Our Commitment to Biodiversity
Actions in Biodiversity and Ecosystem Services in the Middle Magdalena Region

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ECOPETROL

Introduction

Ecopetrol integrates biodiversity and ecosystem services into its 2040 Strategy under the **Generating Value through TESG®** pillar, managing nature-related impacts, risks, and opportunities. It establishes mandatory and voluntary ecological conservation and restoration goals.

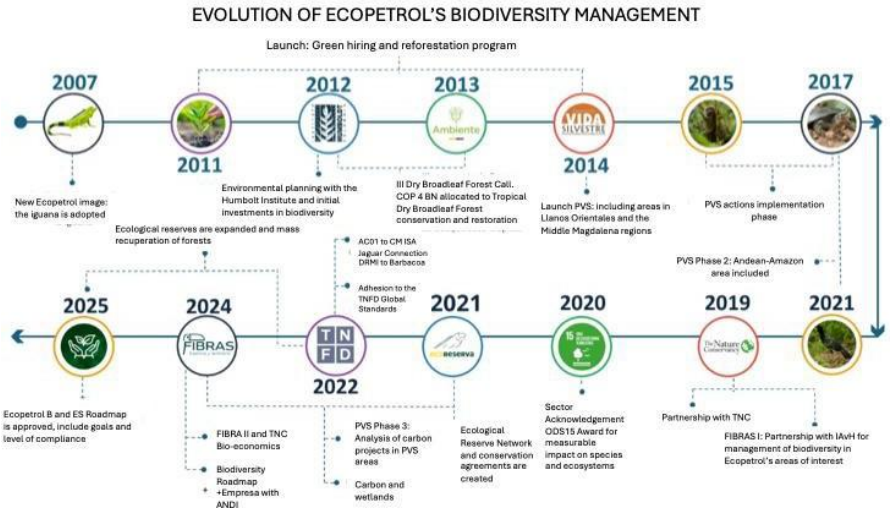
Through the roadmap, the Company defines actions aligned with international standards such as the Global Biodiversity Framework, TNFD, and 1t.org. Its management focuses on four (4) axes: information, impacts and dependencies, positive contributions, and risks. The goal is to achieve a **positive impact on biodiversity in new projects by 2030** and **measurable contributions to nature by 2040**, following the principle of **no net loss** and prioritizing prevention and compensation through restoration, conservation, and cooperation with communities.[1]

Objective and scope

The purpose of this document is to present the results of the actions developed by Ecopetrol in the Middle Magdalena region, focused on Biodiversity and Ecosystem Services, taking into account the Company's progress in this area in the last 10 years (2015-2025).

Additionally, it presents the progress, results, achievements and challenges related to the execution of the environmental management plans that are part of the licensing and environmental control instruments associated with the operational projects in the region, compliance with environmental compensation obligations and the 1% investment norm, as well as the development of voluntary initiatives and strategic projects such as the Wildlife Project (*Projecto Vida Silvestre "PVS"*). FIBRAS "*Esencia y territorio*", Ecoreservas (ecological reserves), among others.

Below is the timeline of the main biodiversity actions carried out by Ecopetrol:



[1] This information can be reviewed in detail at the following links:
ECOPETROL: www.ecopetrol.com.co
SosTECnibilidad:® https://www.ecopetrol.com.co/wps/portal/Home/sostecnibilidad

Governance matters

Board of Directors

Ecopetrol's Board of Directors is the Company's highest administrative body, with six (6) permanent committees that support its governance. The main function of these committees is to conduct a preliminary analysis and issue informed recommendations on issues submitted to the Board for consideration. The most relevant of these committees are:

- **Corporate Governance and Sustainability Committee:** This Committee assists the Board of Directors in matters related to good corporate governance and the sustainability agenda.
- **Territorial Transformation and HSE Committee:** This Committee monitors and manages risks associated with occupational health, industrial and process safety, for both workers and contractors; in addition to the Company's environmental performance and contribution to the development of the territories.
- **Audit and Risk Committee:** This Committee is responsible for, among other duties, overseeing the management and effectiveness of the Internal Control System, ensuring timely risk management, and the effectiveness of the controls implemented.

These committees have the power to take cognizance of Ecopetrol's actions that they consider strategic, and may request the Administration to submit specific reports. In this way, the members of the Board delve into key topics, such as business risks and the Company's impacts on the economy, the environment and people, among other topics.

Senior Management

The Strategic Committee is the highest-level body, led by the Company's president, and serves as a forum for articulating the Ecopetrol Group's strategy. Its main value lies in ensuring alignment between strategic pillars and long-term corporate decisions. In this space, fundamental strategic issues are reviewed, monitored, and approved, including decarbonization objectives, investments in clean technologies, and environmental management across the Ecopetrol Group.

This body has approved and monitored the fulfillment of goals associated with Biodiversity and ecosystem services, as well as resources for the advancement of voluntary and mandatory environmental investment projects and for the adherence to voluntary initiatives and commitments such as the Taskforce on Nature Financial Disclosure: Nature-related Financial Disclosures Group (TNFD). 1t. Trees, Biodiversity Credits Forerunners, and IPIECA: Group on Global Biodiversity Framework.

In turn, the Business Line Committees – Hydrocarbons, Energy for the Transition, and Transmission and Toll Roads – perform supervisory and strategic alignment functions within

their respective operational areas. These committees monitor progress on the specific environmental objectives of each line, promote the exchange of good practices, and ensure coherence between operations and the corporate environmental strategy. Although they do not have decision-making powers, their role is essential for the effective implementation of the environmental strategy in daily operations.

Ecopetrol has voluntarily agreed not to operate in areas designated in categories I to IV of the International Union for Conservation of Nature (IUCN).

- Material Elements and Roadmap for Biodiversity and Ecosystem Services

During 2020, Ecopetrol updated its materiality analysis, on which its TESG strategy was based. This exercise identified 28 elements with a significant impact on their ability to generate value in the short, medium, and long term and/or that had a significant influence on the decisions of their stakeholders.

Of the 28 material elements, eight (8) were classified as worth noting. These topics corresponded to areas in which Ecopetrol sought to adopt best practices and incorporate the most recent trends into how the Company is managed. Included in these eight elements was the issue of Biodiversity and Ecosystem Services.

In that same year, the Company defined the roadmaps for the material issues of Integrated Water Management, Climate Change and Biodiversity, establishing goals, management indicators, and milestones to be achieved in the short, medium, and long term. The Biodiversity Roadmap included a series of commitments that remain in force at the time of publication of this document, as follows:

- Delivery, support and/or planting of 12 million trees by 2030 (accumulated across the entire Business Group).
- 30 ecological reserves designated on Company properties by 2030 (accumulated across the entire Business Group).
- Conservation/restoration of 400,000 hectares by 2030 through voluntary/mandatory actions (maintained/new).
- Conservation of 15 wild species in three (3) locations by 2030 (Middle Magdalena Valley, Llanos Orientales, and Putumayo).
- Enable the supply of 3 million tons of CO_2/year through Natural Climate Solutions projects by 2030 (Capture or reduction).

In February 2022, Ecopetrol launched its new corporate strategy for 2040, "Energy that Transforms", intending to strengthen the leadership of the Ecopetrol Group in Colombia and the region. The new strategy incorporated Generating Value through TESG as one of its pillars, reflecting the importance of sustainable development for the Ecopetrol Group. TESG in Ecopetrol refers to carrying out responsible, safe, and efficient operations, on the basis of a harmonious relationship with both the environment and its stakeholders; within a transparent and ethical governance framework, making use of technology for the development of innovative solutions aimed at current and future challenges.

In 2023, Ecopetrol updated its materiality exercise once more, this time under a dual materiality approach, considering more than 80 impacts on the environment and society caused by its operations; as a result of this exercise, the company defined 14 material elements, all equally important and prioritized by management, including Climate Change, Water, and Biodiversity and Ecosystem Services. In addition, it identified four (4) issues that, due to their transversal nature to Ecopetrol's strategy, are not managed as specific elements, but rather acquire an enabling role thereof. Among these is the Fair Energy Transition.

During 2023, Ecopetrol also carried out two (2) pilots for the implementation of new methodologies proposed by TNFD, aimed at managing nature-related risks and opportunities.

For its part, the Biodiversity and Ecosystem Services Roadmap incorporated a strategic risk management option, which encompasses its economic valuation and ecosystem-based adaptation. This and other roadmaps were approved by the Company's Strategic Committee in 2025.

- Policies and Procedures:

Ecopetrol S.A. has an HSE Management System, which establishes the necessary elements under which the Company adequately manages risks to protect life and promote environmental care. The mandatory basic requirements of the HSE Management System are based on the international standards ISO 14001:2015 and ISO 45001:2018, and the certificate to ensure compliance with national legislation.

Based on the above, Ecopetrol currently has various policies, procedures, and monitoring metrics to manage its biodiversity. The following are among the most relevant:

- HSE-H-047 Trees: Number of individual trees planted, supported, and/or delivered.
- HSE-H-054 Hectares currently under restoration.
- HSE-H-055 Areas currently under conservation.
- HSE-G-126 Guide for the designation of ecological reserves.
- HSE-G-174 Guide for Offsetting Greenhouse Gas Emissions.
- GDE-P-001 Procedure for the Management of Ecopetrol S.A.'s Social, Environmental, and/or Relationship Investment Projects
- HSE-G-158 Methodological Guide for the Management of Environmental Compensation and 1% Compulsory Investment Obligations. Environmental management plans and follow-up and monitoring of the management instruments approved for licensed projects in the Middle Magdalena.

- Risk Management

Risk management at Ecopetrol is supported by the Integrated Risk Management System (SRI for its acronym in Spanish), based on the COSO 2013, COSO ERM 2017 and ISO 31000:2018 benchmarks, and is governed by the provisions outlined in the internal regulations, incorporated in the Bylaws, comprehensive policy, Code of Good Governance, handbooks, guides and internal instructions determined for this purpose. Comprehensive risk management seeks to establish general guidelines for risk management (identification,

assessment, treatment, monitoring, and disclosure), and to foster a culture that enables informed decision-making, considering possible events that may positively or negatively impact the Company's objectives. Under the SRI, depending on the level at which risks are managed, risks are classified as strategic, tactical, and operational, taking into account the specific regulations and standards adopted.

At the strategic level, the current business risk map reflects events that could divert the Company from achieving its strategic objectives; these are constructed and validated with senior management, submitted to the Audit and Risk Committee of the Board of Directors, and approved by the Board of Directors. In this regard, the Company has incorporated into its map the risk of "Inadequate response to challenges associated with climate change, water and biodiversity", which highlights management, monitoring and mitigation mechanisms, such as: the approval of the updated biodiversity and ecosystem services roadmap; structuring of guidelines for the management of natural capital risks and Zero Net Deforestation (DNC for its acronym in Spanish), designed and implemented for the planning and evaluation of projects, as well as the supply chain (alignment of Climate and Water Change Roadmap); and progress in the definition of the work plan for the quantification of risks associated with biodiversity with the corresponding agencies, under the TNFD management and reporting framework.

Additionally, since 2019, Ecopetrol has implemented a regional analysis based on the RCP 6.0 scenario, aligned with the Comprehensive Climate Change Management Plan of the Mines and Energy sector and the Third National Climate Change Communication. Based on the above, the Company formulated regional adaptation plans, which incorporate measures associated with water management, strategic ecosystems, resilient infrastructure, and climate-compatible operations.

At the operational level, within the framework of its participation in TNFD, progress has been made in the identification of nature-related impacts, dependencies, risks, and opportunities, in 10 assets directly operated by the Company and two (2) of its refineries. The above, with the intent to publish in 2025 the first report as early adopters of the framework.

- Environmental Impact Statement and Environmental Management Measures in Current and Future Operations

In order to avoid, minimize, recover, correct, and compensate for impacts on biodiversity, Ecopetrol carries out processes for the management of biodiversity and ecosystem services, aimed at generating the least amount and magnitude of residual impacts, based on the implementation of the mitigation hierarchy in projects and operations.

Following the mitigation hierarchy, the Company harmonizes its activities around territorial planning and environmental determinants, carrying out environmental zoning, identifying areas of non-operation and restrictions, as a measure to prevent negative impacts on biodiversity, complemented by mitigation, correction, and offsetting measures. Residual impacts are offset by actions for the preservation, restoration, and sustainable use of biodiversity, executed through conservation agreements with local communities, purchase of land for conservation and restoration of ecosystems, among others. This, in line with the integration of principles of

prevention and no net loss of biodiversity into the Company.

These measures are documented and presented to the competent environmental authorities, in the Environmental Impact Studies (EIAs for its acronym in Spanish), Environmental Management Plans (PMA for its acronym in Spanish) and other studies, included in the control and monitoring instruments such as Environmental Licenses (LA for its acronym in Spanish), Comprehensive Environmental Management Plans (PMAI for its acronym in Spanish), and serve as support for environmental compliance in projects and operations, as well as in obtaining authorizations for the use and exploitation of renewable natural resources.

- Comprehensive Management of Environmental Impacts in licensed projects

Prevention, mitigation, and corrective measures

As part of its environmental strategy and Environmental Management Plans (EMP) for licensed projects, Ecopetrol executes measures to prevent, mitigate, and correct impacts on the environment. Currently, in the Middle Magdalena region, the company has 18 plans filed with the ANLA, focused on protecting biodiversity, especially natural vegetation and wildlife in its areas of operation. Actions derived from these measures are reported annually in the Environmental Compliance Reports (ICA for its acronym in Spanish), and include:

- **Environmental zoning** to identify areas suitable or not suitable for intervention.
- **Restrictions in protected areas** such as Regional Integrated Management Districts (DRMI for its acronym in Spanish) limiting activities to areas compatible with hydrocarbons.
- **Mitigation measures**, such as wildlife crossings - Six (6) in total: Moriche Field: three (3); Campo Jazmín: two (2); Peñas Blancas: one (1) - that facilitate the safe transit of animals.
- **Strategic signage** (more than 245 signs installed: Casabe Peñas Blancas: 53; Cantagallo: 43; Garzas: 12; Cristalinas: 5; Flamencos: 8; Jazmin: 54; Moriche: 53; Nare
- Sur: 9; Sardinata: 3; Tibú: 5; among others) to prevent collisions and issue warnings on sensitive areas for fauna.
- **Geographic Information System (GIBIS)** for the real-time recording of fauna and flora, facilitating the monitoring and adjustment of management measures.
- **Closure and Abandonment Plans**, which include revegetation with planting of native species to restore the ecological conditions of the intervened areas.

Lisama Rehabilitation Process 158

Within the framework of the Lisama 158 Environmental Recovery Plan, Ecopetrol has rehabilitated key areas by planting more than 122,000 native seedlings.

In this same context, more than 9,000 individual specimens covering 48 native species have been planted in the Tayra Lizama ecological reserve alone, and more than 1,300 individual specimens covering 38 species have been recorded through photo trapping, including reptiles, birds, and mammals. It is noteworthy that, from birdwatching initiatives such as the Global Big Day - VRC in the ecological reserve, 1,033 individual specimens covering 150 species of birds have been recorded.

Environmental Offsets and 1% Investment

Ecopetrol, in the development of its projects, uses natural resources and collects water in accordance with environmental permits. This generates environmental offsetting obligations and a minimum investment of 1%, according to Colombian regulations. Offsetting, mainly for intervention in vegetation cover that has already been transformed, is carried out in accordance with the current regulation, which requires the offsetting of up to five hectares for each hectare intervened (1:5 ratio).

In the Middle Magdalena, 79 offsetting obligations exist, 16 imposed by the National Environmental Licensing Authority – ANLA and 63 by regional corporations.

To comply with environmental obligations, Ecopetrol submits offsetting and investment plans of no less than 1% to the environmental authority for evaluation and approval. The offsets are formulated in accordance with Resolutions 1517 of 2012 and 256 of 2018, which establish criteria on what, how much, where, and how to offset, ensuring ecosystem equivalence. The 1% investment is governed by Decree 2099 of 2016 and Article 321 of Law 1955 of 2019, and must be executed in the same hydrographic zone or subzone where the water resource is captured.

The main actions that Ecopetrol has implemented to fulfill its obligations have been reforestation and the purchase of land. However, since 2016, Ecopetrol has developed a nationwide strategy where areas of execution and conservation-oriented actions with communities were prioritized, through conservation agreements (CAs).

Below are the main milestones achieved in the last 10 years:

MILESTONES FOR ENVIRONMENTAL OFFSETTING AND INVESTMENT 1% - Middle Magdalena Region	
2015	502 ha in reforestation efforts. 183 ha in land purchases.
2018	**National implementation strategy**: implementation and CA activities are prioritized.
2021	**Start of CA strategy:** signing of 23 CAs associated with 80 ha of strategic ecosystems.
2022	**Establishment of sustainable use:** 21.24 ha in agricultural, forestry and pastoral systems
2024	**Conservation in collaboration with communities:** 47 CAs, 64.43 ha in agricultural, forestry and pastoral systems, 364 people trained in sustainable use, >260 ha of gallery forest conserved.

Thus, the main results are the following:

	Unity	1%	Offset
Number of conservation agreements signed	#	21	26
Hectares of conservation associated with the agreements	ha	91.62	173.25

Incentives in agricultural, forestry and pastoral systems	ha	25.29	39.14
Reforestation	ha		502
Land purchases	ha		183
People trained	#	364	

These figures have been included in the Integrated Sustainable Management Reports for the years 2020 to 2024. For more information, see: Compliance to biodiversity offsets and 1% investment* requirements.

Conservation projects in the Middle Magdalena region

Wildlife Project (PVS)[2]

The PVS seeks to address the conservation challenge in Ecopetrol's operating landscapes, such as the Middle Magdalena, the Llanos Orientales and the Andean-Amazonian foothills. In this sense, it is aimed at preserving biodiversity in the long term, through actions aimed at protecting endangered species and promoting sustainable ways of life with local communities. This initiative, financed by Ecopetrol, began in 2014 and is scheduled for initial completion by the end of 2025, with plans for continuity in the coming years. This

[2] **PVS public supporting documents**

1. Strategic alliance: https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/vida-silvestre.pdf
2. Fact sheet:https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/proyecto-vida-silvestre-esp.pdf
3. Book (Logbook): files.ecopetrol.com.co/web/esp/cargas/libro-pvs.pdf
4. Booklets and other products: https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/cartillas.pdf
5. Wild Notes:https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/notas-silvestres.pdf
6. PVS Monitoring Program:https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/programa-de-monitoreo.pdf
7. PVS News:https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/noticias.pdf
8. Community Testimonies – "Voices That Inspire Us": https://www.youtube.com/watch?v=hDTjCO0YnQ4

project has been implemented in conjunction with the Wildlife Conservation Society (WCS) and the Fund for Environmental Action and Children (Fondo Acción).

The PVS works in three (3) landscapes and 15 species under some degree of threat, five (5) species for each landscape:

1. **Middle Magdalena landscape:** Marimonda or Choibo (*Ateles hybridus*), Blue-billed Curassow (*Crax alberti*), West Indian Manatee (*Trichechus manatus*), Striped Catfish (*Pseudoplatystoma magdaleniatum*), and native timber species.
2. **Llanos Orientales landscape:** South American tapir (*Tapirus terrestris*), Moriche Palm (*Mauritia flexuosa*), Orinoco crocodile (*Crocodylus intermedius*), Conger eel (*Acosmium nitens*) and Arrau Turtle (*Podocnemis expansa*).
3. **Andean-Amazonian foothills landscape:** Common woolly monkey (*Lagothrix lagotricha*), Oncilla (*Leopardus tigrinus*), White-lipped peccary (*Tayassu pecari*), Spanish cedar (*Cedrela odorata*), and Black Tinamou (*Tinamus osgoodi*).

Additionally, the implementation of some direct conservation actions with other complementary species has been possible, such as the Magdalena River turtle (*Podocnemis lewyana*), the jaguar (*Panthera onca*), and the American crocodile (*Crocodylus acutus*).

Each of the 15 species has an action plan for its conservation. This analysis was based on the Open Standards for Conservation Practice (CMP 2013), which resulted in a conceptual model for each landscape that includes:
1) the species **under conservation** (five in each landscape),
2) the **threats** that directly affect the species,
3) the **contributing factors** that generate or enhance the threats, and
4) the **conservation strategies** or actions (ecological and social) necessary to improve the status and habitat of the species, and ensure their survival over time.

Species in the Middle Magdalena landscape

The PVS is an initiative financed by Ecopetrol that began more than 10 years ago (2014) and has been executed in stages, the fourth of which is currently beginning its execution period (2025-2028). The PVS articulates its actions through five (5) local organizations: Fundación Proyecto Primates, Fundación Humedales, Fundación Biodiversa Colombia and Fundación Cabildo Verde. Some of the activities carried out in the Middle Magdalena landscape include the recognition of characteristics of some of the prioritized swamps, identifying their main stressors, and the relevant mitigation actions in each of the cases. To achieve these results in a comprehensive manner, monitoring actions are articulated across communities, fishermen, and other regional associations. The following is a detailed description of the actions conducted with each of the five (5) species prioritized in the landscape.

- **West Indian Manatee (*Trichechus manatus)* - Endangered (EN), an aquatic mammal that maintains the balance of ecosystems.**

A Manatee Conservation Program[3] and Monitoring Program[4] were structured as part of the conservation actions for the West Indian Manatee. Between 2021 and 2024, monitoring the manatee population[5] involved 57 people from nine (9) fishing communities. A total of 674 monitoring events were conducted, resulting in 251 recorded activities and a cumulative total of 4,195 hours of observation in 15 swamp complexes, including 29 bodies of water and 190 sectors. The manatee was observed in 11 of these complexes, indicating its significant presence in the area and its use of specific areas with conditions suitable for its habitat[6].

The main causes of accidents involving the West Indian manatee are related to human activities in their habitats. The most critical of these corresponds to collisions with vessels due to the increase in river traffic. The loss and fragmentation of habitats due to the construction of infrastructures and dredging, the pollution of bodies of water[7], and bycatch in fishing nets also have an impact. The accumulation of these factors limits the recovery of the species and increases its vulnerability. The Middle Magdalena Manatee Stranding Network (*Red de Varamientos de Manatíes del Magdalena Medio*), which emerged within the framework of the PVS, brings together entities such as Cabildo Verde, WCS Colombia, CAS, Corantioquia, several regional mayoral districts, and local communities[8].

The PVS has established and strengthened the Manatee Stranding Network, training over 100 individuals and distributing kits to address emergencies. Thanks to this network, help has been provided to more than 20 manatees in critical situations [9]. Recommendations have been shared to avoid the use of trammel nets and regulate the transit of motorboats, which can cause serious injuries to manatees [10].

In cases of death, investigations have been carried out by the Autonomous Regional Corporation of Santander. Based on these investigations, this authority has concluded that the causes are multiple and not attributable to Ecopetrol [11].

To learn more about this species in the Middle Magdalena, you can refer to Ecopetrol's website at the following link: Ecopetrol | Nature-based solutions for the future.

- **Striped Catfish (*Pseudoplatysoma magdaleniensis*) – Endangered (EN), an emblematic species for artisanal fishing.**

[3] Guide to the conservation of the West Indian manatee: Cartilla Manati.pdf
[4] Manatee Monitoring Program Plan+Acción+Manatí.pdf
[5] Mitochondrial Genetic Diversity, Population Structure and Detection of Antillean and Amazonian Manatees in Colombia: New Areas and New Techniques Frontiers | Mitochondrial Genetic Diversity, Population Structure and Detection of Antillean and Amazonian Manatees in Colombia: New Areas and New Techniques
[6] Feeding habits of *Trichechus manatus manatus*, in the San Juana swamp and San Juan river https://repositorio.unbosque.edu.co/items/355ead75-0450-4439-aa8f-e1768094b11f
[7] Parasite fauna of the wild Antillean Manatees (*Trichechus manatus manatus*) of the Andean Region, Colombia https://pubmed.ncbi.nlm.nih.gov/31029160/
[8] - https://colombia.wcs.org/es-es/WCS-Colombia/Noticias/articleType/ArticleView/articleId/21017/LANZAN-RED-DE-VARAMIENTOS-PARA-SALVAR-A-LOS-MANATIES-EN-EL-MAGDALENA-MEDIO.aspx
- https://cas.gov.co/prensa/red-de-varamientos-para-salvar-a-los-manaties-en-el-magdalena-medio/
[9] Guide for managing stranding: Guia Manatí.pdf
[10] - Wastewater discharge, one of the possible causes of death of manatees in Barrancabermeja - BluRadio
[11] Stranding reports of the West Indian Manatee in the middle Magdalena Basin, Colombia 2011 to 2023. https://lajamjournal.org/index.php/lajam/article/view/1647/593

As for the striped catfish, various conservation actions have been implemented to protect this species, such as improvements in the average size of the catfish, restoration of natural cover, and fostering responsible fishing[12], framed in the monitoring plan for the striped catfish[13].

Monitoring is carried out in a participatory manner with 326 fishermen from five (5) fishermen's associations[14] who, in turn, are committed to the agreements of good fishing practices. The greatest difficulty in monitoring corresponded to the rapid identification of the minimum fishing size (currently there is a tendency to decrease the size of individual fish, which begin their reproductive period early[15]) and compliance with the closed period. However, throughout this process, there has been an overall increase in the average percentage of compliance with agreements.

- **Blue-billed Curassow (*Crax albertii)* -** Critically Endangered (CR), an endemic bird vital for seed dispersal.

Since the beginning of the PVS, and all the way to the present, an increase in the probability of occupation of the Curassow has been observed, associated with the monitoring of the status of the population of the species[16]. This has been due, among various reasons, to the effect of conservation agreements with local communities that favored the probability of colonization of the species in conservation areas, that is, the probability that it would reach places it could not inhabit before.

With respect to the indicator associated with the population status of the species, the documents listed in the references can be consulted[17].

- **Brown Spider Monkey (*Ateles hybridus*) - Critically Endangered (CR), key primate for forest regeneration.**

In 2015, when the implementation of actions began in the Middle Magdalena, the occupation of the Brown Spider Monkey was 20%, by 2020 the occupation had increased to 65%, thanks to conservation agreements that include the conservation of the forests, restoration processes, and the absence of hunting[18]. On the other hand, the creation of the Brown Spider Monkey or "*Choibo*" Festival in Puerto Parra has been promoted, which fosters knowledge and cultural appropriation of the species. This demonstrates the importance of the strategies for the

[12] Communities with a Voice. Chapter 8. Strengthening fisheries governance and its contribution to the conservation of striped catfish *Pseudoplatystoma magdaleniatum* in a sector of the Middle Magdalena River (Colombia)Editorial Publication | Research System Editorial Unimagdalena

[13] Striped Catfish Monitoring Plan: Plan+de+acción+Bagre.pdf

[14] Fishermen's associations: San Rafael de Chucuri fishermen's association, Asopezchucuri. Bocas del Carare Fishermen's Association, Asopezbocar. Association of Bagfish Fishermen of Barrancabermeja, Asodesba. Union Fishermen's and Farmers' Association, Asopezgrum. Association of fishermen of the Ciénaga de Chucuri

[15] Effects of selective fishing on a small scale multi-species and multi-gear freshwater fishery in the Magdalena River Basin (Colombia) Frontiers | Mitochondrial Genetic Diversity, Population Structure and Detection of Antillean and Amazonian Manatees in Colombia: New Areas and New Techniques

[16] Curassow Monitoring Plan: Plan+de+acción+Paujil.pdf

[17] Evaluation of alternative conservation strategies for the blue-billed curassow *Crax alberti* in the Middle Magdalena Valley, Colombia Evaluation of alternative conservation strategies for the blue-billed curassow Crax alberti in the Middle Magdalena Valley, Colombia | Oryx | Cambridge Core

[18] Brown Spider Monkey Monitoring Plan: Plan+de+acción+Marimonda.pdf

conservation and restoration of the species, implemented in conjunction with the Fundación Primates, as well as collaboration efforts with the communities.

To learn more about this species in the Middle Magdalena, you can refer to the documents in the references.[19]

- **Timber Species**

Priority was given to 14 native species that, due to their timber potential, are of great relevance to the communities and that, in turn, correspond to species of mature forests or in a good state of conservation, and that are usually affected by unregulated use and poor forest management[20]. There is a general trend towards an increase in the abundance of species in restoration areas, highlighting species such as the *Genipa americana* ("*Jagua*"), the *Enterolobium cyclocarpum* (Elephant ear tree), the *Cordia gerascanthus* ("*Móncoro*"), the *Ceiba Pentandra* ("*Ceiba"*), and the *Cedrela odorata* (Spanish cedar), which significantly increase their populations in 2024 compared to 2020. This analysis highlights that restoration strategies are favoring not only the recovery of the abundance of key species, but also the structural and functional diversity of forests[21].

Partnerships with the Alexander von Humboldt Institute: "Essence and Territory" Fibers Agreement (Phase I 2019/2023 – Phase II 2024/2027) and Ecoreservas 2022/2024

Ecopetrol has entered into several partnerships with the Alexander von Humboldt Institute, of which the following stand out: ***FIBRAS "Essence and territory"*** in two (2) phases, the first between 2019 and 2023. The second, which began in 2024 and runs until 2027, ***and ECORESERVAS*** between 2022 and 2024***.*** These partnerships have provided elements and tools to advance Ecopetrol's purposes, incorporating scientific knowledge to generate new ways in which the Company can relate with its rural territories and areas of influence. This is attained through ongoing work with the community in participatory science processes, providing new biological records to the country and the first genetic inventory for natural hydrocarbon springs using public information that allows different stakeholders to make decisions based on science.

- **FIBRAS "Essence and territory" – Phase I and ECORESERVAS**

This partnership between the Humboldt Institute, Ecopetrol, and strategic collaborators resulted in activities conducted in the Middle Magdalena and Orinoquia regions, as well as in the department of Huila, starting in 2019. The technical developments associated with these agreements have served as input for companies, trade associations, and public entities with similar challenges to manage biodiversity in their areas of influence. The purpose of these agreements is to plan and manage biodiversity and its contributions to territorial well-being,

[19] Corridors in heavily fragmented landscapes: reconnecting populations of critically endangered brown spider monkeys (*Ateles hybridus*) and sympatric terrestrial vertebrates in the lowland rainforests of Central Colombia Corridors in heavily fragmented landscapes: reconnecting populations of critically endangered brown spider monkeys (Ateles hybridus) and sympatric terrestrial vertebrates in the lowland rainforests of Central Colombia - Torres - 2022 - Restoration Ecology - Wiley Online Library

[20] Monitoring Plan: Plan+de+acción+Flora+Magdalena.pdf

[21] Third-party Information: WCS Colombia Annual Report 2024_español.pdf

based on sustainable development criteria and scientific bases. This process integrated research knowledge, private enterprise, and social systems. Phase I of the FIBRAS agreement was structured in six (6) components, complemented by the ECORESERVAS agreement.

- **Component 1- Ecological reserves**[22]

The FIBRAS project operated in six (6) Ecological reserves in the departments of Huila, Casanare, Meta, and Santander (11,935 ha), and the ECORESERVAS agreement in four (4) areas of Cundinamarca, Meta, and Córdoba (683 ha), totaling more than 12,600 ha. Activities included establishing biodiversity baselines, conservation strategies, governance analysis, green business, biodiversity and regional connectivity plans, and cost-effectiveness evaluations. In the La Tribuna and ASA La Guarupaya ecological reserves, participatory management plans (Biomonitor Program) were implemented with communities and students. 2,426 species were recorded (about 100 endemic and 31 endangered), 61 values subject to conservation, and some 60,000 genetic sequences were generated. Ecopetrol has declared 20 ecological reserves in eight (8) departments, thus consolidating a voluntary business model that can complement protected areas and contribute to sustainability in its areas of influence.

The results have allowed for the proposal of a voluntary conservation business model that complements the traditional schemes of protected areas. In the case of hydrocarbon companies, this model can serve as an effective strategy towards sustainable development in their areas of influence, especially during project closure stages.

- **Component 2 - Socio-Ecological Resilience Tool**

Through this component, the socio-ecological resilience was evaluated in areas of interest to Ecopetrol in the Middle Magdalena and Orinoquia regions. A conceptual model and a trend analysis tool were developed that simulate territorial behavior in the face of productive impacts, integrating environmental, social, and threshold change variables. This tool allows the generation of "what if" scenarios to evaluate alternatives for intervention. In the current phase of Fibras, the model is being optimized to better support decision-making, integrating inputs from other components such as monitoring.

- **Component 3 – Biodiversity monitoring**

The component integrated passive and active monitoring through camera traps and community work, respectively.

Participatory monitoring: articulation with communities based on their interests to learn about biodiversity. Two processes were strengthened at the national level: 1) in the rural division of La Primavera, Acacías-Meta, and 2) in the San Silvestre Swamp and Creek, in the Galán-Santander field.

[22] **Eco-reserve**: geographically delimited area, owned by the Ecopetrol Group, which is partially or totally voluntarily destined to the conservation (preservation, restoration, sustainable use or research) of biodiversity and the supply of ecosystem services, without limiting its productive or exploratory vocation.

Passive Monitoring and Biomodels: 600 camera traps were installed in the Middle Magdalena region and foothills, Casanare foothills, Meta and on the Tillavá River. Using modeling and artificial intelligence, the habitat of the species was created based on the modeling of their environmental niche, and the data obtained with remote sensors as predictors. A total of 194 regionalized biomodels of species distribution were developed, of which there are 56 species are in the Middle Magdalena region.

Community monitoring in the Middle Magdalena

Between 2021 and 2022, participatory monitoring activities were developed with stakeholders, mainly fishermen, to learn their level of knowledge regarding biodiversity. In the Middle Magdalena region, the focus was on monitoring water resources. The following question was posed: "What is the state of the San Silvestre Creek and the San Silvestre and Llanito swamps?" Three (3) key components were evaluated: water quality, the flannel-mouth characins ("*bocachico*"), and the manatee, considering that the presence of fauna is an indicator of the state of the ecosystem.

1. Water quality: the methodology used included working with community monitors, who were provided with a basic characterization kit, to identify the basic properties of the samples analyzed. This kit has a low sensitivity, as its confidence level is highly variable and depends on various external factors:

35 sampling events were carried out, distributed across 12 strategic points in the El Llanito and San Silvestre swamps, which were: Llanito, Bosque, Lindero, Mirador, Muelle, Guadualito, Tesoro, Caño Rosario, Palotal, Estadero, Bocatoma and Aguas de Barranca (Figure below/left).

Source: https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/01-fibras-esencia-y-territorio.pdf

The points with the most sampling events were Palotal, Rosario Creek and Estadero; during 2022, one (1) sampling was carried out in the Rosario Creek and two (2) in Estadero. Among the results obtained, the following is worth noting "90% of the waters sampled in the last five months presented the minimum acidity level (pH=6). Lead, copper, and iron were recorded. The areas with the highest presence of heavy metals were Palotal and Caño Rosario. According to the participants, this may be because industrial material is being unloaded in the area. The water area in Barranca presented a high degree of iron accumulation, which may be associated with the discharge of sedimentation sludge from the aqueduct. In the Estadero area, the presence of garbage and bad odors was evidenced, generating an early warning, especially because tourism activities are being carried out" (Figure above/right).

2. Flannel-mouth characins ("*bocachico*"): when monitoring the *bocachico*, the species was captured in four (4) opportunities. The size, contour, and presence of abnormalities such as fats or malformations were recorded each time. No mortality event was recorded.

3. Manatee: Monitoring and recording data of the manatee population poses greater difficulties, as it is more time-consuming and requires stealth and silence; hence, direct observation was only possible on one occasion. Other sampling events only recorded food

remains. However, this direct observation confirmed that the manatee still inhabits the swamps.

In the Gala field, located in Barrancabermeja, between March 2021 and April 2022, 66 people participated in monitoring activities, including 23 men, 18 women, and 21 young people. However, participation decreased over time due to members of the community moving away, changes in their work schedules and teaching staff, as well as a diminishing interest resulting from an absence of economic incentives.

- Regarding these complementary scientific exercises where voluntary participation is a factor, it is important to clarify that "*the information collected is only used as an initial indication to make decisions and generate early warnings that lead to better management and care of water resources*," as explained in the documents delivered within the framework of the agreement by the Humboldt Institute.

Some of the results stemming from the monitoring process conducted with the community are included in the book that resulted from this initiative, available on Ecopetrol's website.[23]

- **Components 4 and 5 - Biodiversity and Bioeconomy Uses**

In addition to the topics of genomics, mentioned above, the topic of Useful Plants was addressed**.** In this case, for the Orinoquia, Huila, and Middle Magdalena regions, 21 species of plants with potential uses that contribute to the well-being of local communities and, eventually, to alternative economic development based on sustainable practices were identified and prioritized.

Likewise, there were **research stimuli,** giving support to undergraduate and master's students, with the participation of members of the communities surrounding the La Tribuna Ecoreserve (Huila) and ASA La Guarupaya -Biomonitors-, to generate scientific projects focused on taxonomic and genetic monitoring of biodiversity. Furthermore, support was provided to strengthen capacities on the subject, through open and free seminars held in the areas of influence of the project, and by offering a Diploma in conservation, biodiversity management, and sustainable bioeconomy.

- **Component 6 – Communications**

A communications strategy with a multidimensional approach was implemented, aimed at the social appropriation of knowledge. This strategy recognizes the citizen as the protagonist in the interpretation of the messages and uses various channels such as digital media, press, printed materials, audiovisuals, and a microsite on the Humboldt Institute's website, in order to socialize the advances made on each research component.

FIBRAS "Essence and territory" – PHASE II (2024-2027)

[23] https://files.ecopetrol.com.co/web/esp/enlaces-ambiental/01-fibras-esencia-y-territorio.pdf

Ecopetrol and the Humboldt Institute began the second phase of FIBRAS in December 2024. One of its main objectives is to *strengthen the inclusion and measurement of biodiversity and ecosystem services management in the Company's business model*. The activities conducted under this agreement are addressed through three (3) components:

Component 1. Positive Nature: Comprehensive Monitoring and Decision-Making Tools

This component seeks to build a robust monitoring strategy that will allow Ecopetrol to measure how it advances towards its goals. In addition, it works towards generating different tools to support the decision-making process, as well as the installation of 300 camera traps in La Guajira and the foothills of Casanare. This exercise is articulated into the Colombian Photo Trapping Network - OTUS. During the first quarter of 2025, the first monitoring event was held with the installation of 150 camera traps in the foothills of Casanare.

Component 2. Innovation in biodiversity monitoring

Through this component, environmental DNA protocols and sequencing technologies will be used to monitor biodiversity in microorganisms, invertebrates, and vertebrates, in water and soil in three (3) Ecopetrol Ecological reserves, located in the Middle Magdalena region and the departments of Meta and Huila. An assessment of the composition, structure, and function of the microbial communities will be conducted (metabarcoding, metagenomics, and soil enzyme analysis) in areas close to and distant from natural oil outcrops (*manaderos*). Training workshops on environmental DNA and state-of-the-art sequencing will be held, and biological monitoring capacities will be strengthened at the local level.

Component 3. Transversality: social appropriation of knowledge and communication

A complete strategy of social appropriation of knowledge and communication will be developed within Ecopetrol and in local communities, to strengthen capacities in knowledge and monitoring of biodiversity.

REDD+ Middle Magdalena Valley-ISA-Jaguar Connection

The REDD+ Project (Reduction of Emissions from Deforestation and Forest Degradation) seeks to actively contribute to the conservation and ecological connectivity of the Barbacoas swamps, an area that is currently threatened by extensive cattle ranching. Within the framework of this project, conservation and restoration actions have been carried out, as well as biodiversity monitoring of large mammals, such as the jaguar. Likewise, progress is being made in strengthening capacities with communities and Natural Reserves of Civil Society adjacent to the swamps.

TNFD - Implementation of the LEAP Framework in the Middle Magdalena Region

Ecopetrol has placed itself at the forefront of new environmental management frameworks, seeking to become a pioneer in the oil and gas sector in Colombia. Intending to strengthen its process for managing nature-related impacts, dependencies, risks, and opportunities, the company joined the TNFD (Taskforce on Nature Financial Disclosure) in 2021. Of the 40 entities worldwide that make up this working group, it is the only Oil & Gas company. In addition, it

publicly committed to being an early adopter of the management framework and to presenting its first TNFD report in 2025. As part of the working group, it carried out two (2) pilots in the Middle Magdalena region to test the framework and move forward with sectoral metrics and indicators[24].

Other advances

Ecopetrol is making progress in the creation of its Biodiversity Information System, whose central component is an initial-phase GIS platform (SIGBSE), which allows for real-time reporting and consultation of fauna and flora sightings within its areas of operation. This tool supports the decision-making process, improves the evaluation of management measures, and facilitates more effective conservation strategies. In addition, the Company participates in national and international working groups to strengthen the fair energy transition process.

Conclusions

- Ecopetrol, together with its partners, has strengthened comprehensive biodiversity monitoring and developed tools for cost-effective decision-making, aimed at achieving a net positive impact on biodiversity.
- Strategic partnerships have made it possible to generate relevant scientific information, conserve endangered species, expand conservation and restoration areas, and strengthen capacities in communities, authorities, and their collaborators, both for the Middle Magdalena region and for the entire country.
- The Company maintains its commitment to the responsible management of biodiversity, complying with national regulations, promoting public access to information, and moving towards international standards such as the TNFD, within the context of a megadiverse country such as Colombia.
- Taking into account the progress made so far, one of the Company's main challenges is the implementation of more advanced systems for analyzing biotic information at the regional level, as well as continuing to strengthen work throughout its value chain. To this end, progress is being made in the construction of a company-wide Biodiversity Information System. The Company also seeks to increase its participation in different working groups at the national and international levels to improve and strengthen its fair energy transition process.

[24] Public information available: Ecopetrol to disclose nature-related financial data | Companies | Business | Portfolio, TNFD FRAMEWORK PILOTING TESTING -Pilot one, pILOT-II OF THE TNFD FRAMEWORK, 3RD Virtual Meeting: TNFD Framework Advances V0.3 - YouTube