordination between the competent entities, which guarantees the inclusion of the territorial approach in the implementation of these instruments and the use of regional institutional and community knowledge.**

The implementation of these instruments, in a region like La Mojana, must clearly establish the governance system for their administration at the time of their regulation. This is particularly the case when demarcating communal floodplains and defining the boundaries of riparian buffers. In the case of La Mojana one suggestion is to take into account how the community currently manages these

areas. In some cases, they are administered by the Community Action Boards (JACs). These forms of organization and decision-making provide an opportunity to coordinate the instruments with the dynamics of the territories. However, in doing so, it should be borne in mind that these governance models, as mentioned in the case of land demarcation, must include strategies for addressing the socio-environmental conflicts that will normally arise during the implementation of the instrument. Failure to address and take into consideration these possible conflicts constitutes a risk for the implementation of the aforementioned policy instruments, especially in the case of the demarcation of communal floodplains. Given the consequences and implications that instruments such as the agrarian process of demarcating the national lands and the demarcation of the riparian buffers around can have, as part of these governance schemes it is advisable to establish strategies for understanding, accompanying and resolving these socio-environmental conflicts.

The recommendations and conclusions proposed here can feasibly be implemented within one or two years, as they involve modifications to existing instruments that will enable their implementation by the competent bodies and their appropriation in the territory in the short and medium term. Whether they are carried out quickly and efficiently will depend on the political will to make it happen and the allocation of financial and human resources to achieve it. Relying on political will has advantages and risks, since it is necessary to adhere to the guidelines of the government and development plan of each administration and its intentions to make progress or not with these issues. Despite this and bearing in mind the National Development Plan (2022–2026), and knowing the fact that biodiversity is one of the central themes of the plan and a catalyst for actions related to land use management, it is expected that during the current government there will be opportunities for dialogue and progress towards the implementation of the adjustments proposed here.

Finally, it is expected that the recommendations made here will be considered by the Decentralization Mission led by the National Planning Department (DNP), with regard to the competencies related to the approval and implementation of the policy instruments analyzed herein.

The aforementioned factors must take into account that an adequate and efficient decentralization of competencies and resources implies a better implementation of policy instruments, adapted to the particularities of each territory and to their ecosystemic and productive characteristics.

5.1 Recommendations for the reform of the Policy Instruments

5.1.1 Agricultural Development Credit (CFA) and Special Lines of Credit (LEC)

1. CFAs and LECs have been mainly oriented towards investments to increase agricultural yield and productivity, as well as working capital for the main mechanized production systems (rice, corn, cattle), which has significant consequences for biodiversity and environmental stability. **In this respect, it is very important to encourage sustainability practices and, with this, to have environmental sustainability guidelines for their allocation**. These criteria should be based on the levels of impact on the structuring elements of the ecosystems in which the agricultural production system is based (wetlands, in the case of La Mojana) so that they are related to the ecological functions supported by each structuring element of the ecosystems. In such a way that these are rigorous criteria that allow the size and type of agricultural production to be in accordance with the natural environment in which it is found. Ecological functions are an enabling factor for good productive development.
   At the national level, both instruments should be adapted to the needs, conditions and environmental determinants of the territory in which they are being implemented. Meanwhile, credits aimed at agricultural intensification must meet the ecological criteria of each region where agricultural activity takes place. **Agricultural diversification and the implementation of agro-ecological production practices present an opportunity for sustainable production systems and agriculture that is cleaner in terms of its impact on the environment and the products harvested.**
2. In the case of La Mojana, this type of production system presents an **opportunity to acknowledge the local population's knowledge of the sustainable use of their ecosystem and is an option for addressing the food security problems the region faces due to flooding and its potential to connect with regional and national agrifood markets**. For this region, this means considering water flows and the behavior of the wetland ecosystem, as well as the agroecological practices that its inhabitants and small-scale farmers continue to implement.
3. **At the national level, restrictions or guidelines for production and environmental management must be considered when deciding where certain production activities can be carried out within the agricultural frontier and/or in relation to environmental zoning.** A fundamental aspect of proper land use is the environmental and cultural conservation of the land, which in turn is a determining factor for the

allocation of LECs and CFAs. The above is linked to the possibilities of diversifying production systems in certain regions that have intensive agricultural production patterns in some production chains.

4. Currently, this process has reached a bottleneck in the case of La Mojana, as the formulation of the Productive Management Plans (POP) with emphasis on the buffalo livestock chain is lacking, since this information is an important input for the delimitation of this agricultural activity. Not having this information available has a particular impact on ecosystems such as that of La Mojana, where this production system has been established without taking these guidelines into account. **On the other hand, there is the opportunity to propose a series of guidelines for this region on productive and environmental management according to the type of macrohabitats present in the wetland ecosystem**. For example, knowing the habitat maintenance function of the *zapal* microhabitat, a guideline could be to condition buffalo production to times other than species nesting times, and which coincide with the transition periods between drought and flooding. Concerning rice production, this can be conditioned by the use of production methods that do not affect soil structures and are less intensive in the use of agrochemicals, depending on their proximity to swamps, waterways and rivers.

5.1.2 Administration of national lands through land demarcation and regulation of their use.

1. The instruments of the social management of property, such as the allocation, recovery and demarcation of vacant land, have generally been developed in a way that has omitted greater consideration of their relationship with or impact on biodiversity, which has constituted a bottleneck for their adequate implementation. From the territorial analyses carried out in this study (Caquetá and La Mojana), a viable conclusion is that phenomena such as the removal of forest reserve areas for the allocation of vacant land and the lack of sufficient and adequate implementation of the recovery of vacant land facilitated the consolidation of agricultural expansion based on patterns of land occupation that acted as a driving force for the loss of biodiversity, through direct and indirect promotion of the colonization of forested areas; the transformation of savannas, wetlands and páramos; and the subsequent establishment of production systems in these areas with negative consequences on native and creole species and breeds.
2. Although agricultural and environmental regulations contemplate figures that are complementary due to their configuration, the analysis of the behavior of the instruments analyzed for the department of Caquetá and

the region of La Mojana allowed us to conclude that in practice, the demarcation processes, through which the boundaries of vacant plots of land are defined and rights, responsibilities and restrictions regarding these are granted, have operated in a non-coordinated manner in relation to the provisions of the environmental authorities, thus omitting criteria relevant to the identification and protection of certain ecosystems, as well as restrictions derived from territorial environmental planning that would place limits on certain land uses, this has constituted an obstacle to its adequate implementation. The aforementioned lack of coordination, with different territorial impacts, and in other cases the non-implementation of property management instruments, have led to a lack of governance of public goods and inappropriate land use, which, as indicated, is one of the drivers of biodiversity loss.

3. In the case of La Mojana, the demarcation process and the subsequent administration through the allocation of usage rights has been applied at a property level, implying a lack of territorial and ecosystem criteria in its management. This often makes its results incompatible with territorial environmental planning and generates conflicts over the use of common goods. This can be seen in the overlap of allocated land with areas of expansion of water bodies, which may be the result of the process being carried out in a dry season without taking hydrological dynamics into account.
4. Some progress was made in defining joint criteria and strategies for addressing these land use management processes through technical discussions between some of the entities in the sectors involved, especially through efforts made possible by agreements between the ANT and some Autonomous Corporations. Although these efforts constitute a point and an opportunity to advance this dialogue, they have not yet been scaled up to generate a real impact on the methodologies for implementing the instruments. These developments must be deepened in order to generate practices and guidelines that effectively allow the incorporation of environmental criteria in the execution of the nation's land administration processes, as well as the adequate assessment of the most customary forms of land use to avoid conflicts over its regulation and use.
5. To this end, the discussion must be taken to the Higher Council for the Administration of Rural Land Use Management (Decree 2367/2015), whose existence is a positive development. Its functions include coordinating matters relating to the planning and management of rural land use within the national government, which involves coordinating with the sectors and entities involved, establishing guidelines and criteria for the implementation of this type of instrument, and proposing and promoting the adoption of incentives for the proper management of rural territories, with regulatory powers to establish intersectoral technical committees that allow the conclusions of the experiences that have been built up to be

formally incorporated into the methodologies for implementing tools that impact territorial management.

6. The implementation of the technical criteria whereby a riparian buffer is defined contributes to the specification of the limits of private property and common use. These must include the participation of local communities, so that the existing ways of managing the territory and the local implications of decisions about it are acknowledged in the definition of the governance schemes. As such, the criteria for the participation of technical instruments should be among the elements to be reviewed in the proposed inter-institutional meetings, so as to make them binding and functional to the overall environmental and social planning process of the property and the territory. These forms of territory-based organization should be recognized as an opportunity to understand their ways of organizing and making decisions and thus optimize how these types of instruments that affect the relationship of the population with their ecosystem are applied.
7. Given the consequences and implications that instruments such as the agrarian process of demarcating the national lands and the demarcation of riparian buffers may have, it is advisable to establish within these governance schemes strategies for understanding, accompanying and resolving the socio-environmental conflicts that will arise during implementation.

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Annex

Annex 1. List of identified agricultural sector instruments

Instrument	Name of instrument
No. 1	Land Suitability Policy 2018-2038
No. 2	National Irrigation and Drainage Plan for the Peasant, Family and Community Economy
No. 3	Productive Alliances Programme
No. 4	Strengthening care for rural women at the national level
No. 5	Forestry Incentive Certificate
No. 6	Rural Capitalization Incentive Certificate - ICR
No. 7	Special Line of Credit
No. 8	National Programme for the Substitution of Illegal Crops
No. 9	Building capacities - Rural Business
No. 10	National Plan to support and consolidate Income Generation in the Peasant, Family and Community Economy
No. 11	National Agricultural Innovation System - SNIA
No. 12	Rice Storage Incentive
No. 13	Agricultural Guarantee Fund
No. 14	Agricultural Insurance Incentive
No. 15	Rural Microfinance Fund
No. 16	Authorization for the production, import and commercialization of agricultural inputs
No. 17	Import and export certificates for agricultural products and by-products
No. 18	Good agricultural practices certifications
No. 19	Supervision of tests, approval of protocols and standardization of seed tests.
No. 20	Certificates for companies that produce, market, distribute, import and export plant material, material of animal origin and Genetically Modified Organisms (GMOs).
No. 21	Certificates of agricultural land, forest crops and/or commercial agroforestry systems, nurseries
No. 22	Study of requests for access to the resources conserved in the National Germplasm Banks
No. 23	Administration and use of germplasm banks
No. 24	National policy to improve the competitiveness of the dairy sector in Colombia
No. 25	Formulation and implementation of comprehensive agricultural and rural development plans and projects with a territorial focus for the rural population at the national level
No. 26	Strengthening the Co-financing of Integral Agricultural and Rural Development Projects (PIDAR)
No. 27	National Plan to Promote the Commercialization of Production in the Peasant, Family and Community Economy (ECFC)

No. 28	Implementation of a model of service provision and support for commercialization
No. 29	Strengthening the Provision of the National Public Agricultural Extension Service
No. 30	Programme to promote projects and productive initiatives in aquaculture, artisanal fishing and related activities
No. 31	Development of climate-smart initiatives for adaptation to climate change and sustainability in prioritized agricultural production systems (rice, corn, bananas, sugar cane, potatoes and cattle farming)
No. 32	Improving the sustainability of agricultural production in the face of climatic phenomena.
No. 33	Allocation of vacant land to natural persons
No. 34	Collective land and territory titling
No. 35	Demarcation, recovery and administration of community savannas and floodplains
No. 36	Reversion, asset forfeiture and expiration
No. 37	Comprehensive property survey for the purposes of social management of property and multipurpose land registry.
No. 38	Awarding of rights of use over vacant land ineligible for allocation
No. 39	Subtraction of Forest Reserve Zones
No. 40	Establishment of the Peasant Reserve Zones
No. 41	Administration of environmentally protected areas
No. 42	Calculation of the Family Agricultural Unit (UAF) extensions

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