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IMPLEMENTATION COMPLETION AND RESULTS REPORT

ON A

GRANT FROM THE GLOBAL ENVIRONMENT FACILITY TRUST FUND

(TF-96465)

IN THE AMOUNT OF USD 7.00 MILLION

AND

AN ADDITIONAL FINANCING GRANT

(TF-17041)

FROM

DEPARTMENT OF ENERGY AND CLIMATE CHANGE (DECC)

IN THE AMOUNT OF USD 20.7 MILLION

TO THE

COLOMBIAN CATTLE RANCHING ASSOCIATION (FEDEGAN)

FOR THE

COLOMBIA: MAINSTREAMING SUSTAINABLE CATTLE RANCHING PROJECT

December 17, 2020

Agriculture And Food Global Practice
Latin America And Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective January 31, 2020)

Currency Unit	=	Colombian Peso
COP 3397.48	=	US$1.00
US$ 1.00	=	COP 0.0002943

FISCAL YEAR
July 1 - June 30

Regional Vice President:	Carlos Felipe Jaramillo
Country Director:	Ulrich Zachau
Regional Director:	Anna Wellenstein
Practice Manager:	Preeti S. Ahuja
Task Team Leader(s):	Luz Berania Diaz Rios
ICR Main Contributor:	Anna Roumani/ Rafael Parra-Pena/ Lucia Amiri-Talesh

ABBREVIATIONS AND ACRONYMS

AF	Additional Financing
BCR/RCR	Borrower/Recipient Completion Report
BP	Business Plans
CR	Cattle Ranchers/Cattle Ranching
CIAT	International Center for Tropical Agriculture
CIPAV	Centre for Research on Sustainable Agricultural Production Systems
CNCA	National Agricultural Credit Commission
CMSCR	Colombia Mainstreaming Sustainable Cattle Ranching
COP	Colombian Peso
CO2	Carbon Dioxide
CPF	Country Partnership Framework
CPS	Country Partnership Strategy
DECC (now BEIS)	UK Department of Energy & Climate Change (DECC), now Department for Business, Energy and Industry Strategy (BEIS)
DNP	National Planning Department
EA	Environmental Assessment
ES	Ecosystem Services
EIRR	Economic internal rate of return
ESI	Environmental Services Index
ENPV	Economic Net Present Value
EOP	End-Of-Project
FA	*Fondo para la Acción Ambiental y la Niñez* (*Fondo Acción*)
FEDEGAN	Colombian Cattle Ranching Association
FINAGRO	Fund for Agricultural and Livestock Sector Financing
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
FOLU	Food and Land Coalition in Colombia
Fondo Acción	Environmental Action and Childhood Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEO	Global Environment Objective
GHG	Greenhouse Gas Emissions
GoC	Government of Colombia
Ha	Hectare
IADB	Inter-American Development Bank
IBRD	International Bank for Reconstruction and Development
ICF	International Climate Fund
ICRR	Implementation Completion and Results Report
IE	Impact Evaluation
IFC	International Finance Corporation
IFR	Interim Financial Report
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contributions

iSPS	Intensive Silvo-pastoral Systems
LD-SP	Land Degradation Strategic Program
LU	Land Use (*or* Livestock Unit)
MADR	*Ministerio de Agricultura y Desarrollo Rural* (Ministry of Agriculture and Rural Development)
MASD	*Ministerio de Ambiente y Desarrollo Sostenible* (Ministry of Environment and Sustainable Development)
MAVDT	*Ministerio de Ambiente, Vivienda y Desarrollo Territorial (*Ministry of Environment, Housing, and Territorial Development)—currently MASD
MIC	Multiple of Invested Capital
MTR	Mid-term Review
M&E	Monitoring and Evaluation
NAMA	Nationally Appropriate Mitigation Action
NDP	National Development Plan
NPV	Net Present Value
NRM	Natural Resource Management
PAD	Project Appraisal Document
PES	Payments for Environmental Services
PDO	Project Development Objective
PPP	*Planeación Predial Participativa* (Participatory Farm Planning)
RCI	Rural Capitalization Incentive (*Incentivo a la Capitalización Rural*)
RF	Results Framework
RSPS	Regional Integrated Silvo-pastoral Approaches to Ecosystem Management Project
SENA	National Training Service
SPS	Silvo-Pastoral Systems
TA	Technical Assistance
TDP	Training and Information Diffusion Plan
TF	Trust Fund
TFA	Tropical Forest Alliance
TNC	The Nature Conservancy
ToC	Theory of Change
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
UPRA	Rural Planning and Management Unit
USD	United States Dollar
WB	World Bank
WBG	World Bank Group
WRI	World Resource Institute
WWF	World Wildlife Fund

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P104687	Mainstreaming Sustainable Cattle Ranching
Country	**Financing Instrument**
Colombia	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
Colombian Cattle Ranching Association (Fedegan)	Colombian Cattle Ranching Association (Fedegan)

Project Development Objective (PDO)

Original PDO

The Project's Global Environment Objective is to promote the adoption of environment-friendly Silvopastoral Production Systems forcattle ranching in Colombia's Project areas, to improve natural resource management, enhance the provision of environmentalservices (biodiversity, land, carbon, and water), and raise the productivity in participating farms.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
TF-96465	7,000,000	7,000,000	7,000,000
TF-17041	20,700,000	20,527,186	20,527,186
Total	**27,700,000**	**27,527,186**	**27,527,186**
Non-World Bank Financing			
Local Farmer Organizations	15,936,150	28,560,000	21,858,645
Total	**15,936,150**	**28,560,000**	**21,858,645**
Total Project Cost	**43,636,150**	**56,087,186**	**49,385,831**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
16-Mar-2010	02-Jul-2010	06-Jun-2016	31-Jan-2018	31-Jan-2020

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
04-Aug-2014	3.62	Additional Financing Change in Results Framework Change in Components and Cost Change in Loan Closing Date(s) Reallocation between Disbursement Categories
08-Mar-2017	14.62	Change in Results Framework Change in Components and Cost Change in Financing Plan Reallocation between Disbursement Categories
19-Jan-2018	19.01	Change in Results Framework Change in Components and Cost Change in Loan Closing Date(s) Reallocation between Disbursement Categories
02-May-2019	25.34	Reallocation between Disbursement Categories

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Satisfactory	Satisfactory	Substantial

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	08-May-2010	Satisfactory	Satisfactory	.22
02	06-Mar-2011	Satisfactory	Moderately Satisfactory	.92
03	07-Aug-2011	Satisfactory	Moderately Satisfactory	.92
04	15-Mar-2012	Satisfactory	Moderately Satisfactory	1.24
05	12-Jun-2012	Satisfactory	Moderately Satisfactory	1.41
06	16-Dec-2012	Satisfactory	Moderately Satisfactory	2.02
07	24-Jun-2013		Moderately Satisfactory	2.33
08	07-Jan-2014		Moderately Satisfactory	2.72
09	24-Jul-2014		Moderately Satisfactory	3.84
10	03-Feb-2015		Satisfactory	7.54
11	13-Jul-2015	Satisfactory	Satisfactory	9.76
12	15-Mar-2016	Moderately Satisfactory	Moderately Satisfactory	9.76
13	06-Sep-2016	Moderately Satisfactory	Moderately Unsatisfactory	12.57
14	30-Mar-2017	Moderately Satisfactory	Moderately Unsatisfactory	15.27
15	13-Jun-2017	Moderately Satisfactory	Moderately Satisfactory	17.09
16	28-Dec-2017	Moderately Satisfactory	Moderately Satisfactory	19.23
17	20-Jun-2018	Satisfactory	Satisfactory	22.06
18	18-Dec-2018	Satisfactory	Satisfactory	24.26
19	14-Apr-2019	Satisfactory	Satisfactory	25.56
20	27-Oct-2019	Satisfactory	Satisfactory	27.92

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Agriculture, Fishing and Forestry	**100**
Fisheries	11
Livestock	11
Other Agriculture, Fishing and Forestry	78

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)
Social Development and Protection	**0**
Social Inclusion	2
Participation and Civic Engagement	2
Urban and Rural Development	**0**
Rural Development	57
Land Administration and Management	57
Environment and Natural Resource Management	**0**
Renewable Natural Resources Asset Management	40
Biodiversity	34
Landscape Management	6
Environmental policies and institutions	2

ADM STAFF

Role	At Approval	At ICR
Vice President:	Pamela Cox	Carlos Felipe Jaramillo
Country Director:	Gloria M. Grandolini	Ulrich Zachau
Director:	Laura Tuck	Anna Wellenstein
Practice Manager/Manager:	Ethel Sennhauser	Preeti S. Ahuja
Project Team Leader:	Juan Pablo Ruiz	Luz Berania Diaz Rios

ICR Co Author:	Anna F. Roumani

I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. **When the Colombia Mainstreaming Sustainable Cattle Ranching (CMSCR) Project was appraised in 2010, the Government of Colombia (GoC) was seeking to strengthen agriculture sector competitiveness in ways which generated mutual benefits for the environment and rural livelihoods.** Agriculture suffered from low productivity, limited specialization, and ineffective land use. Agricultural growth (including livestock) lagged overall growth, averaging 2 percent from 2000–09 versus 4 percent in the overall economy. While cattle ranching (CR) in Colombia was socio-economically significant, contributing 3.5 percent of national GDP and 27 percent of agricultural GDP, and accounting for 7 percent of national employment and 28 percent of rural employment, it faced structural barriers common to rural development in Colombia.[1] These included deficient human capital, low productivity, high degree of informality, inefficient use of natural resources, and inadequate access to financing and new technologies.

2. **Like most agricultural activities in Colombia, CR occurred in a context of poverty, unequal income distribution and land ownership, illiteracy, and violence.** About 80 percent of the country's total farmland area was under pastures, a large proportion of them used for cattle ranching activities. Around 82 percent of CR landholdings were small and most had fewer than 50 animals.[2] Average stocking rates were estimated at less than one animal per hectare. Cattle ranching's environmental footprint was high, including from greenhouse gas (GHG) emissions and loss of unique animal and plant species, as secondary Andean forest with high biodiversity had been replaced by degraded pastures over many decades,[3] and some 66 percent of the land being used as permanent pasture was degraded or unsuitable for grazing. Traditional ranching tended to be a low-profit activity with high vulnerability to climatic variation.

3. **Cattle ranching based on innovative approaches known as Silvo-pastoral systems (SPS) promised to be more sustainable, efficient, increase rural incomes, and deliver environmental benefits.** The latter included increased biodiversity and reduced GHG emissions, soil erosion and water pollution. SPS convert degraded, extensive (open, treeless) pastures into a richer, more productive environment where trees and shrubs are interspersed with fodder crops such as grasses and leguminous herbs. However, such systems were little known and seldom used in Colombia, while the more intensive SPS were essentially unknown. A small, GEF-financed pilot project of narrow scope implemented by the World Bank (Regional Integrated Silvo-pastoral Approaches to Ecosystem Management Project (RSPS, P072979)) in 2003–08 in Colombia, Nicaragua, and Costa Rica, introduced SPS and demonstrated its benefits while also showing that establishing SPS required technical knowledge, expertise and investment. Expanding the scope, achievements and impact of this narrow SPS pilot across more diverse regions of Colombia required the right set of financial and non-financial incentives, and efforts to provide proof of concept, and to build capacity and expertise. That said, the CMSCR was also a pilot, designed to prove the SPS concept under geographically diverse farming conditions, and emphasizing an applied research and adaptive management and investigation agenda. Given Colombia's 38 million ha dedicated to CR, the project was not intended, nor characterized, as the transformational post-RSPS scale-up, although it was expected to demonstrate the potential for such change at scale.

[1] See Annex 10 Endnotes corresponding to text numbers.

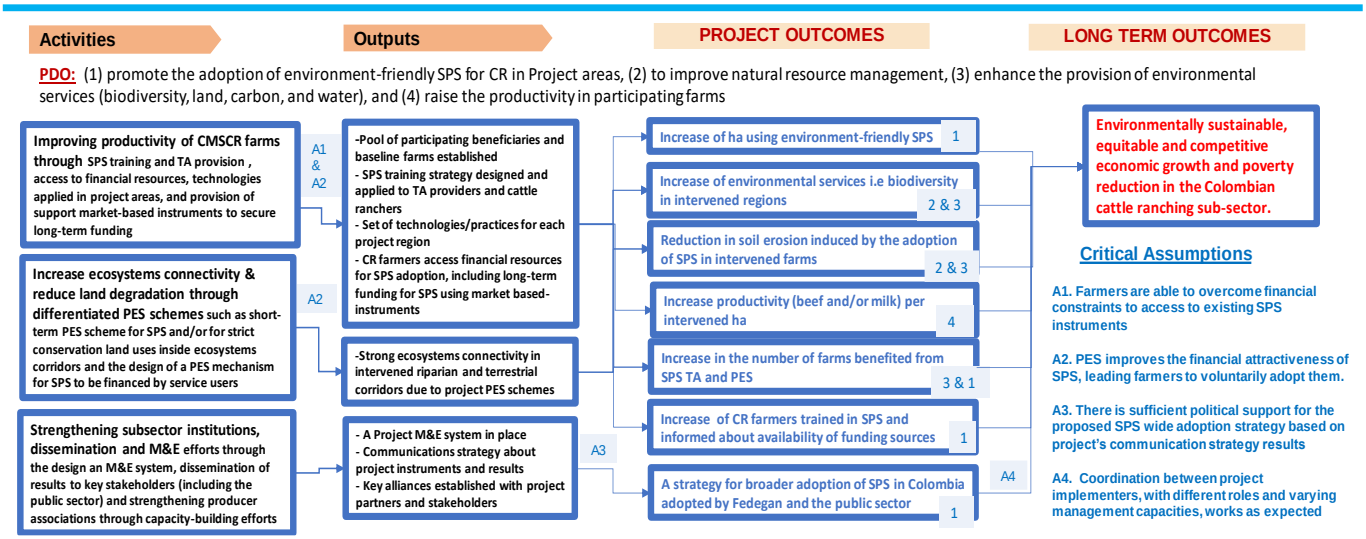
4. **The CMSCR Project sought to expand land area under SPS and was thus strongly aligned with the higher-level objectives of the GoC and World Bank.** Colombia's National Development Plan (NDP, 2006–10) laid out comprehensive programs aligned with six pillars: peace and security, equity, high and sustainable growth, environmental sustainability, good governance, and transversal themes. The World Bank's Country Partnership Strategy (CPS, 2008-2011) responded directly to the NDP, defining "areas of concentration and collaboration". By fostering broader adoption of SPS in cattle ranching, the project contributed to four of the six CPS areas: Area I—Sustained Equitable Growth (by improving agricultural competitiveness); Area II—Poverty Alleviation and Equity of Opportunity (by implementing income-generating strategies to reduce rural poverty and promote economic inclusion, supporting more productive land use and protection, and promoting the use of innovative rural technologies); Area III—Environment and Natural Resource Management (emphasizing environmental sustainability in an important economic sector and in critical ecosystems); and Area IV—Peace (via the project's contribution to social and political inclusion).

5. **Project components aligned closely with the strategic objectives of the Global Environment Facility (GEF).** The project contributed to Biodiversity Strategic Program #5 (Fostering Markets for Biodiversity Goods and Services) and Land Degradation Strategic Program #1 (Supporting Sustainable Agriculture and Rangeland Management). It also provided data for three indicators applied by the GEF Biodiversity Program: (a) coverage in hectares of production systems that contribute to biodiversity conservation or the sustainable use of its components; (b) integration of biodiversity aspects into sector policies and plans at a national level; and (c) improved livelihoods.

6. **Within the context of these higher-level strategic objectives, the rationale for World Bank support to scale up SPS in Colombia was compelling.** The CMSCR Project stemmed directly from the GoC's commitment to improve the CR subsector, and the success of the RSPS pilot.[4] The RSPS demonstrated: how SPS could contribute to sustainable, productive CR, documenting impacts on GHG emissions, soil erosion, forest and water conservation, and biodiversity; and, that participating farmers would adopt and retain SPS. On average, RSPS-supported farmers converted half of their land to SPS practices. The CMSCR Project aimed to provide proof of concept (leveraging the small RSPS pilot), across more diverse regions of Colombia. The project would rely on the combined knowledge and expertise of the World Bank, local players and GoC in forming alliances with partners/stakeholders to validate a mix of incentives to induce farmers to convert their production systems - including land-use strategies - to SPS, thus linking productive investments with environmental benefits.

Theory of Change (ToC - Results Chain)

7. The ToC was constructed retroactively from the Project Appraisal Document (PAD, 2010). Subsequent changes – which did not affect the ToC – are explained in Section IB. The PAD asserted that a constellation of factors prevented sustainable transformation of the CR sub-sector (see paras. 1-2). The ToC posited that if: (a) on-farm barriers to the adoption of sustainable CR practices were removed; (b) incentive schemes including technical assistance were implemented to reward steps toward sustainable land use; and (c) information dissemination and collaboration between key players were improved, then CRs would realize opportunities to increase productivity, and natural resource management (NRM) and the provision of ecosystem services would be improved. These achievements would in turn, contribute to local, national and global environmental objectives, and improve livelihoods. See ToC figure below.[5]



Project Development Objectives (PDOs)

8. **The project was a free-standing GEF Grant with the following Project Development Objective,** as designated and stated in the Grant Agreement: "*to promote the adoption of environment-friendly Silvo-Pastoral Production Systems for cattle ranching in Colombia's project areas, to improve natural resource management, enhance the provision of environmental services (biodiversity, land, carbon, and water), and raise the productivity in participating farms.*" [6]

Key Expected Outcomes and Outcome Indicators

9. Expected outcomes, referred to in this ICR as themes, were: (a) promote the adoption of environment-friendly SPS for cattle ranching; (b) improve natural resource management; (c) enhance the provision of environmental services; and, (d) raise the productivity in participating farms. Table 1 presents by theme, the outcome indicators selected at appraisal to measure PDO achievement. Note that some PDO indicators contribute to more than one theme. (See Section B).

10. The "adoption of environment-friendly SPS" was, for GEF financing and strategic purposes, always interpreted by the Bank/GEF, Client and project partners as a distinct objective outcome, for which the RF included two PDO Indicators (see Table 1). The ICR therefore, in Section IIB, analyzes Efficacy based on four objective outcomes (or themes), assigning the appraisal-stage PDO Indicators as per Table 1, and taking subsequent adjustments and restructurings into account.

Table 1: Original PDO Indicators, by PDO Theme

PDO Theme	PDO Indicators as per PAD
1. Promote the adoption of environment-friendly Silvo-Pastoral production systems for cattle	• 50,500 ha of environment-friendly Silvo-Pastoral CR production systems† implemented in 5 project areas. **(*Also contributed to Theme 2*). • Strategy for the broader adoption of SPS in Colombia validated and adjusted during project implementation, ready for adoption by the Colombian Cattle Ranching Association (FEDEGAN) and other strategic allies, such as the

ranching in Colombia's project areas	National Planning Department (DNP), Ministry of Agriculture and Rural Development (MADR), Ministry of Environment, Housing, and Territorial Development (MAVDT—now MADS). **(*Also contributed to Theme 2*)
2. Improve natural resource management	• Reduced soil erosion (t/ha) induced by the adoption of SPS and measured in at least 2 pilot areas. **(*Also contributed to Theme 3*)
3. Enhance the provision of environmental services	• At least 2 PES mechanisms, financed by local users of environmental services, implemented by the project on participating farms in project areas. **(*Also contributed to Theme 2*) • Improved presence of globally important biodiversity in project areas, as measured by an increase in the Environmental Services Index (ESI) resulting from the adoption of environment-friendly SPS.
4. Raise the productivity in participating farms	• 5% increase in the production of beef and/or milk per hectare with interventions on participating farms, with a reduction of external inputs. • 2,000 cattle ranching farms benefiting from project instruments (TA, PES, and/or support for credit access).

† "Environment-friendly" SPS was defined in the PAD as: increase in vegetative cover on-farm (including trees), which decreases use of agrochemicals (pesticides and fertilizers), contributes to reducing soil erosion, and improves landscape quality.

11. **Targeted beneficiaries:** The primary target population was 2,000 small and medium cattle ranches – defined by landholding area (small (4-70 ha) and medium (71-200 ha) based on a social assessment and rural legislation in force, and consideration of cross-regional variations) – located in five regions selected for their high biodiversity and proximity to strategic ecosystems and protected areas: (a) Cesar River Valley; (b) adjacent lower Magdalena River Basin (in the western part of Atlántico Department); (c) traditional dairy cattle production regions of Boyacá and Santander (linked to the Andean Oak Forest Corridor); (d) coffee production ecoregion; and, (e) low foothills of the eastern cordillera of southern Meta.[7] Selection criteria and screening procedures were rigorous: (a) municipalities and provinces with low levels of internal displacement based on a national register; (b) demonstration of legal occupancy of land and absence of criminal record; and, (c) final selection of beneficiaries from locally validated lists, then agreed by the Project Steering Committee (see para. 70). Large landowners could participate if it contributed to project outcomes supporting the provision of key environmental services. The overall approach was demand-driven, based on voluntary changes in land use on-farm, and it assumed that modifications and adaptations would be made as needed, based on emerging evidence from implementation experiences across the diverse project areas.[8]

Components

12. The project had the following four components, shown with estimated and actual costs and financing:

- **Component 1: Improving productivity in participating CR farms in project areas, through SPS** *(Initial financing*: *US$ 30.9M, of which US$1.7M from GEF and $29.2M counterpart contributions; at closing*: *US$37.8M, of which US$3.3M from GEF, US$9.1M UK/BEIS, and US$25.4M counterpart contributions).* This component financed: (a) SPS training to national, regional, and local technical assistance (TA) providers; (b) selection of beneficiaries and baseline farm assessments; (c) TA to farmers for implementing SPS; (d) assistance to farmers in accessing financial resources to adopt SPS; (e) assessment and adaptation of SPS technologies applied in each project area; and, (f) support for market-based instruments to secure long-term funding.[9]
- **Component 2: Increasing connectivity and reducing land degradation through differentiated PES schemes** *(Initial financing*: *US$6.4M, of which US$3.8M from GE and US$2.6M counterpart contributions; at closing*: *US$9.6M, of which US$1.9M from GEF, US$6.6M UK/BEIS and US$1M counterpart contributions).* This component financed: (a) adjustment/implementation of a short-term payment for environmental services (PES) mechanism (Biodiversity Scheme), to reward producers who adopted SPS and conserved forest-enhancing biodiversity and landscape connectivity; and, (b) design/implementation of long-term, local PES mechanisms—financed by the users of environmental services (ES)—that would pay producers over the long term for adopting SPS that were financially unattractive to adopt but important for providing ES.

- **Component 3: Strengthening of subsector institutions, and dissemination and M&E efforts contributing to the broader adoption of environment-friendly SPS in Colombian cattle ranching** *(Initial financing*: *US$1.4M, of which US$0.8M from GEF and US$0.6 counterpart contributions; at closing*: *US$4.8M, of which US$1.1M from GEF, US$2.9M UK/BEIS and US$0.8 counterpart contributions).* This component financed: (a) monitoring and evaluation (M&E) of project activities, and applied research on SPS contributions to ES including for climate change adaptation and mitigation; (b) broad dissemination of results, including the internalization of SPS in national plans and programs; and (c) strengthening and capacity-building of producer organizations.
- **Component 4: Project management** *(Initial financing*: *US$3.0M, of which US$0.7M GEF and US$2.3 counterpart contributions; at closing: US$3.7M, of which US$0.6M from GEF, US$1.8M UK/BEIS and US$1.3 counterpart contributions).* This component financed improved intra- and inter-institutional capacity and coordination to develop, execute, and manage the project, and M&E of the project's administrative activities.

13. **Reasons for cost deviations:** Actual project costs were mostly on par with component allocations at the time an Additional Financing (AF) of US$20.7 million was processed (2014), contributing 75 percent of total grant funds. Several changes are noted by end-of-project: (a) Component 1 costs increased 22 percent, reflecting project information dissemination, awareness-building and TA costs for an expanded number of farmers; (b) Component 2 costs increased 50 percent, due to the AF's inclusion of demonstration farms, plant and seed multiplication as well as the piloting of a new PES scheme ; (c) Component 3 costs increased 225 percent, as a result of a stronger focus on monitoring of results and support for broad SPS and results dissemination efforts; and, (d) Component 4 project management costs increased 21 percent, to cover an added two-year implementation period. See Section B.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

Revised PDOs and Outcome Targets

14. **The PDOs did not change but outcome targets were revised.** Adjustments to PDO Outcome Indicator targets under the AF (2014) and restructurings in 2017 and 2018 reflected, inter alia, the increased number of project beneficiaries, changes to PES schemes from emerging lessons, evidence of limited land conversion capacity of beneficiary ranchers given small farm size, high up-front cost of establishing SPS (especially intensive SPS (iSPS)) and other factors. See details, Annex 1C.

Revised PDO Indicators

15. **PDO Indicators were changed by the AF and restructurings.** Changes included introducing new PDO Indicators, transferring two PDO Indicators to the Intermediate Outcome level, dropping one PDO Indicator and revising another. See details, Annex 1C.

Revised Components

16. **Changes were introduced to component activities, primarily under the AF.** These included: improvements to TA services; consolidation of a pool of expert professionals trained in establishing SPS; additional support for market-based initiatives; piloting of a new PES scheme supporting the adoption of iSPS focused on carbon sequestration; introduction of demonstration farms; development of a seed multiplication strategy and establishing nurseries for plants and trees; and strengthening of M&E and results dissemination. See details, Annex 1 C.

Other Changes

17. **Additional Financing and Restructuring:** The project was initially financed via a US$7.0 M Grant (TF096465) from GEF approved by the World Bank in March 2010.[10] An Additional Financing (AF - TF017041) of US$20.7M from the United Kingdom (UK) Department of Energy and Climate Change (DECC)—now the Department for Business, Energy, and Industrial Strategy (BEIS)—became effective in December 2014. The AF (processed concomitantly with a Level 2 restructuring), did not change the PDO but did adjust components (see above), the Results Framework and the closing date, and reallocated funds among expenditure categories. The AF also expanded project activities to new areas (La Guajira and El Meta), national deforestation hotspots with significant ecosystem fragmentation, but with high potential for restoring ecosystem connectivity between remnant riparian vegetation. The 2018 Restructuring again extended the closing date, while all three post-AF restructurings reallocated grant resources. Table 2 summarizes key changes, while Annex 1C explains all changes in detail.

Table 2: CMSCR Project – Summary of Key Changes and Timeline

Item	GEF Grant (2010) US$7.0 M	Additional Financing (2014) US$20.7 M	Level 2 Restructuring (March 2017)	Level 2 Restructuring (January 2018)	Level 2 Restructuring (May 2019)
Focus	As specified in the PAD, 2010	-Carbon sequestration and poverty reduction -New PES scheme (PES-2) piloted -2 deforestation hotspots added -RF adjusted -Reallocation of funds among expend. categories -Closing date extended to March 23, 2017	-PES schemes adjusted -Deforestation hotspots increased to 4 -RF adjusted -Reallocation of funds among expenditure categories	-RF adjusted -Reallocation of funds among expenditure categories -Closing date extended to end-January, 2020	-Reallocation of funds among expenditure categories
PDO	Original as per PAD	No change to PDO	No change to PDO	No change to PDO	No change to PDO
PDO Indicators	7 PDO Indicators, as per PAD	7 PDO Indicators: 2 new, 3 revised, 2 downgraded to Intermediate level, 2 unchanged	6 PDO Indicators: 1 dropped, and 1 revised	6 PDO Indicators: 1 revised	6 PDO indicators: No change
Project Targets	Original targets, as per PAD	-Changes to all PDO Indicator end-targets -Minor changes to Intermediate Indicator targets	-Changes to 4 PDO Indicator end-targets -Minor changes to Intermediate Indicator targets	-Changes to 2 PDO Indicator end-targets -Minor changes to Intermediate Indicator targets	No changes

Rationale for Changes and Their Implication for the Original Theory of Change

18. **The ToC was unaffected by these changes, but the delivering of specific environmental objectives was given stronger emphasis.** The original objective was to support the adoption of SPS in specific geographical areas of Colombia, with a strong emphasis on biodiversity conservation and natural resource conservation. Under the AF, positive effects of sustainable ranching and SPS were expected on carbon sequestration; at the impact level, an emphasis was put on supporting small-scale ranchers to increase incomes and ultimately, contribute to poverty reduction. The rationale for changes was as follows:

- **AF, December 2014:** The UK donor (DECC, now BEIS) provided the AF Grant under the International Climate Fund (ICF) to promote further adoption of SPS in Colombia. Climate change mitigation and poverty reduction were/are key ICF objectives, thus AF-financed activities complemented the original project focus by emphasizing these two fronts. Climate change mitigation was underscored by expanding the range of environmental benefits to include

carbon emissions reduction, mainly via carbon sequestration and the avoidance of deforestation, reflected in: a new PES2 (Carbon) scheme;[11] project expansion into two deforestation hotspots to improve understanding of the project's impacts on reducing deforestation/improving forest connectivity; and, the production/distribution of high quality planting material for SPS at reduced cost to farmers.[12] Poverty reduction was reflected in the AF's tighter focus on small- and medium-scale CRs. The supply of TA was also expanded to galvanize SPS adoption - coupled with demonstration techniques - elements under-estimated at appraisal.

- **Restructuring, March 2017:** Changes were introduced to PES1 and PES2 to accelerate implementation. The scope of several indicators in the Results Framework (RF) was adjusted and their meaning/measurement were clarified.
- **Restructuring, January 2018**: The project's two-year extension to January 31, 2020 provided additional time to fully disburse grant funds, expand project impacts, disseminate learning, and inform the design of a set of policy initiatives to scale up the project approach.
- **Restructuring, May 2019:** Grant funds were reallocated to cover payments to farmers participating in the PES1 Biodiversity Scheme, as land conversion to SPS under PES1 had accelerated over time, ultimately comprising 65 percent of all silvo-pastoral practices (e.g., planting of live fences or scattered trees in open pasture) in use under the project. Funds were also reallocated to cover costs of project regional teams, given the larger number of farmers that responded to the fourth call.

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

19. **The CMSCR PDOs remained highly relevant to the strategic objectives of the World Bank Group Country Partnership Framework (CPF, FY 2016-21) at closing.** Under Objective 2, "Enhanced Capacity for Natural Resource Management in Target Regions," of Pillar 1, "Fostering Balanced Territorial Development", the CPF affirms that Colombia recognizes the effects of climate change on its development and has made low carbon growth, resilience, and environmentally sustainable development principles priorities in its planning and green growth strategies. This includes reduction in GHG emissions, and emphasis on the sustainable management of its rich natural capital: land, water, biodiversity and forests, assets whose protection/conservation were either explicit or implied in the PDO. The CMSCR project, focused on the performance of SPS in distinct target regions, land-use types and ecosystems (Section II B), remained consistent with the CPF's strategic regional orientation, emphasizing development solutions tailored to Colombia's regional diversity and specificity. The CPF refers explicitly to the CMSCR project, affirming that its lessons/experiences: (a) "highlight the relevance of improvements in productivity and climate resilience as key drivers of adoption of sustainable production systems"; and, (b) can support the design of future sustainable, climate-smart investments in the Orinoquía and Amazon regions, and in deforestation hotspots nation-wide.[13]

20. **The CPF signals the Bank's intention to continue promoting investments in SPS and climate-smart land use through various instruments including the BioCarbon Fund and GEF.** In the Amazon, the focus on biodiversity conservation and reduced deforestation is a key element. The CPF intends to continue supporting Colombia's scaled-up adoption of SPS and climate-resilient systems, coupled with the implementation of associated sector policy frameworks (e.g., National Mitigation Adaptation Action/NAMA for the Bovine Sector, a sustainable CR policy framework and guidance prepared under the project), and within the context of ongoing sub-sector planning

strategies for the beef and dairy value chains, under leadership of the Rural Planning and Management Unit (UPRA). Linked to Objective 2 expected results, the CPF seeks to "increase the area brought under environmentally-friendly cattle ranching production systems" – reiterating CMSCR objectives - and increase the area (of the Amazon) brought under protective measures. The latter means zero net deforestation: scaling up low carbon development models in all forested areas and ensuring the conservation of valuable areas. This, plus efforts to reduce GHG emissions in the Orinoquía region, demonstrates that the PDO – in both substance and spirit - remained highly relevant at closing.[14]

21. **The PDO maintained high relevance to GoC's strategic development priorities, environmental policy, and international initiatives anchored in Colombia.** First, the PDO addressed challenges identified in the follow-on NDP 2014–18 on the impact of CR on natural ecosystem deterioration (watersheds, forest land, soil quality, biodiversity) and expansion of the agricultural frontier. Second, NDP 2018–22 incorporates CMSCR results and lessons in strategies to promote sustainable, climate-resilient production, includes a strong role for SPS – to which the President of Colombia has, recently, publicly committed - and pledges to increase the pasture converted to SPS. Third, national environmental policies/strategies are aligned directly with the PDO and project achievements. The latter informed GoC's low-carbon development plan for the agricultural sector, and supported the development of zero-deforestation agreements; the project-developed Bovine NAMA informed the national emissions baseline and sector targets as part of Colombia's National Determined Contributions (NDC); and, national policies recognizes SPS as a landscape tool to restore degraded lands and increase ecosystem connectivity. Finally, sustainable livestock practices and land-use transformation are highly visible components of international, multi-stakeholder initiatives anchored in Colombia, including the Food and Land Use Coalition (FOLU) and the Tropical Forest Alliance (TFA).

22. **GoC commitments under the 2016 Havana peace accords to rebuild the rural economy also signal continued relevance of the PDO.** These involve re-launching agricultural growth - the main driver of the rural economy - while ensuring environmental protection. A high proportion of the productive projects formulated in post-conflict areas and targeting ex-combatants, relate to CR. The CMSCR project partners/allies, as well as donors, are working closely with the ART (Agency for the Renewal of Rural Territories) to mainstream the project's sustainable CR approaches within the context of these projects, making sustainable livestock a public sector priority in the post-conflict setting, and underscoring the ongoing strategic relevance of the CMSCR PDO.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

23. The project was highly innovative for Colombia at the time, requiring flexible, adaptive management and course corrections responsive to emerging results and challenges, an implementation strategy planned and well-understood from the outset. Three integrated streams of activity supported the PDO:

- **Strengthening technical and operational capacity to support sustainable land-use transformations.** This focused on generating new knowledge on sustainable CR production models tailored to the diverse eco-regions covered by the project, implying an intensive innovation and research effort, piloting and scale-up of effective training and TA - including demonstration farms - and efficient provision of services and inputs (e.g., seeds and trees).
- **Piloting and validating incentives supporting those transformations.** The project sought in five eco-regions (a) to pilot green finance in Colombian agriculture (especially targeting the CR sector) using a newly-developed FINAGRO (*Fondo para el Financiamiento del Sector Agropecuario*) financial instrument for iSPS adoption; (b)

tested a PES scheme rewarding land use conservation in CR landscapes (PES1-Biodiversity scheme); [15] (c) piloted a new PES scheme supporting conversion to iSPS (PES2-Carbon scheme); and, (d) designed/piloted a longer-term PES SPS conversion scheme.

- **Focusing on results, understanding the impacts of sustainable land transformation, and disseminating experiences, knowledge and lessons.** The project impact evaluation was formulated specifically to understand the effects of TA and PES on inducing sustainable land-use transformations.[16] Research linked to the effects of SPS on biodiversity was commissioned. The Project supported a rich body of analytical work, which has informed the project's implementation and is also an important source of reference to other public/private efforts for sustainable CR (see Annex 9). The project's piloting and validation features required significant flexibility to learn from ongoing experiences: course correction, further innovation and adjustments were expected and undertaken.

24. The PDO is disaggregated under its four themes (see para 9) and evidence for achievement is presented based on the Outcome and Intermediate Indicators and other supporting information. Primary sources include: project monitoring/reporting system (Annex 1); Recipient Completion Report (RCR); [17] project Impact Evaluation and end-of-project perception survey;[18] Bank-sponsored analysis of the business case for scaling up SPS in Colombia;[19] study on SPS-induced, reduced soil degradation (Centre for Research on Sustainable Agricultural Production Systems, (CIPAV)); [20] and, a quasi-experimental assessment of productivity.[21] See Annex 6 (Sections 6.1-6.9), and Annex 8.

PDO Theme 1: Promote the adoption of environment-friendly SPS for cattle ranching

PDO Outcome Indicator 1: *Area under environment-friendly CR production systems implemented in project areas (ha)* (Target exceeded: **120 percent**)

25. **Project promotion, investments and TA resulted in 100,522 ha being managed under environment-friendly CR production systems/land uses** (120 percent of target). Farmers adopted SPS (non-intensive and intensive) and other best practices which intensified cattle ranching systems and released or protected land for conservation and restoration.[22]The project developed a typology of nine land-use (LU) types, with 21 subtypes, to track changes in land use. Productive activities were associated with seven of the land-use types, and two corresponded to natural ecosystems (primary and secondary forests and *páramos*).[23] See Annex 6.3, and Table A6.2.1 description of SPS/iSPS.

26. **Analysis *in situ* confirmed the conversion of traditionally-managed lands to sustainable systems.** Land-use changes attributable to project interventions were analyzed and compared to a baseline of 3,383 cattle ranching farms with an area of influence of 127,308 hectares. The latest land-use verification showed that 15.5 percent of area degraded and/or used for traditional agriculture had shifted to more sustainable use – mainly grasslands with dispersed trees and iSPS. Primary forests had suffered no losses, and conservation of secondary forest had increased, compared to baseline. Area with live fences and wind breaks expanded 3.5-fold compared to baseline. See Annex 6.3 for the land use monitoring methodology and Table A6.3.1 for a description of land use changes.[24]

PDO Outcome Indicator 2*: Land area where sustainable land management practices were adopted as a result of the project* (Target exceeded: **108 percent**)

27. **Participating producers transformed 38,390 ha of pastureland to SPS, on average shifting 25 percent (highlands) to 29 percent (lowlands) of their farm area to SPS and iSPS.** Compared to PDO Outcome Indicator 1, which reports all area under sustainable use or set aside for conservation, PDO Outcome Indicator 2 (Bank Core

Indicator) focuses only on the additional/incremental area brought under SPS (including iSPS) by the project (LU3, LU5 and LU7: see Annexes 6.2 and 6.3). This incremental area is included as part of the PDO Outcome Indicator 1 target. Non-intensive SPS increased the area covered with dispersed trees (LU3) and live fences (LU5), while iSPS (LU7) included forage hedges, multi-species fodder banks, and direct animal foraging. The 2017 Restructuring reduced the Indicator 2 target from 48,000 to 35,000 ha, to reflect key findings/events: much smaller than expected land size of participating CRs did not realistically allow the initial target level; climatic factors in 2015 and 2016 negatively affecting trees already established; and, the need for adjustments in the pilot PES2 scheme supporting iSPS to catalyze conversion.[25] Land transformation is attributed to the strong TA strategy, tailored technology packages, and (under the AF) demonstration farms. The TA strategy addressed diverse production and environmental conditions in the highlands and lowlands, delivering a complete range of benefits according to local needs: production, biodiversity, ecosystem protection, avoided deforestation, climate resilience, and food diversification. See Annex 6.2, TA strategy.

28. **Farmers adopted iSPS on 4,640 ha** (103% of the revised Intermediate Indicator target). This achievement is attributed to an iSPS-specific TA strategy, combined with PES2 (supporting intensive systems) and demonstration farms, instruments introduced by the AF to boost conversion to iSPS (from a baseline of just 263 ha). The RSPS pilot had shown that iSPS arrangements offered better environmental and productivity benefits, resulting in the ambitious CMSCR target of 12,000 ha, which in turn relied on FINAGRO credit and on estimated average land-conversion areas per farm. The target was reduced to 10,000 ha, then to 4,500 ha when the pilot PES2 schemed entered full implementation. Constraints accessing financing and the fact that most beneficiary farms were too small to support large-scale transformation to iSPS affected iSPS adoption.[26] With adjustments introduced to the PES2 scheme in 2017, the adoption of iSPS accelerated dramatically, resulting from the effective combination of up-front support and realistic expectations of what was possible in terms of on-farm transformations. Importantly, while direct project experience reduced end-targets for iSPS adoption, the effort to achieve widespread adoption of environment-friendly SPS remained paramount and was intensified (e.g. through engaging larger number of farmers).

29. **Some 65 percent of farm area converted to SPS (including iSPS) across project regions was in the Lower Magdalena River Basin and Cesar Valley.** In the former, the predominant land-use change was the shift to dispersed trees in pasturelands, adopted as a natural pasture regeneration strategy. Linear arrangements such as live fences and forage hedges, used for dividing paddocks, were more common forms of SPS in the Coffee Ecoregion. The Orinoquía Region (Piedmont) experienced the most significant reduction in degraded lands. See Figure A6.3.2, Annex 6.3, for the regional distribution of area converted to SPS.

PDO Outcome Indicator 6: *Number of cattle ranching farms benefiting from project instruments (technical assistance, PES, or support for establishment of on-farm nurseries)* (Target exceeded: **103 percent**)

30. **Some 4,100 farmers (17% women) in five regions benefited directly from TA, demonstration farms, seed and plant multiplication strategies and PES.** The target for direct beneficiaries was increased by at least 1,000 farmers, consistent with the two-year extension of the closing date to January 2020. Of the 6,572 applications received from four public calls for engagement (2011, 2012, 2015 and 2018), 4,100 properties were approved (Map, Annex 6.1). By the final call, demand overpassed projections, 73 percent of received applications had been approved but only 62 percent could be funded (as the project had funds to support only 1,000 new farmers). The final call used a cluster approach, grouping beneficiaries in adjacent geographical areas, which improved TA cost-effectiveness, reduced withdrawal rates, further promoted demonstration and landscape approaches, and yielded faster results. The project

successfully reached small-scale producers: 77.7 percent of beneficiary farms averaged 19 ha, 17.4 percent were medium-scale, averaging 85 ha, and 4.85 percent were large-scale averaging 306 ha. Table A6.3.2, Annex 6.3.

31. **Project TA and training were delivered to 24,416 ranchers, technicians, and professionals** (124 percent of Intermediate Indicator target). Recipients included 4,100 direct beneficiaries, 10,326 producers who visited demonstration farms, and 9,990 technical professionals, farmers, and others. TA support was highly valued by beneficiaries, focusing on establishing SPS/iSPS, and instilling good CR practices using integrated farm management and production techniques. The TA model used group extension (demonstrations, group workshops, training events, field days, and tours with producers), and individual extension (farm visits). The project's Participatory Farm Planning tool (PPP in Spanish) supported integrated farm management by helping beneficiary CRs to develop work plans based on their productive and land use transformation goals (Section III). Through 458 training events, the project reached 12,204 stakeholders: farmers (46%), students (32%), technicians (19%), and training professionals (3%). Specialized, intensive training was delivered to 691 professionals on SPS design/establishment. See Annex 6.2.

32. **Demonstration farms were highly effective.** Producers interested in establishing SPS increased their knowledge of SPS' environmental, productive, and socioeconomic benefits through direct instruction. Of the 50 demonstration farms established by CIPAV- *Alianza* (GCS), 43 remained in place at project closing, and an additional 12 demonstration farms were being supported in Meta-Ariari River by TNC. Such farms were first established in 2014, and the AF employed a strategy and dedicated funding to establish more, covering diverse production systems, and conservation and restoration areas. Demonstration farms effectively built CRs' understanding of/commitment to diverse sustainable production arrangements, and demonstrations were developed/adapted specifically to different regional production systems and ecotypes. See Annex 6.2.

33. **Short-term PES schemes for Biodiversity and Carbon Sequestration (AF) were the project's primary instrument for inducing/driving conversion to sustainable land uses.** The result was improved environmental services and natural resource management, as discussed below (see Annex 6.2 for specific schemes):

- **PES1 (Biodiversity) benefited more farmers over a wider area than initially targeted.** That said, on average payments were lower than expected for reasons of small farm size already discussed. Farmers participating in PES1 (1,866) exceeded the target by 10 percent, and the project surpassed the area targeted for PES1 by 22 percent (60,158 ha vs target of 49,000 ha). Of these, 39,223 ha corresponded to land uses LU1 to LU5 at baseline (see Annex 6.3) and 20,935 ha corresponded to new areas established under dispersed trees in paddocks, and live-fences and windbreaks. PES 1 payments totaled US$2.123M (averaging US$1,430 per contract).
- **PES2 (Carbon Sequestration), introduced by the AF, proved an effective incentive inducing producers to establish iSPS.** Some 1,341 producers (107% of target) established iSPS on 4,240 ha (92% of the target area), plus an additional 400 ha of iSPS were established through TA alone or in combination with PES1 (total 4,640 ha). PES2 compensated farmers for the carbon sequestered by iSPS through ex-ante, in-kind support to establish iSPS, e.g., an equivalent US$450/ha in seeds or cuttings of forage shrubs, soil analysis, a personal protection kit for applying agro-inputs, electric fencing, and/or land preparation support. Following verification of iSPS establishment, the producer received an ex-post cash payment of US$150 per ha converted. The project issued 274 contracts for ex-post payments and paid US$71,584 to maintain the agreed iSPS arrangements.[27]
- **Shares of payments differed by region.** The largest share of PES1 payments went to producers in the Cesar Valley River Region (39%), the Coffee Ecoregion (19.6%), and Orinoquía Region (Piedmont) (19,9%). These regions

reported the largest land transformations towards non-intensive SPSs. For PES2 (supporting iSPS), the largest share of payments went to the Coffee Ecoregion (47.1%), followed by Boyacá and Santander Region (24.8%).

34. **Capacity was created to propagate and manage tree species.** The project established a network of 116 plant nurseries (60 nurseries located on CRs, and 56 private-commercially operated nurseries) supporting the propagation of forage species and incorporation of native tree species. Nurseries produced around 3.1 million fodder trees, delivered to beneficiary farmers. These trees were incorporated into live fences and arrangements of dispersed trees in paddocks. More than 50 percent of the species planted contributed to environmental conservation and/or to connectivity restoration in the project areas with the remainder demonstrating value in terms of fodder, wind breaks, shade and other uses and overall carbon sequestration benefits.[28]

PDO Theme 2: Improve natural resource management

35. Results for this PDO theme are intrinsically linked to, and a proxy for, the results for PDO Theme 3 (provision of environmental services). Substantiation of achievements highlights the contributions of specific project activities and results to Theme 2 outcomes. Results described relate to activities under Components 1 and 2 that promoted good management practices on-farm for soil, water, and natural ecosystems, by establishing SPS and iSPS. Other project activities that helped to improve NRM - including of soils and water - and those more closely associated with improved biodiversity and carbon benefits, are discussed under PDO Theme 3.

36. **TA and demonstration farms successfully promoted the adoption of integrated NRM technologies and practices under SPS, including sound management of soils and water and clean energy options.** Technologies included: paddock rotation, silage technologies for fodder conservation, protection of water sources, on-farm aqueducts and water harvesting technologies, and restoration and conservation of fragile areas or habitats of environmental interest. The use of bio-digesters as a strategy for decontamination of wastewater and as an alternative energy generator, and establishment of solar powered electric fencing systems and water pumping, are examples. The project demonstrated the positive effects of improved NRM on the restoration of soils degraded by overgrazing, sustainable management of pests, and reduced use and costs of fossil fuel-based pesticides and fertilizers. The project enabled: 86 percent of the beneficiary farms to adopt good practices for pastureland management; 73 percent adopted practices to protect watersheds; 43 percent are now using organic compost to fertilize soil, and 33 percent are applying fodder conservation practices, including establishment of fodder reserves (the last result is especially high, since national adoption of these practices averages about 3 percent). Refer to PDO Theme 1 above for data on CR land area converted to SPS.

37. **PPP data confirmed that the productive and environmental performance of CR improved under sound, proven land/natural resource management techniques.** PPP enabled individual farmers to evaluate the sustainability of their production systems. Progress was scored based on 20 sustainability variables (environmental, socio-economic and productive), a farm-specific work plan was developed based on short, medium and long-term goals, and progress was compared to the baseline. Farmers in all regions improved their management of natural resources and production systems on-farm, reporting improvements from 8 to 37 percent over baseline. The Piedmont in the Orinoquia and the Coffee Ecoregions recorded the best performance after four years of implementing good practices. See Annex 6.2, Figure A6.2.4 for regional reported PPP sustainability scores.

38. **Integrated water management technologies were introduced under SPS.** While there was no explicit focus on watershed issues because the initial GEF funding was largely from the GEF Biodiversity window, water conservation

and quality were strong components of SPS messages/packages (e.g., fencing, riparian plantings). Technologies were promoted to increase water quality (e.g., water purification systems) and reduce vulnerability to water scarcity (e.g., water harvesting systems). Cattle-ranching aqueducts were established on demonstration farms, and TA demonstrated water technologies and practices. To complement the short-term PES schemes earlier described, the project also designed and piloted a long-term PES scheme in Caldas Department in the Coffee Ecoregion, explicitly focused on watershed issues, as water users were the most important likely funding sources for these efforts. Annex 6.2 discusses the Caldas PES scheme.

39. **Numerous beneficiaries observed that their knowledge of NRM and conservation had increased.** The beneficiary perception survey at project closing (Annex 6.3, Figure A6.3.4 (a) to (g)), showed that about 88 percent of beneficiaries fully agreed that they learned water management and conservation techniques from the project, 75 percent fully agreed that their understanding of the benefits of forest resources had improved, and 35-45 percent fully agreed that the adoption of SPS had reduced the incidence of pests on their farms, with the highest scores reported by farmers implementing iSPS systems. Intensive systems have been associated with higher benefits in terms of disease and pest control than the non-intensive systems.

PDO Theme 3: Enhance the provision of environmental services

PDO Outcome Indicator 4: *Reduction of greenhouse gases (GHG) from reduction of deforestation and forest degradation and increase of carbon sequestration at the farm level, through the adoption of SPS in the participating farms* (Revised target: **98 percent** achieved)

40. **Implementation of SPS and forest conservation increased the amount of carbon sequestered in soils and reduced GHG emissions, helping to mitigate climate change** (1,565,026 tons of carbon dioxide equivalent (t CO2e), 98% of target). The project's establishment of factor removal emissions (Tier 3), for different silvo-pastoral uses made an important contribution, especially to preparation of the NAMA and other strategic sector planning. Based on the Tier 3 factors, reporting of this indicator improved since early 2018. The PDO Indicator target was established applying emissions factors current in the literature at AF preparation. Applying the same methodology at closing, the revised target is exceeded: total carbon removals of 1,826,000 t CO_2e, 147 percent of revised target. See Annex 6.4.

41. **Emission reductions via carbon capture were estimated at 1,131,056 t CO_2e.** As discussed in Section IV A, the project made critical contributions to carbon monitoring in Colombian livestock systems. Based on measurements of soil carbon content and above-ground biomass, the project developed Tier 3 factors for carbon sequestration for each land-use type to measure carbon capture associated with actual farm-level changes in land use.[29] Dispersed trees in pasturelands, live fences, and iSPS, along with secondary forest conservation, contributed to carbon sequestration in all project regions, but particularly the Cesar River Valley. Net accumulated CO_2 removals resulting from the conversion of pasturelands were estimated at 1,131,056 t CO_2e. If project-promoted management practices are maintained, carbon capture is likely to increase to 1,462,236 t CO_2e by 2030.

42. **Emissions reductions resulting from avoided deforestation were an estimated 433,970 t CO_2e.** The project validated methods for understanding how land-use changes would affect deforestation and carbon sequestration. An analysis of deforestation risk for 2010–16 indicated that the Coffee Ecoregion had the most extensive forest and lowest risk of deforestation, whereas the highest risk was in the Cesar River Valley and Boyacá/Santander Regions. Model estimates show that in 2010, primary forest on beneficiary farms occupied 18,920 ha in all regions, and the

deforestation risk was estimated at 1,315ha. By 2018, 111 ha had been deforested on beneficiary farms, and deforestation had been avoided on 1,542.5 ha, corresponding to 433,970 t CO_2e of cumulative carbon removals. Avoided deforestation was highest in the Cesar River Valley Region, followed by Boyacá/Santander and the Meta low foothills. Tables quantifying carbon removals resulting from avoided deforestation are presented in Annex 6.4.

43. **Land use changes under SPS resulted in a positive carbon balance.** A Bank-commissioned study assessed the carbon balance of the sustainable land uses induced by the project. Although still preliminary, the results are positive and suggest the potential of SPS systems to reduce total emissions, including from animals (enteric fermentation). Emerging results from data sets suggest a reduction in animal emissions of 3.2 percent compared to a baseline and a significant reduction in total emissions on project beneficiary farms (see Annex 6.4).

PDO Outcome Indicator 3: *Improved presence of globally important biodiversity in project areas, as measured by an increase in the Environmental Services Index (ESI) resulting from the adoption of environment-friendly SPS implemented in participating farms in project areas* (Revised target: **93 percent** achieved)

44. **Globally important biodiversity markedly increased in project areas, resulting from SPS adoption.** At closing, the project's aggregate ESI score – a surrogate for biodiversity - was 1,410,874.5 compared to the targeted 1,522,000 (93 percent of target). The ESI supported M&E of the farm-level provision of environmental services, assigning a value of zero to 9 to each project-defined land use, based on its contribution to those services. The use of native species in SPS arrangements and a farm's contribution to landscape connectivity were also scored. ESI scores increased over time as farm area under SPS and iSPS increased, along with area set aside for vegetation regeneration and conservation. ESI scores also correlated with the abundance and richness of birds and beetles, further evidence of increased biodiversity at the farm and landscape level. In parallel, TNC/CIPAV biodiversity monitoring showed that bird populations increased 32 percent in monitored project areas, as did populations of plants and dung beetles; project areas registered 522 bird species and 230 species of beetles. Silvo-pastoral systems establishment and resulting connectivity proved critical to the mobility of 65 percent of the species monitored.

45. **SPS played a major role in increasing and conserving biodiversity at the farm and landscape level and delivering local and global environmental benefits**.[30] Sustainable systems established on CR added to the biodiversity and conservation of important native species and their habitats, with effects extending well beyond productivity and environmental benefits on individual farms (Annex 6.6). The positive global and local environmental benefits of SPS include increased number of species (richness) and number of individuals observed (abundance), including many forest-dependent and endangered species. Conclusions emerging from the biodiversity monitoring and an integrated analysis of biodiversity indices, show: (a) Richness of forest plants,[31] beetles, and birds is positively correlated with an increase in forested areas on pastures under SPS systems; (b) Productive efficiency of cattle ranches is increased by implementing SPS; and, (c) SPS areas are correlated with increased carbon capture as a result of sustainable land use. See Annex 6.4 for further details.

46. **Tress of 50 focal species (native) – 25 of which are globally important—were distributed to CRs, contributing to biodiversity conservation.** Tree nurseries were a critical part of the effort to implement SPS, and the project distributed 3.1 million trees of local and global biodiversity importance for fodder and domestic purposes. A total of 50 species were focal, contributing to biodiversity conservation (see also Annex 6.2).

47. **SPS significantly improved the physical condition of soils compared to degraded pasture soils that received no project land-use interventions.** An essential element of SPS systems is improved pasture management, which helps

to improve soil quality through the decreased use of pesticides and fertilizers, and reduced erosion. CIPAV was commissioned to study/quantify the magnitude (t/ha) of reductions in soil erosion induced by the adoption of SPS in the Coffee Ecoregion and Cesar River Valley Region.[32] In the Coffee Ecoregion, the mean reduction in erosion was 35.3 percent in soils under SPS compared to degraded pasture soils: SPS soils experienced annual erosion of 12.3 t/ha, whereas degraded soils lost 19 t/ha. In the Cesar River Valley Region, the reduction in erosion was 5.4 percent: SPS soils eroded by 17.5 t/ha annually versus 18.5 t/ha on degraded pasture soils. The much flatter topography in the Cesar River Valley - which tends to reduce the erosion rate - provided less scope for improvement. An associated indicator at appraisal was dropped because it was an impact - not outcome - indicator which could not be measured/reported sequentially during project implementation. It became the subject of the above-mentioned CIPAV research study of a sample of participating farms to permit understanding of the impacts of SPS on soil erosion and to increase the body of scientific knowledge on the soil erosion benefits of SPS arrangements.

PDO Theme 4: Raise the productivity in participating farms

PDO Outcome Indicator 5: *Increase in the production of milk per intervened hectare in participating farms. (Target exceeded: **170 percent**)*

48. **Application of the PPP tool to 1,532 participating milk producing farms showed average gains of 17 percent in milk production per intervened hectare** (vs. targeted 10 percent). Under the 2017 Restructuring, the productivity focus shifted to milk, acknowledging that some 90 percent of beneficiary small-scale ranchers were primarily milk producers or engaged in dual-purpose milk/beef, and the measurement of meat production/productivity would add complexity without value. The project's effects on productivity variables were measured by: on-farm monitoring based on PPP (measured at five points along the project period); and, a quasi-experimental methodology applied to a random sample of 101 farms in the five project regions to identify the effects of different SPS on milk production and animal load. Control plots under traditional management were identified on each farm. See Annex 6.3.

49. **SPS practices enhanced productivity and profitability.** SPS: (a) increased the quality and quantity of milk produced per head (average 17 percent increase in milk production/ha, 170% of target); (b) increased stocking rates by 15 percent (150% of target); (c) reduced animal mortality during the dry season by providing more fodder compared to traditional ranching; and, (d) reduced expenditures on agro-chemicals and nutrients, i.e. higher productivity was achieved with reduced inputs. Systematic review of end-project PPP data revealed even higher productivity gains averaging 29 percent, and a higher average increase in stocking rates of just under 22 percent.

50. **Increased milk productivity on participating farms was a significant achievement with important social and environmental implications**. SPS practices to which these results are attributed include: improved availability of pasture; multi-species fodder banks of high nutritional value (fresh or dried); rotational grazing of mixed pasture and forage bushes, with added benefits of reducing sun stress on animals (shade-raised cows are more productive and emit less methane); a richer supporting resource base resulting in higher stocking rates (livestock units per ha); and, reduced use of fossil fuel-based fertilizers and pesticides due to increased vegetative cover.

51. **These results were confirmed by the quasi-experimental analysis of differences in productivity with/without SPS.** As noted, a random sample of 101 farms was selected from the 2,555 farms responding to the first three calls for participants. Data were collected from sample farms twice-yearly (to account for seasonal effects on productivity) over three years (2016 - 2018). Compared to production areas without SPS: milk production in SPS areas was an

estimated 24.4 percent higher (90% confidence); stocking rates were 32.6 percent higher; costs of milk production declined by 9.1 percent/liter; and, biomass increases were 6.47 percent higher. Annex 6.3 discusses these results.[33]

52. **Production costs were US$127/ha lower on average under SPS compared to traditional ranching systems**. This value was estimated by the Bank-commissioned business case[34] and attributed to SPS-induced, improved animal nutrition, productivity and fertility, and lower incidence of animal death and disease. The switch to SPS increased farmers' annual income by as much as US$523/ha. Production cost savings were highest in the Lower Magdalena River Basin and Coffee Ecoregion (32 percent and 20 percent respectively). Income increases were highest in the Low Foothills/Southern Meta region and Lower Magdalena River Basin, respectively US$177/ha/yr. and US$163/ha/yr.

Justification of Overall Efficacy Rating

53. **Overall Efficacy is rated Substantial.** The project achieved its four objectives, based on the following. Four of six PDO Outcome Indicator targets were exceeded, and the other two targets achieved 98 percent and 93 percent, respectively. Most Intermediate Outcome Indicator targets were met or exceeded. In aggregate (original project and AF), the project reached far more beneficiaries and converted significantly more land to SPS, than targeted. The strong, evidence-based causal relationship between project investments and outcomes supports the ToC.

C. EFFICIENCY

Assessment of Efficiency and Rating

54. Although the indicative economic and financial analyses (EFA) in the CMSCR PAD (2010) and AF Project Paper concluded that the adoption of SPS and iSPS would be profitable and sustainable, they provided no specific data on estimated/expected economic or financial returns which could be compared to the results of the ex-post analyses presented here. The final EFA comprises four elements: economic, financial, climate variability resilience, and project leverage. See below, and Annex 4 for full EFA.

55. **The *economic analysis* demonstrates that the project was an efficient investment that simultaneously created monetary and social value.** Detailed estimates of cash flows over ten years in nine of the most representative cattle ranching archetypes in Colombia, were extrapolated to the entire area where the project drove changes in land use. These cash flows were estimated with/without the project, using an incremental analysis methodology. A social price of carbon of US$40/t CO_2 was used to calculate the value of carbon captured by the SPS. Results were calculated for three scenarios: (a) all project investments; (b) investments under Component 1 (focused on improving productivity), and Component 2 (focused on increasing connectivity and reducing land degradation); and (c) investments more directly related to changes in land use (Table 9). Based on those results, the CMSCR Project created sizable economic value, with an economic internal rate of return (EIRR) ranging from 24.5 percent to 30.1 percent, depending on the scenario, and net present value (NPV) ranging from US$1,650/ha to US$1,935/ha. At the project level, total economic value (Project NPV) is estimated to range from US$63M to US$74M, depending on the scenario. Also, these results were calculated with and without the carbon price to estimate the global environmental value created by the project. Total value from carbon capture driven by the project is an estimated US$66M.

56. **The *financial analysis*, which evaluates the financial return offered by SPS investments to farmers, finds that SPS technology has strong potential to reach scale and deepen impact based on market forces.** Cash flows and key financial indicators were estimated for nine representative production archetypes in nominal terms, discounted at

14.6 percent (the cost of equity of investments in Colombia), and extrapolated to the entire area where project SPS interventions were implemented. The financial internal rate of return (FIRR) and NPV were estimated for all nine archetypes under two scenarios: (a) with the project, to reflect the financial return to SPS investments; and (b) with the project, and taking the environmental impact of SPS into account, using the carbon price in Colombia's emerging carbon market. Estimates for the two scenarios were based on the incremental cash flows generated, compared to the cash flows under conventional ranching. The results show that financial returns to investments in SPS (Scenarios 1 and 2) far outstrip cash flows to conventional ranching. At the same time, they yield a sizable environmental impact (Scenario 2), which will contribute to the sustainability of the CR subsector in the long term. See Annex 4.

57. **The *climate variability resilience analysis* indicates that the greater environmental resilience of SPS compared to traditional systems creates economic value to strengthen the long-term sustainability of cattle ranching.** The analysis compares milk and cattle production losses incurred under conventional CR with losses incurred on ranches adopting SPS, based on the risk and duration of climate variability. The improvements in productivity resulting from SPS serve to shield producers from the worst impacts of that variability. Producers adopting SPS would avoid losses in milk production valued at US$1.5M and losses in cattle production valued at US$483K. These are the revenues that CRs are most likely to protect as climate variability grows. Notably, however, these systems - particularly iSPS - are highly vulnerable to droughts and floods during the first year of establishment.

58. **The analyses above show that the CMSCR Project leveraged and created significant economic and environmental value**. The project leveraged private capital in the form of investments by CRs. It created economic and environmental value in the form of the incremental revenue obtained by project beneficiaries, the value of carbon captured over the project period (2010–20), and the value of carbon that is projected to be captured in the following ten years. The resulting estimate of the multiple of invested capital (MIC) indicates that the project has leveraged/created US$3.6 for every US$1 provided by funding agencies (GEF, BEIS) and partners (see Annex 4).

59. **Sensitivity analysis:** A sensitivity analysis looked at the effects of changes of plus/minus 15 percent in milk prices, cattle prices, production volumes, labor costs, and total costs, as well as the social price of carbon. Returns generally remained positive across numerous scenarios, although a decline of more than 15 percent in production volumes and total costs drove returns similar to the social discount rate, making the project an unattractive social investment.

60. **Implementation efficiency:** Implementation efficiency was substantial considering the following: The PDO Indicators and most Intermediate Outcome Indicators were substantially met or surpassed, and execution of Grant funds reached 99 percent. Even though project momentum was curbed initially by complex methodologies for verifying land use, inter-agency coordination issues, and credit constraints, implementation under the AF accelerated due to the demonstration farms and tree/seed production strategies, and the flexible design/implementation of pilot PES1 and PES2 schemes. While project implementation exceeded by two years the planned AF closing date, this enabled a complex and important project to demonstrate a high level of achievement on its PDO Indicators (partially attributed to the use of exchange rate gains from devaluation of the Colombian currency to expand project activities).

61. **Assessment of Efficiency and rating:** Overall efficiency of the CMSCR Project is rated Substantial, based on the efficiency assessment – economic, financial, climate variability resilience, and project leverage—plus substantial implementation efficiency and a generally positive sensitivity analysis. See Annex 4 for the full EFA.

62. **Split assessment of Overall Outcome Rating:** Given adjustments in some target values at PDO and Intermediate Outcome level, the ICR Team analyzed the need for a split assessment of the overall outcome rating. Taking into account adjustments made by the AF (2014) and the 2017 Restructuring, and final project outcomes, the consensus of the ICR team and reviewers was that the case for a split assessment was not compelling, for the following reasons:

- **The CMSCR was an experimental operation requiring adaptive management based on frequent assessment of progress and of the factors affecting the adoption of specific technologies and instruments.** As a "laboratory" to test important land use and climate smart mechanisms and technologies, the project always envisaged implementation as a dynamic process likely to involve shifting/modified approaches and targets, depending on the context. The PAD acknowledged that not all SPS practices are equally feasible, profitable or contribute equally to biodiversity conservation. Many factors facilitate or intervene and thus adjustment of project strategies and benchmarks over time was expected.
- **Experience from Year 1 showed that SPS uptake was affected by dynamic contextual circumstances requiring continuous research, monitoring, learning and/or reassessment of instruments, methodologies, incentives, indicators, targets and solutions to achieve the PDO and consolidate proof of concept.**[35] The AF and three restructurings sprang from, and facilitated, this process.[36]
- **Targets revised by the AF were generally higher than appraisal for most indicators.** PDO-level targets for improved CR practices, beef and milk productivity, and project scope including numbers of CR farms benefiting directly, all increased. Similarly, most of the Intermediate Results Indicators were retained and target values were increased or maintained: stocking rate, cattle ranchers trained, training strategy, area under PES schemes, and species used/conserved.
- **PDO-level and Intermediate Indicators were revised/adjusted by the AF.** New PDO Indicators were: reduction in GHG emissions; and, land area where sustainable land management practices were adopted as a result of the project (Bank Core Sector Indicator). The PDO-level soil erosion indicator was dropped but continued to be monitored under a research study, and two PDO Indicators were demoted to Intermediate level. Two Intermediate Indicators - water springs covered under PES, and reduction in use of inputs – were dropped due to expensive and complex measurement protocols; and, a third was reduced (iSPS) for reasons of cost and farm size explained earlier. These three indicators were important, but not at PDO level.
- **The 2017 Restructuring reduced some targets in response to monitored field outcomes and associated issues.** While the incremental area for improved practices at the PDO level was reduced, the overall area under environmental management practices increased (see bullet below). The GHG emissions target value was reduced based on ongoing evidence that beneficiary landholdings were small (an explicit requirement of the AF's UK donor), and their land conversion potential modest. The beef portion of the PDO productivity indicator was dropped because 90 percent of beneficiary ranchers were either fully or partially dedicated to milk production, negating the value-added of a complex analysis. Reduction of the PDO-level global biodiversity/ESI indicator target was an error; its correction in 2018 increased the target three-fold.
- **The aggregated target value for hectares under environmental-friendly, improved land management practices was increased at the PDO level.** While the iSPS target value was further reduced based on compelling contextual factors discussed elsewhere in this ICR, the overall target value under sustainable land management systems/practices increased by 21,000 ha (including forest protected/conserved). The contributions of individual pilot initiatives are embedded in this narrative. Notably also, the target value for direct beneficiary CRs increased from 2,000 at appraisal, to 2,700 at AF (and to 4,000 at 2018 Restructuring).

- **All PDO level indicators either exceeded or substantially achieved target values. Notably, the achievement for reduced targets was not only high, but substantial compared to the original targets.** For example, the target for incremental land conversion was reduced from 48,000 ha to 35,000 ha in 2017, but the final achievement of 38,000 ha is 80 percent of the original target. Similarly, the GHG emissions target was lowered from 2 million tons of CO2eq to 1.6 million tons in 2017, but actual achievement of around 1.6 million tons is about 80 percent of the original target. See Annex 1C, Tables A.1.C.1 - C.4 on RF changes.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

63. Overall Outcome is rated **Satisfactory**, reflecting the following:

- **High ongoing relevance of the PDO:** There were no shortcomings in current relevance of the PDO to the Bank's CPF objectives (FY2016-2021). The PDO at closing was also well-aligned with: (a) GoC development priorities outlined in the NDP 2018–22,[37] (b) Colombia's NDCs and recent commitments on SPS by the President of Colombia; and, (c) continuing efforts by project partners, allies and donors to promote/expand sustainable CR based on SPS.
- **Substantial rating for Efficacy:** The project achieved its objectives. Achievement under PDO Outcome targets was strong: four of the six PDO Outcome targets were exceeded, one achieved 98 percent and the other 93 percent. Most Intermediate Outcome targets were achieved or exceeded.
- **Substantial rating for Efficiency:** Efficiency is what would be expected in the operation's sector. This is especially relevant given that the CMSCR pilot proved to be an efficient investment which simultaneously created monetary and social value, and achieved impressive environmental impacts pointing to the potential for long-term sustainability of the project investments.

E. OTHER OUTCOMES AND IMPACTS

Women and Youth

64. **Efforts were made during implementation to include more female participants and service providers, and to reach younger people.** The project's initial design did not consider gender, but women's participation was increasingly sought and monitored over the project lifetime.[38] FINAGRO was urged to enhance rural women's participation in credit schemes longer term, e.g., by adjusting loan requirements to enable more women engaged in small-scale ranching to qualify. Demonstration farms were effective mechanisms for convincing women to participate in the project. (See Aide Memoire, November 2015). At closing, 17.3 percent of beneficiary CRs were operated by women and better positioned to improve productivity and livelihoods. Women's presence within project technical teams was also strengthened. At closing, women were over 68 percent of the Project Implementation Team and 24 percent of the regional implementation teams. Recognizing that shifting CR production patterns to sustainable approaches longer term would require behavioral changes, the project reached out in its final years to school children and youth in rural areas through its *Herederos Sostenibles* ("future sustainable cattle ranchers") program. Six workshops in rural schools informed 382 participants about the benefits of linking CR with biodiversity conservation, and related publications were produced/distributed to 51 rural schools in the five eco-regions (Annexes 6.2). Furthermore, although the project did not have a geographical focus on areas highly affected by the internal conflict, displaced populations also benefited, particularly in areas surrounded deforestation hotspots.[39]

Institutional Strengthening

65. Institutional strengthening was achieved through the following:

- **SPS planning and financial tools:** The project developed tools to support producers' SPS planning and financial decisions. The PPP tool enables farmers to envision/align production and conservation objectives; and, the biodynamic model – a planning tool - is enabling FINAGRO to pilot credit schemes for smaller producers under the ongoing Vision Amazonia Program.
- **Systematic training:** Local and national technical capacity was built to support SPS; a training program was developed to build future SPS expertise; and, the project partnered with SENA (the National Training Service of the Ministry of Labor, which offers free courses to vulnerable populations) to design seven short courses – now part of SENA's national curriculum for livestock training – on the establishment/management of SPS.[40]
- **Strengthened global knowledge on SPS in cattle ranching:** The project generated a set of technical and scientific publications (see Annexes 6 and 8) – several of them Bank-commissioned - presenting the results of original project-supported research and analysis. Regional and international conferences, workshops, and forums on sustainable livestock were also venues for CMSCR results dissemination, and for identifying ways to improve project implementation.
- **Inclusive, more productive dialogue:** The project supported the establishment of National and departmental roundtables on sustainable livestock, which were still functioning post-project.[41]
- **Showcasing SPS' national agenda:** The position of sustainable land conversion and SPS in the national agendas for rural and low-carbon development was advanced. Around 30 strategic alliances were fostered between project and outside partners, magnifying interest in SPS for rural development (see Section D and Annex 6.5 on partnerships).

Mobilizing Private Sector Financing

66. **Substantial funding was mobilized from private sources.** At closing, beneficiary producer contributions to sustainable land-use changes were an estimated US$16.35M for non-intensive SPS and US$5.5M for iSPS (total US$21.85 M), equivalent to 68.2 percent and 50.1 percent, respectively, of the costs of establishing those systems (including the cost of TA), and almost four-fold the contribution expected at appraisal (US$6.0 M). The MIC estimated that the project leveraged/created US$3.6 for every US$1 provided by the funding agencies and project partners (Table A4.20). Contributions were from own funds, or formal/informal credit. (See Annex 3, Table A3.4). Farmer contributions compensated significantly for structural barriers affecting credit mobilization for SPS expansion (particularly iSPS).[42] Counterpart contributions by project partners totaled US$6.73M (102 percent of the initial target), including US$3.7M in cash from FEDEGAN through the National Livestock Fund (FNG), US$0.97M from *Fondo Acción* for PES cash payments for land conversion, and US$0.98M from TNC and US$1.06M from CIPAV for SPS initiatives. (See Annex 3, Table A3.3).

67. **The project highlighted the role of private companies in scaling up sustainable approaches to cattle ranching.** The project supported public-private dialogue on Green Markets, reaching agreement on/developing a checklist of good practices contributing to a sustainable livestock operation, a more efficient value chain, and better environmental outcomes. Through TNC, supported by *Dinámica Financiera* SAS (a consulting firm), the project signed an MOU with *Asobrangus Comercial* SA (major Colombian beef processor) to understand/exploit opportunities for expanding the use of good practices for sustainable livestock production among beef CRs and to pilot a good practices checklist.

Poverty Reduction and Shared Prosperity

68. **The project monitored the contribution of SPS adoption to poverty reduction through socioeconomic surveys at baseline and end-line.** This acknowledged that cattle ranching was conducted mostly in areas with high levels of poverty, illiteracy and unequal land distribution. At baseline, 47.2 percent of the prospective beneficiaries were living below the poverty line (3.6 percent in extreme poverty). Increased milk productivity and other productive variables were shown to improve incomes. That said, the full income benefit of project activities has likely not yet impacted on poverty reduction, as many SPS at closing were still in their establishment/growing phase. Further, it is difficult to separate project impacts from the effects of drought and other climatic events.[43] Nonetheless, participating households did improve productivity and natural resources at the farm level - including water sources and soil quality – improving their asset base for cattle ranching. Longer term, such improvements are expected to help reduce poverty.

69. **Beneficiaries reported strong agreement on the landscape-level and environmental impacts of the land-use transformation promoted by the project.** Water management/conservation, and forest management/conservation were specifically mentioned. The project surveyed 345 beneficiaries at closing to gain insight into their perceptions of project implementation and the benefits of project interventions (summarized in Annex 6.4). Significant percentages – depending on the treatment – reported increases in yields, value, profitability, herd size and water availability, as well as cost reductions. The project successfully promoted behavior change in livestock production systems - namely, the integration of environmental and productive objectives.

70. **Beneficiary selection.** Selection criteria and screening procedures were rigorous - designed to reach the target population while preventing the participation of individuals associated with armed groups. The project: (a) selected municipalities and provinces with low levels of internal displacement based on a national register; (b) required demonstration of legal occupancy of land and absence of criminal record; and, (c) made final selection of beneficiaries from locally validated lists, subsequently agreed by the Project Steering Committee. CIPAV and TNC personnel conducted quality control of baseline assessments undertaken by FEDEGAN staff. Fondo Acción carried out public calls for expressions of interest divulged in the regions via mass media. Initial experience showed that more direct communication with CRs was essential, to transmit the nature/objectives of the project, the benefits available to and commitments required from ranchers who adopted, and the processes required to become a participant. Sites commonly aggregating ranchers (dairies, cattle yards, agricultural fairs) were used to organize meetings of stakeholders and prospective beneficiaries, to promote and explain the project.[44] Participants had to agree to specific terms of reference. Regional teams and promoters identified producers in each municipality by contacting ranchers' organizations and community groups. Applications to participate were evaluated technically, land property documents were analyzed, and priority was assigned based on established criteria including the application's order of receipt. Procedures were also standardized/formalized for cases where participants chose to withdraw. While time- and resource-consuming (and relaxed somewhat under the AF), beneficiary screening for participation proved effective and the process was seen as generally transparent and fair.[45]

Other Unintended Outcomes and Impacts

71. **Contribution to national policies.** Project actions contributed to the preparation of policy guidelines for sustainable CR, making "social, economic, and environmental sustainability" a national priority for the livestock sector, and informed current efforts undertaken by UPRA on strategic planning for the dairy and beef sectors. The current NDP 2018–22 includes a strong role for SPS and pledges to increase, importantly, the pasture converted to SPS by

2022. Project achievements were key to helping GoC define the NDP goal of ecological restoration on 301,900 hectares, equivalent to planting around 180 million trees.[46] The adoption of SPS is expected to account for 6 million of those trees—this target includes the 3.1 million trees already planted by the CMSCR project. The project also led preparation of the Bovine NAMA, the national strategic framework for GHG emissions reduction in the sector.

72. **Contribution to climate resilience.** Results of a World Bank study suggest that well-established SPS could help reduce vulnerability to climate shocks.[47] While extensive CR operations in Colombia reported milk productivity losses of up to 19 percent during periods of climate variability from 2009 to 2019, farms with well-established SPS reported productivity losses of just 0.4-5.5 percent. Under a scenario where SPS are implemented at scale, projections suggest producers could avoid annual losses from climate variability equivalent to 680-2,268M liters of milk and 60,000 tons of beef. Unlike traditional, extensive systems, well-established SPS are better adapted to climate shocks because their improved vegetative cover and efficient land management reduce vulnerability. Even so, such systems, particularly iSPS, are highly vulnerable to climate shocks during planting and establishment, as evidenced by project experience.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

- **The PDO was well-aligned with World Bank and GoC strategies and was designed to demonstrate proof of concept across critical, intersecting environmental and productive themes.** The PDO reflected the project's experimental nature and pilot elements by focusing on adoption of SPS as a discrete objective, and on proving that adoption was associated with environmental and productive benefits/effects. By making adoption of sustainable land use an objective in its own right, the PDO was in the mainstream of GEF projects. Further, a project of this nature addressing critical agro-ecological issues in diverse contexts and via piloting is invariably complex and challenging, but its complexity was, and is not considered evidence of flawed design. Project objectives were realistic, clearly-expressed - and to the extent known at appraisal - well-supported by financed activities and the assumption that implementation would be flexible/adaptive.
- **RF indicators captured operational objectives and the multi-themed PDO, supported by a comprehensive and well-conceived, albeit ambitious M&E plan.** Even so, the RF adopted a set of longer-term indicators, both at the PDO Outcome and Intermediate Outcome levels. The AF and subsequent adjustments revised many RF indicators to reflect project outcomes rather than impacts, and to separate outcomes from outputs.
- **Beneficiary targeting and selection were appropriate.** Given the complex political economy around the sector and to minimize reputational risk to the Bank associated with project development, beneficiary selection criteria specified in the operational manual (and agreed upon by the grant parties) were complex, with heavy documentation requirements that inherently and unavoidably entailed delays. See also para 65.
- **Readiness to implement was satisfactory,** within the constraints normally and realistically entailed in launching such projects in an untried setting. Learning-by-doing was tacitly embedded in the project activities and implementation arrangements. However, as noted, there were shortcomings in some aspects of the analytics supporting project formulation.
- **Certain assumptions were flawed.** Essentially, the forces of supply and demand affecting credit provision (especially for iSPS), the need for a demonstration component to reinforce TA/training and scale up impact in new geographic areas, and potential shortages of planting material to establish SPS, were either over-looked or, if acknowledged, were under-estimated at appraisal.

- **Targets for land conversion were optimistic:** The PDO indicators envisioned that 2,000 cattle ranchers would benefit from project instruments (TA, PES, or support to obtain credit) to influence 50,500 ha under environment-friendly CR production systems. Conversion at this level assumed the participation of some 600 larger farmers (30 percent) each converting 20 ha.[48] This assumption proved unrealistic due, importantly, to most approved beneficiaries being small-scale ranchers with the will - but not the area available - to undertake land conversion at the level envisaged, and challenges in meeting essential up-front costs particularly for iSPS.
- **Project risk identification was realistic, with rational mitigation measures, but some gaps are evident.** Risks associated with potential small rancher demand for/adoption of, the project's innovative instruments/technologies, and their likely chances of accessing credit even under the FINAGRO credit "umbrella" and with related training, were acknowledged in the PAD, but proposed mitigation measures proved ineffective or unworkable in practice. This affected early operational progress.

B. KEY FACTORS DURING IMPLEMENTATION

Factors subject to the control of government and/or implementing entities:

- **Effective solutions were found to facilitate the selection of beneficiaries, provide TA over a wide geographical area, and induce land conversion.** The AF simplified the complex beneficiary selection process, speeding up the application and approval process while preserving quality and security standards. Project teams adopted more localized TA strategies to develop awareness of SPS, generate knowledge and train people so as to provide TA more cost-efficiently to widely dispersed beneficiaries and accommodate cultural and geophysical differences across regions. Demonstration farms proved strategically effective in catalyzing local action by ranchers and achieving the end-targets for changes in land use. Tree nurseries (private commercial nurseries and nurseries established on farms) were another critical factor inducing producers to undertake land conversion. Technical teams were strengthened to provide needed assistance/ monitoring.
- **The PES2 Carbon scheme, piloted with AF funds, proved the importance of mainstreaming climate-finance schemes supporting the up-front costs of SPS establishment (particularly intensive systems).** The unwieldy credit system initially impeded efficient land-use transformation. As planned, beneficiaries were to obtain credit through commercial banks and benefit from FINAGRO's incentive scheme (RCI), particularly to fund the upfront investments associated with adopting iSPS.[49] The constricted flow of credit to CRs initially impeded large-scale adoption of SPS (and especially iSPS). Barriers were mostly structural and knowledge-based - a mix of supply and demand-side factors.[50] The PES2 scheme required adjustments to reflect farmers' response to the incentives but generated invaluable lessons for unlocking the flow of climate finance to participants under future SPS projects.
- **PES implementation logistics were improved by adopting a streamlined method for validating land-use changes.** The MTR identified inefficiencies in the validation of land-use transformation and the logistics of paying ranchers for ecosystem services. Validation at the farm level using a geo-referencing methodology proved burdensome and expensive to perform annually, but without annual validation, payments were delayed, and beneficiaries began to lose trust in the project. Post-MTR, the project mainstreamed ranchers' self-reporting of land-use changes, supervised by project extension workers (the *Autodeclaración* methodology). Validation costs were reduced and payments to farmers accelerated.
- **PES successfully achieved proof of concept through adaptation based on rigorously monitored field outcomes.** First, PES1 was adjusted - to strengthen the conversion of land to iSPS - by modifying the scoring of payments for different types of land use. Second, the finding that ex-post payments under the pilot PES2 scheme

supporting the adoption of iSPS and enhanced carbon sequestration did not - in practice - drive land conversion to iSPS, saw the budget for and proportion of ex-ante support increased, and for ex-post payments, reduced. Also, ex-ante support (including in-kind) began to be provided by area converted rather than participant. PES payments to farmers reached 56 percent of the appraisal-plus-AF amount: US$3.8M in direct support, including US$1.68M in upfront support as inputs and US$2.14M in ex-post payments.[51]

- **Improved coordination among the project partners boosted the efficiency and effectiveness of project administration and decision-making.** The original institutional arrangements worked well (except for those associated with credit to participating ranchers, discussed above), and were sustained by the AF. Administrative processes required the approval of each partner and, in several cases, face-to-face meetings of all partners. By the AF, coordination between project partners had improved markedly – including using organizational coaching experts at AF outset - and administrative bottlenecks were resolved. As the partners forged more effective alliances, they were better positioned to assume their crucial role in sustaining project outcomes. The high-level stewardship of the Public Policy Committee, where MADS and MADR provided consistent support throughout, was a key institutional factor influencing project outcomes.
- **The project took advantage of exchange rate fluctuations to accelerate implementation and expand project activities.** Between the first disbursement (May 8, 2010) and the last (October 27, 2019), the devaluation of the Colombian peso against the US dollar was about 167 percent, resulting in more pesos for every dollar of GEF and UK DECC resources (Annex 3, Figure A3.1). These exchange rate gains were used to expand project activities (including a fourth call for engagement of beneficiaries and marked expansion of training and awareness-building activities) and to accelerate the achievement of outcomes and targets.

Factors subject to the control of the World Bank:

- **The Bank team acted decisively, pivoting in an agile manner to resolve implementation issues.** The causes were promptly identified, and measures devised to restore progress and key performance ratings. The MTR of September 2016 downgraded ratings for Project Implementation Status to Moderately Unsatisfactory for about one year due to PES-related delays. PES1-scheme payments to farmers were delayed by slow progress in establishing baseline land use and verifying land conversion to alternative uses, and by complex administrative procedures (Component 1). Timely corrective measures to improve operational efficiencies in payments (coordination between central and regional project teams), and validation of the auto verification methodology for land use baseline, along with efficiencies achieved in deployment of seed and tree production strategies contributed to restoring Satisfactory ratings. The Bank also responded effectively – with Client support - to critical operational, technical and financial needs (see above), making essential adjustments via the AF and several Restructurings, discussed in Section I and Annex 1C.
- **The Bank played a catalytic role in preserving a stable implementation environment for the project in the face of political pressure.** Early in 2016, MADR requested that project implementation responsibilities be transferred from FEDEGAN to MADR, which could have impacted the private-driven, innovative nature of this intervention and further delayed implementation of the project. The Bank team acted decisively, based on legal documentation and previous agreements, to ensure that project implementation continued as expected, setting clear boundaries between technical and political agendas.

Factors outside the control of government and/or implementing agencies:

- **Climatic events caused losses and delays**. Between 2015 and 2016, droughts provoked by El Niño caused significant losses of trees planted by the project.[52] Severe climatic events affected project activities again in

2018 and early 2019. The project strengthened actions to increase climate resilience (for example, supporting the use of gel protection for recently planted trees) and to enhance knowledge of water management techniques through demonstration farms, training, and extension.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

73. **M&E design:** The following captures key features of M&E design:

- **The Theory of Change was complex, but the results chain was coherent.** Complexity derived from the intersection of three distinct streams of activity to achieve an ambitious PDO, and the project's high technical content. The RF indicators adequately captured land transformation and its associated productivity and environmental benefits, but the level of detail on assessing land conversion's benefits added complexity.
- **The PAD provided specific guidance for measuring the impact of introducing SPS on the provision of Environmental Services (ES).** The ES to be measured included biodiversity conservation, land restoration, carbon sequestration and water quality. Guidance was also included to formally evaluate the impact of SPS on farm productivity, and the contribution of specific land uses to sedimentation and run-off on selected farms. In practice, the ambitious M&E framework outlined was treated as advisory, not prescriptive.
- **M&E features and arrangements were technically sophisticated.** They included: (a) *a geo-referencing methodology to measure changes in land use at baseline, end-line, and annually.* This technically-advanced approach required trained extension workers to integrate various tools including GPS, and conduct rigorous field testing; (b) *a two-pronged approach to measure productivity improvements.* This entailed: using the PPP tool so beneficiaries could report their measured productive (and environmental) improvements; and, a quasi-experimental methodology applied to a random sample of 101 farms across the five project regions to identify the effects of different SPS arrangements on milk productivity (within each farm, and on control plots under traditional management methods); (c) *an improved environmental services index to monitor biodiversity, and actual biodiversity monitoring on the ground.* The project improved the ESI used under the RSPS pilot project, measuring biodiversity by the type of landscape and land use to capture the effects of different project interventions and practices; and, (iv) *properly defined M&E roles/responsibilities and a set of deliverables* including final assessment studies and a Recipient Completion Report (RCR).

74. **M&E implementation**: M&E implementation performance met expectations, as follows:

- **The system evolved responsively, incorporating new approaches and providing lessons to improve implementation.** National capacity expanded to monitor and evaluate the productivity and environmental impacts of SPS in cattle ranching, and the project's fiduciary compliance. While facing some challenges stemming from RF design (see below), M&E data were collected and analyzed in a methodologically sound manner, generally consistent with the PAD's M&E vision.
- **Changes were required to simplify the RF, increase its operational (rather than research) focus, and facilitate measurement**. Some long-term outcome and impact indicators were hard to measure, and some technically complex indicators needed clarification. The AF introduced important changes in the RF which was subjected to further adjustments under subsequent restructurings, detailed in Annex 1 C.

- **Environmental Services were monitored/measured effectively and regularly.** For example, an integrated M&E platform, including web application, was developed to monitor and assess the effects of SPS on conservation of natural ecosystems and on the presence of flora and fauna in each project region, and the effects of land conversion on carbon capture. The platform cross-referenced farm-level data collected by FEDEGAN and CIPAV with landscape-level data from TNC on soil-scale biodiversity richness and abundance.
- **Robust methodologies were piloted and validated to measure climate benefits**. Reductions in GHG emissions were calculated based on estimates of CO2 sequestered as a result of project activities, including forest conservation. Reduced emissions from avoided deforestation were calculated using ALOS PALSAR radar imagery of changes in forest cover from 2010 to 2016, and DINAMICA EGO software and project data were used to develop spatially explicit models of those changes. Radar imagery was more accurate but over-stated predicted deforestation, leading to calibration of an improved deforestation model for 2010–16, recalculation of the estimated area of deforestation prevented in 2016, and - due to cost – the use of national deforestation rates for 2017 and 2018, ensuring consistency with earlier measurements.
- **Impact evaluation succeeded in attributing changes in productivity and environmental variables to project activities**. A quasi-experimental exercise assessed, in depth, the productivity results of different SPS approaches, with bi-annual measurement of variables including milk production and stocking rates, over three years. Given the experimental nature of the project, it was intended that beneficiaries receive different types of project support, and therefore, the impact evaluation examined four discrete "treatments"[53] whose impacts varied depending on the local context and project evolution. Experimentation and adjustments were needed in activities, methods, and approaches. Drought affected some treatments, both at baseline and end-line. The resulting challenges for data collection were significant, and several changes to the impact evaluation approach were required during implementation.
- **Integrated monitoring of SPS' production and environmental outcomes supported the business case.** This approach proved fundamental for providing sound information to structure a clear business case for ranchers, and other private and public actors, on the socioeconomic and environmental benefits associated with the different land uses promoted by the project. It also enhanced the project's national visibility.
- **The full geo-referencing methodology for monitoring PES-related land use was substituted by a more cost-effective, self-reporting methodology.** Geo-referencing proved costly to implement in terms of training, time, and coordination. To substitute, a FEDEGAN extension worker, with a rancher, sketched the land uses on the ranch, indicating the area (in hectares) and lengths (in meters) of the SPS arrangements. The sketch was signed by both parties, with the rancher certifying that the information was an acceptable approximation of his/her farm reality. The resulting field data were consolidated with the geo-referenced field data in Excel, although compatibility issues arose in some cases (Annex 7).
- **Critical research initiatives/studies were conducted, complemented by activities to create awareness and provide SPS training** (Annex 6.6 and Annex 8). The goal was to understand the relevance of SPS systems to biodiversity at the farm and landscape levels.[54] Other studies including a socio-economic survey applied at baseline and endline, and a participant perception survey, yielded key insights into the benefits of SPS, with implications for global efforts to support sustainable transformation of the livestock sector. Finally, the project partners (FEDEGAN, TNC, *Fondo Acción* and CIPAV) jointly produced a comprehensive, high quality final technical report on the project experience (March 2020).

75. **M&E utilization:** The main features of M&E utilization were as follows:

- **M&E data were used extensively to generate accessible knowledge products**. Beneficiaries and extension workers consulted these sources to implement project strategies (TA, PES and other) supporting technology adoption. Distributed widely, these products included an archive of successful experiences in adopting SPS, a video library of 50 testimonials (English sub-titled for accessibility) and illustrated field guides to biodiversity monitoring at the farm and landscape level, covering mammals, birds, and bats commonly found in CR environments. M&E data were the catalyst/evidence for adjustments to project mechanisms and approaches, while the communication strategy ensured wide impact of M&E data on SPS awareness.
- **Data generated by the M&E system were/are being used to inform policy and programming.** Dissemination of early project results strengthened the case for converting land to SPS, which translated into the inclusion of SPS targets in the NDP 2018–23 and the national PES policy and influenced other policies. Tier 3 factor indicators for carbon sequestration attributed to project-promoted land uses: (a) influenced the design of Colombia's NAMA for Sustainable Bovine Livestock;[55] (b) are providing a reference for estimating emission baselines and scenario planning, both nationwide and for specific initiatives, such as the BioCarbon Fund investments in the Orinoquía Region; and (c) will contribute to broader strategic planning in the beef and dairy subsectors.[56]

Justification of Overall Rating of Quality of M&E

76. **Performance of M&E is rated Substantial.** Moderate shortcomings in the design of the M&E system were addressed, and adjustments dictated by evolving contextual factors were identified and implemented. Complementary Bank/partner assessments triangulated the evidence of project results and impacts. Overall, M&E was adequate to assess the achievement of ambitious project objectives (and associated indicators), track/monitor fiduciary compliance, and communicate project results effectively to producers and decision-makers.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

77. Under World Bank environmental screening protocols, the CMSCR Project was classified as Category B and triggered the following safeguards: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Forests (OP/BP 4.36), and Pest Management (OP 4.09).

78. **Environmental safeguards:** Overall environmental safeguards compliance was satisfactory. Consistent with Bank policies, an Environmental Assessment was prepared. Measures taken to mitigate negative environmental effects were mainstreamed throughout the project, strengthened the capacity of partners to implement environmental safeguards, and reinforced local approaches to sustainable natural resource management. Consistent with its objectives, the project generated positive impacts on the protection, maintenance, and restoration of natural habitats, increased landscape connectivity and functionality, and improved the provision of ecosystem services. The project's integrated approach to agricultural extension improved local capacity for soil and water management (erosion control, restoration of degraded land, protection of watersheds, and waste reduction and management) and helped to diversify production systems to protect against losses from climate variability. Biodiversity monitoring systems tailored to each intervention area expanded knowledge of SPS and PES impacts. The project's extension and TA activities built local capacity to follow good pest management practices in cattle ranching; reduced the use of chemical inputs, including pesticides, benefiting human health and the environment; and, reduced production risks.

79. **Social safeguards:** Compliance with social safeguards was satisfactory. Social risks defined at appraisal included limited participation by small-scale producers lacking funds to adopt SPS; farmer participation involving coercion or projects in contested lands; and potential conflicts with municipalities not selected for project interventions. The project presented no social risks associated with: (i) promotion of extensive CR or conflicts with peasants and small-scale producers; or, (ii) indigenous peoples and community lands (project areas did not overlap with indigenous or Afro Colombian territories, and project interventions had no indirect impacts on these groups). No involuntary resettlement, land acquisition, or infrastructure development occurred. Municipalities with low levels of internal displacement were selected to curb risks associated with local participation and land tenure. Prospective beneficiaries had to comply with legal requirements (e.g., access to land). To encourage participation, a communication campaign informed producers about project benefits. Project incentives reduced the constraints on SPS adoption, including financial. SPS adoption increased local incomes and livelihoods by reducing on-farm production costs, and by increasing productivity and the demand for local labor.

80. **Grievance Response Mechanism (GRM):** A GRM was established and accessible to all project beneficiaries and stakeholders. Bank Implementation support missions verified that the GRM was functioning as planned. Beneficiary complaints – associated mostly with delayed payments under PES – were received by FEDEGAN's regional offices (RO), conveyed to its headquarters for review, and then passed to Fondo Acción for resolution. FEDEGAN's ROs verified with beneficiaries whether actions taken were satisfactory and had resolved their complaints.

Fiduciary Aspects

81. **Financial Management (FM):** FM performance was rated as Moderately Satisfactory or Satisfactory throughout the project lifetime, with a final rating of Satisfactory at closing. The GEF funds and DECC/BEIS funds were 100 percent and 99.1 percent disbursed, executed and reported, respectively. The project complied with the Bank's financial covenants. Project interim unaudited financial reports were generally submitted to the Bank on time and deemed acceptable, and the project's FM arrangements related to staffing, accounting, budgeting, funds flow and auditing were adequate. Internal controls and procedures were effectively implemented, and potential fiduciary risk associated with achieving project outcomes was limited. Project funds were transferred to project partners (FEDEGAN, CIPAV and Fondo Acción), as detailed in the subsidiary agreements, with proper justification of expenditures. The audit report covering 2018 was submitted to the Bank on time with unqualified opinions and approved. On June 25th, 2020, the Bank approved an extension for submission of the final audit report from June 30, 2020 to December 31, 2020.

82. **Procurement.** Project procurement performance was rated Moderately Satisfactory throughout. The Bank provided mentoring and training to FEDEGAN and project partners. Procurement was conducted within the Bank's procurement regulations and Bank oversight was continuous and comprehensive. Challenges facing the procurement function were associated primarily with high transaction costs of local procurement, high turnover of qualified procurement staff, and delays in updating procurement plans. The project procurement risk was rated Moderate because most of the procurement had low complexity and low risk.

C. BANK PERFORMANCE

Quality at Entry

83. Quality at entry was sound with moderate shortcomings, and characterized by the following:

- **Effective application of the accumulated experience of the Bank and project partners.** The RSPS pilot project (P072979, 2003–08) demonstrated the positive impacts of SPS on the sustainability and productivity of cattle ranching, influencing the project's design and technical/operational methodology.
- **Close strategic alignment with World Bank and GoC priorities.** The project's strategic relevance for Colombia was clearly articulated, and GEF priorities were well-represented. The technical strategy was forward-looking and well-integrated, reflecting expert inputs, global best practice and defined needs.
- **Well-articulated PDO and design elements, albeit complex, due to untested or innovative nature of several activities.** No ToC was formally presented at project inception, but the results chain was clear from the PAD. The PDO was rational and clearly-stated – albeit complex. The PAD explained how the adoption of SPS was linked to improving the productive, economic, and environmental outcomes of an important sub-sector of the economy, and the investments required to achieve that. Pivotal, planned activities and mechanisms were un-tested at any scale in Colombia, and involved extensive piloting/experimentation, integration, analysis and re-calibration. Certain instruments including credit showed some formulation and/or analytical shortcomings.
- **Poverty, gender and social development aspects were unevenly reflected.** The characteristics of targeted beneficiaries implied an underlying socio-economic development focus, but gender and other vulnerable groups were not initially factored in or measured. The emphasis was on small- and medium-scale producers (defined by land area). Large-scale producers could participate under certain defined circumstances. Gender shortcomings were corrected, and activities focused on youth were included, during implementation (Section III A). The project made commendable contributions to skills development for a set of young professionals who are now well-trained and engaged in various emerging projects/initiatives.
- **Fiduciary provisions and implementation arrangements were sound.** Environmental risks were properly identified, and safeguards applied to minimize adverse consequences. The organizational structure and procurement practices of FEDEGAN were deemed satisfactory for implementation purposes, and financial management processes/arrangements were satisfactory. Institutional roles and responsibilities were clear. Certain reputational risks were successfully mitigated by establishing rigorous selection criteria and screening procedures. Also, FEDEGAN, CIPAV, *Fondo Acción* (FA) and TNC were required to make decisions collectively, avoiding the perception that a single entity dominated project administration.
- **Risk assessment and mitigation measures were adequate, with shortcomings.** As discussed in Section III A, some risks were acknowledged but not adequately analyzed/mitigated and certain assumptions were flawed. These assumptions/risks included: inherent structural barriers to credit access and essential inputs for SPS, and inadequate grasp of the land title status of potential beneficiaries.
- **M&E arrangements were technically sophisticated and comprehensive.** This reflected a strong commitment to ensuring that the emerging evidence and development impacts of an important and innovative operation were measured and disseminated from the beginning (Section IV A).

Quality of Supervision/Implementation Support

84. Strong features of Bank supervision/implementation support performance included the following:

- **Biannual, regularly-scheduled implementation support missions with appropriate mix of specialists**. Missions included livestock, fiduciary, financial management, procurement, agribusiness, rural development, environmental and social specialists, and engaged proactively with the Bank country team. Mission findings were reported comprehensively and candidly.

- **Strong collaborative relationships with project partners and institutions.** All missions included meetings with the four project partners (FEDEGAN, FA, CIPAV and TNC). A Policy Committee comprising representatives of some 20-line institutions, led by MADS and chaired by a vice minister, also met with Bank missions to discuss project progress and advise on the incorporation of GoC priorities into project activities.
- **Decisive, responsive action to address implementation challenges.** The Bank team identified the causes of delays in establishing payment schemes and iSPS and pursued successful corrective measures. The Bank also responded firmly to political intrusions that threatened to paralyze implementation and place the project's technical objectives at the service of a political agenda.
- **Diligent supervision of fiduciary compliance.** The project recorded transactions and corresponding balances as required and on time; prepared and transmitted reliable, timely financial statements; and maintained appropriate audit mechanisms. Procurement was consistently rated Moderately Satisfactory, given the complex procurement processes associated with PES and the ongoing need to improve procurement capacity. Social and environmental safeguards were effectively supervised and reported.
- **Effective administrative and supervisory arrangements to support expanded activities under the AF.** The Bank team ensured that FEDEGAN took the steps warranted to ensure that implementation contracts were modified and extended; the Project Operations Manual was updated; additional financial and technical personnel were hired to implement and supervise project activities; fiduciary agents were hired to manage the PES schemes; FEDEGAN's Internal Control Office was strengthened; and, external auditors made quarterly, on-site verification visits to beneficiaries.
- **Strong focus on development impact,** supporting methodologically sound evaluation and exacting technical studies to ensure optimal learning from a complex, innovative project with a global profile and implications. See Section IV A.

Justification of Overall Rating of Bank Performance

85. **Bank performance is rated Satisfactory.** This rating balances the following: (a) strong Bank commitment to demonstrating the environmental and productive impacts of innovation in the use of Colombian ranchlands, weighed against some analytical and formulation shortcomings which affected early project implementation until decisively resolved/corrected; and (b) diligent, highly effective implementation support which defined and resolved difficult technical, operational, political and administrative challenges to ensure efficacy and efficiency. Flexibility and adaptability - including an AF and several restructurings – along with the strong, collaborative relationship with project partners, enabled an important, innovative project to thrive. Overall, Bank performance was commendable.

D. RISK TO DEVELOPMENT OUTCOME

86. The risk to development outcome post-project is moderated by design and implementation features that suggest strong prospects for sustainability, balanced by some uncertainties:

- **The potential environmental "rebound" effect is expected to be mitigated by stakeholders' greater capacity, skills and awareness, as well as overall GoC commitment to the agenda.** Most beneficiary CRs are likely to continue with SPS ex-post, despite the cessation of project monitoring and TA. Having received support to overcome technical hurdles and pay the upfront costs, they perceive – and analysis shows - that newly-established systems are more profitable and resilient than traditional. Further, producers' newly acquired understanding of climatic risks motivated them to adopt and maintain land-use practices that reduce those risks.

Amid the severe effects of recent El Niño and La Niña weather patterns, producers learned first-hand how to use SPS to reduce climate vulnerability. A 2019 external research project surveyed 90 CRs and 101 extension agents involved in the project.[57] Ranchers were aware of the effects of land degradation and the rising incidence of extreme weather (heatwaves) on the viability of their farms; seemed highly-motivated to change land use to withstand land degradation, climate change, and declining productivity; and, recognized that such changes support the ecosystem services regulating local climate and land restoration.[58] Broader government commitment to climate mitigation/resilience is discussed in Section IIA.

- **The business case for SPS is financially viable at farm level:** As reported in the EFA (see Annex 4), and based on nine representative production archetypes, the CMSCR Project leveraged and created significant economic and environmental value. The project leveraged private capital in the form of investments by CR. It also created economic and environmental value in the form of the incremental revenue obtained by project beneficiaries, the value of carbon captured from 2010–2020, and the value of carbon projected to be captured in the subsequent decade. The estimated MIC indicates that the project leveraged/created US$3.6 for every US$1 provided by funding agencies (GEF, BEIS) and partners. The financial analysis finds that SPS technology has strong potential to reach scale and deepen impact based on market forces. Project investments also yield a sizable positive environmental benefit/impact, contributing/pointing to their longer-term sustainability.
- **Project partners are actively engaged in initiatives to ensure the continuity of the project framework in their own regions and beyond** (see Annex 6.5): (a) **New programs**: Donor-funded SPS investments include a Green Climate Fund project, the *Colombia Sostenible* initiative, and NAMA Facility to operationalize the Bovine NAMA. Project learning is influencing the design and implementation of World Bank grant-funded operations in Colombia, including BioCarbon Fund investments in the Orinoquía Region; GEF investments targeting deforestation in the Andes; and International Finance Corporation (IFC) advisory support in the livestock sector; (b) **Strategic alliances**: Some 30 alliances between project institutions and outside partners are yielding practical results (technical capacity for SPS in Colombia) and strategic results (higher visibility of sustainable land use and SPS in Colombia's rural development agenda); and, (c) **Policy and planning**: Project collaboration with the Government influenced policies such as the Environmental Compensation Law and Payment for Ecosystem Services Law. The Bank and project partners with WRI and CIAT led preparation of the Bovine NAMA. President Duque announced Colombia's intention to continue to support conversion to SPS, and the NDP includes targets for SPS expansion. (d) **Financing:** The project continues to engage with FINAGRO, in the testing and deployment of credit schemes to support productive-conservation objectives in the CR sector.[58]These initiatives reflect project contributions and are critical for the continuation of efforts to scale up sustainable livestock in Colombia.
- **Transforming the livestock sector at the scale needed to generate widespread economic and environmental benefits in Colombia will require a much stronger alignment of public and private support.** The CMSCR Project was a first attempt to implement sustainable CR in different geographic settings across Colombia. It achieved important results, including its proven delivery model, and broadened awareness of the social, economic, and environmental relevance of SPS. However, SPS systems are a significant departure from traditional systems transmitted inter-generationally. Discussion has intensified around the idea that private sector investment alone could drive the expansion of SPS, because the higher productivity of these systems generates higher financial returns. Research on the business case for SPS concluded, however, that sustained public financing and other types of support are likely essential to scale-up SPS, specifically in areas where CR is less profitable but producers are genuinely interested in sustainable approaches.

V. LESSONS AND RECOMMENDATIONS

87. The project's emphasis on innovation and learning to scale up sustainable cattle ranching produced the following important lessons and recommendations relevant to future projects:

- **Expanding SPS adoption in Colombia and beyond depends on convincing producers of the value of SPS investments and helping them overcome the upfront costs.** Producers were convinced to convert a significant portion of their farm-degraded land in targeted project areas to SPS by a delivery model focused on knowledge-sharing to influence behavioral changes, and financial incentives to invest in SPS: upfront support (inputs) to change land use, and ex-post cash payments following conversion. CRs' interest in adopting new/improved technologies hinged on successful demonstrations at sites approximating their own farm conditions. They were also willing to cover higher investment costs if the improved technology produced better results and higher returns. This "package" of support proved effective, but its component parts need to be well-organized and reliably available, and key institutions must be on board.
- **TA and communications should focus on highly motivated CRs and organizations, adopt cluster approaches and operate at landscape scale.** Providing perennial TA to participants can be costly with diminishing returns for the adoption of new practices in some cases. To achieve rapid results and maximize impact, similar projects should prioritize CRs who show high interest in implementing land use changes and SPS – which should include larger farmers - and, phase out support based on analysis of producer progress versus costs. Communications campaigns/selection criteria should be tailored accordingly. Future projects should group CRs by geographic proximity to improve the cost-effectiveness of TA and communications and give higher visibility to aggregate impacts of land-use changes at the landscape level.
- **PES schemes should be kept simple so that farmers understand the potential benefits.** The PES mechanism paid for incremental environmental benefits based on changed land use. This arrangement created the right incentives - payments varied depending on the relative importance of changes - but entailed the project in a major effort to establish a detailed land-use baseline. Further, such projects need flexibility to adjust project rules based on experience, e.g., the PES rules were revised several times to address problems and promote functionality. An entirely new PES modality was developed for iSPS when the initial, credit-based approach proved unworkable. Future projects are advised to explore alternatives for achieving the correct mix of incentives, and to maintain the operational/technical flexibility to adapt PES as needed.
- **Incentives for SPS adoption need to factor in the potential for severe weather events to reduce expected outcomes.** Severe droughts affected planting during project implementation, including the final year. Climate change is likely to make such events more common. This variability is particularly problematic for PES mechanisms where payment is conditioned on outcomes. During CMSCR implementation, drought either delayed planting or caused high seedling losses, reducing outcomes. It is thus advisable to associate "insurance" schemes with any kind of support aligned to expanding SPS systems, particularly iSPS, to protect farmers from potential losses when severe climate events materialize during early SPS establishment.
- **Realistic design and cost-effectiveness are key considerations when designing monitoring systems for land use changes at farm level.** The project tested a set of approaches for monitoring on-farm land use changes, with some demonstrating high cost, design complexity and limited scalability potential, while others proved to be practical while compromising accuracy. Drones and digital technologies offer tremendous opportunities for scalable on-farm monitoring solutions, but there is a greater need for validation and piloting in specific contexts.

- **Support targeting mixed SPS arrangements on-farm (combination of non-/intensive-SPS) is likely to deliver the best productive and conservation benefits and enhance profitability.** While non-intensive SPS such as dispersed trees can deliver important carbon sequestration benefits once established, their impacts on farm productivity are more limited. Intensive SPS, however, tends to deliver higher productivity benefits and contribute to protect dung beetle and bird diversity. Higher environmental and productive benefits – and profitability – can be achieved by planting a combination of SPS (dispersed trees, live fences, and intensive systems) over time, starting with non-intensive, i.e., a sequential transformation. Further, production archetypes also heavily influence the gains possible from SPS adoption. Overall, SPS stave off the unfavorable cash flows of conventional cattle ranching in all production prototypes analyzed. However, in some production models, even positive returns to SPS investments remain below the cost of capital, but despite their limited profitability, the environmental gains from SPS adoption are significant. For those prototypes, monetization of environmental benefits associated with SPS conversion could galvanize adoption/scale-up.
- **Best practice, integrated monitoring of SPS' production and environmental improvements, built confidence in outcomes.** This approach was fundamental for providing sound information to structure a clear business case for CRs and other private and public actors, on the socioeconomic and environmental benefits associated with the different land uses promoted by the project. The project's national visibility was also enhanced. Future such projects will benefit from incorporating integrated monitoring.
- **Communication activities tailored to target audiences are vital for disseminating innovative approaches to sustainable cattle ranching**. The project supported/engaged in multi-stakeholder discussions on sustainable CR, project staff participated in national and international results dissemination events, and information products were featured at national and regional events for CRs and on the project website and social media. The project archive of studies/tools became a resource available to anyone interested in adoption or replication of SPS. Strong engagement with public authorities was a fundamental part of the late-stage communication strategy to support the CR subsector through ongoing programs. Follow-up efforts should continue such activities to influence transformational change in the Colombian CR sector.
- **Catalyzing transformational change in the Colombian livestock sector requires strong joint commitment by the public and private sector, and collective action, i.e., partnerships.** For SPS to become the self-sustaining norm in cattle ranching, private sector investment alone will not be sufficient. Sustained public finance and other support are also required to scale up silvo-pastoral ranching systems, including fostering more effective collective action among CRs to take better advantage of TA and meet the initial costs of establishing SPS.
- **Moreover, transformational change in the Colombian livestock sector calls for interventions at a scale permitting impacts at national level.** This successful pilot impacted about 0.26 percent of the total area of Colombia under CR. Even though – as intended - the project demonstrated what works in different regional contexts, taking these outcomes and knowledge and applying them at scale will require closely coordinated policies, institutional engagement, TA and financing. A strategy for scaling up the impacts of SPS in Colombia will require further institutionalization of SPS innovations, anchored in stronger public-private partnerships, and in a clear policy supportive framework. Recent policy developments in this field, along with government and donor commitments, and increased private sector awareness, offer a promising ground for scaling up SPS approaches to achieve large scale transformational impact.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: Promote the adoption of environment-friendly Silvopastoral Production Systems for cattle ranching

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
All Indicators of PDO are reported as Global Environmental Objectives (see respective section)	Text	NA 01-Dec-2014	-- 06-Apr-2010	--	NA 31-Jan-2020
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area under environment-friendly cattle ranching production systems	Hectare(Ha)	0.00 06-Apr-2010	50500.00 06-Apr-2010	84000.00 08-Mar-2017	100522.00 31-Jan-2020

implemented in Project areas					

Comments (achievements against targets):
Target exceeded: 120 percent. This indicator measures the total land area with changes promoted by the project (basically SPS and iSPS), including areas where existing forest/vegetation was conserved/not cut. The target value subsequently increased due to the increased number of beneficiaries under the AF. The target value resulted from adding area under environmentally-friendly CR production systems at baseline, and the land conversion changes expected due to the project. The project designed a land-use monitoring system which helped evaluate land use at the farm level attributable to project interventions, and which was also a tool to calculate payments to farmers based on the number of points assigned to each land use type. A manual included the 9 land use types and 21 sub-types defined by the project, as well as points assigned to each of them. To monitor land use, the project implemented two methodologies: (a) full geo-referencing (FULL) and a self-reporting methodology (AUTO). FULL consisted of geo-referencing properties and land uses capturing the information directly in the field from spatial analysis elements such as polygons and polylines; (b) the AUTO was based on a survey conducted by Fedegan extension agents, who together with the ranchers prepared an illustration (sketch) of the land uses found, indicating the area (hectares) and lengths (meters) of the production arrangements. See Annex 6.3.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Land area where sustainable land mgt. practices were adopted as a result of proj	Hectare(Ha)	190.00 30-Jun-2014	48000.00 05-Sep-2014	35000.00 08-Mar-2017	38390.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 108 percent. This indicator measures the total incremental area converted to sustainable land use (SPS and iSPS) as a direct result of the Project.

Objective/Outcome: Improve natural resource management, enhance the provision of environmental services

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improve presence of globally important biodiversity in Project areas measured by an increase in the ESI resulting from the adoption of environment-friendly SPS in participating farms, over baseline	Number	0.00 30-Jun-2014	750000.00 06-Apr-2010	1522000.00 19-Jan-2018	1410875.00 31-Jan-2020

Comments (achievements against targets):

Substantial achievement: 93 percent. The value for this indicator corresponds to the monitoring of the farms of the I and II calls (five moments: baseline and 4 verification), the III call (four moments: baseline and 3 verification) and the IV call (baseline and verification) for a total of 3,383 farms monitored during the life of the project. The Environmental Services Index (ESI) monitored the transformation of land, taking into consideration a list of elements (with a point system) to determine the valuation in change of land use and calculate the payment to participants. The elements considered were: mature forests and private wetlands; secondary forests; pastures with high tree density and managed ecological succession; agroforestry crops; live fences and wind barriers; agricultural and livestock lands with over 80% vegetative cover; iSPS including MFB with or without woody species; other agricultural and livestock practices (temporary crops, forest plantations); and, degraded soils and degraded pastures (See Annex 6 – Table B6.2.1 for details). Farmers received payments based on the difference ESI points between the initial land use and the silvopastoral use they adopted, thus payments were proportional to the expected increase in environmental services. Land use changes in priority connectivity corridors and/or that used native species received bonuses. Payments were made after verification in the field that farmers had effectively adopted the proposed land uses. Farmers also received an initial payment based on their baseline ESI points. (See Annex 6B for details). An increase in the ESI points is directly translated as an improvement of the presence of globally important biodiversity in Colombia, as it is one of the world's megadiverse country, hosting close to 10% of the planet's biodiversity and worldwide

ranks first in bird diversity, concentrating 1,889 bird species from which 66 are endemic. Within the adoption of environment-friendly SPS in participating farms, 50 plant strategic species and bird species (including migrating bird species of global biodiversity importance) were conserved in project areas.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Reduction in GHG emissions from avoided deforestation and forest degradation and increase in carbon sequestration at the farm-level through adoption of environment-friendly SPS in participating farms	Number	0.00 30-Jun-2014	2000000.00 05-Sep-2014	1600000.00 08-Mar-2017	1565026.00 31-Jan-2020

Comments (achievements against targets):

Substantial achievement: 98 percent. End target value was recalculated to 1.6 M t CO2eq based on continued evidence of beneficiaries' small-scale farm size and thus inability to convert enough land to achieve the 2.0M original target. The net accumulated CO2 removals resulting from the conversion of pastures to non-intensive SPS (dispersed trees, live fences) and intensive SPS, in the five regions of the project are estimated at 1,131,056 t CO2 equivalent, with an additional removals of 433,970 t CO2 equivalent resulting from avoided deforestation. The CO2 removals by SPS systems are estimated based on Tier3 carbon removal factors established by the project during implementation (based on research work). When the indicator is estimated based on the assumptions made at the time of the AF, the estimated value of carbon removals due to conversion to SPS reaches 1.8 million t CO2, well above the revised end-target.

Objective/Outcome: Raise the productivity in participating farms

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in the production of milk per intervened hectare in participating farms	Percentage	0.00 30-Jun-2014	5.00 06-Apr-2010	10.00 05-Sep-2014	17.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded:170 percent. The indicator has been determined based on the estimations at baseline and data points collected for 1,532 farms applying the participatory planning tool (PPP, in Spanish). Systematic analysis of the data taken during five moments carried out at project closing showed higher figures that the ones reported in the final ISR, with average increase on milk productivity of 29%. Additional observations were carried out in a probabilistic sample of 101 farms, where the variations in milk production associated with the SPS arrangements versus control lots were estimated at 24.4%.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of cattle ranching farms benefitting from Project instruments (technical assistance, PES, or support for establishment of on-farm nurseries)	Number	0.00 30-Jun-2014	2000.00 06-Apr-2010	4000.00 19-Jan-2018	4100.00 31-Jan-2020
Out of which percentage of	Number	0.00	17.27		17.27

female			30-Apr-2018		

Comments (achievements against targets):
Target exceeded: 103 percent. The target value was increased twice (AF and 2018 Restructuring), reflecting expansion of the project under the AF, its expanded outreach efforts, and strengthened emphasis on awareness-building, training and capacity-building activities. During the life of the project, 4,100 farms benefited from project strategies, of which 17 percent were female owned and/or managed.

A.2 Intermediate Results Indicators

Component: Improving productivity in participating cattle ranching farms in Project areas, through SPS

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area converted to intensive SPS in participating farms	Hectare(Ha)	190.00 30-Jun-2014	12000.00 06-Apr-2010	4500.00 08-Mar-2018	4640.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 103 percent. This indicator reported only on iSPS. The target value was reduced because: project TA and PES1 instruments did not result in conversion at the scale expected; associated costs of establishing iSPS were high; credit access for many participating farmers was difficult; farm size was generally smaller than expected at appraisal and thus conversion capacity was limited; and, adverse climatic events affected tree plantation. A total of 4,640 hectares in iSPS were planted through the different project strategies (TA, PESs and demonstration farms).

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in stocking rate (LU/ha) in intervened areas in participating farms	Percentage	0.00 30-Jun-2014	10.00 06-Apr-2010		15.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 150 percent. The indicator has been determined based in the estimations at baseline and data points collected for 1,532 farms applying the participatory planning tool (PPP, in Spanish). Systematic analysis of the data taken during five moments carried out at project closing showed higher figures that the ones reported in the final ISR, with average increase in stocking rates of 21.9%. Additional observations were carried out in a probabilistic sample of 101 farms, where the variations in stocking rates associated with the SPS arrangements versus control lots were estimated at 32.6%.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of cattle ranching farmers sensitized and trained on SPS and sustainable cattle ranching production systems	Number	0.00 06-Apr-2010	2000.00 06-Apr-2010	18500.00 19-Jan-2018	24416.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded:132 percent. Target was progressively increased from 2,000 at appraisal to final value of 18,500 farmers (2018 restructuring), based on expanded project outreach and strengthened focus on training, awareness- and capacity-building. 4,100 selected cattle ranchers were trained by the project during the 4 calls, 10,326 more through demonstration farms and 9,990 were reached through presentations, promotional events, workshops, fora, congresses and technological brigades.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of professionals and technicians trained on SPS establishment and management	Number	0.00 06-Apr-2010	100.00 06-Apr-2010	550.00 19-Jan-2018	691.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 126 percent. A total of 377 trained professionals were direct project staff, and 314 (45 percent) external to the project. Training programs included the design and establishment of sustainable production systems and SPS arrangements as well as the implementation of techniques and methods to support farmers to implement ecological restoration approaches, tree selection for CR production, land-use reporting and geo-referencing tools, among other aspects related to the implementation of good practices to reduce GHG emissions, improve productivity and reduce animal health risks.

Component: Increasing connectivity and reducing land degradation in participating cattle ranching farms, through differentiated PES schemes

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area under PES-1 (biodiversity) scheme in Project areas	Hectare(Ha)	5250.00 30-Jun-2014	33280.00 05-Sep-2014	49000.00 08-Mar-2017	60158.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 123 percent. The baseline reported here (5,250 ha) corresponds to the farm area benefiting from the project's PES1 scheme at the time of the AF. As the baseline was defined for each participating farm at the time they entered the project, the total area under PES1 corresponds to the sum of the total area verified at baseline for each beneficiary farm (1778 farms/39,223 ha) PLUS area planted in SPS by the project on those farms (20,935 ha).

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area under PES-2 (carbon) scheme in Project areas	Hectare(Ha)	0.00 30-Jun-2014	4000.00 05-Sep-2014	4500.00 19-Jan-2018	4240.00 31-Jan-2020

Comments (achievements against targets):

Substantial achievement: 94 percent. Corresponds to the iSPS area under the PES2 scheme.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of cattle ranching farms benefitting from a PES-1 (Biodiversity) scheme	Number	292.00 30-Jun-2014	1700.00 05-Sep-2014		1866.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 110 percent. During the life of the project, 1,866 cattle ranching farms benefited from PES1 (Biodiversity) scheme.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of cattle ranching farms benefitting from PES-2 (carbon) scheme	Number	0.00 30-Jun-2014	1255.00 05-Sep-2014		1341.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 107 percent. A total of 1,341 farms benefited from the PES2 scheme.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of market-based / consumer initiatives designed, (including large-scale PES mechanism), that could support the broader adoption of SPS by the end of the project	Number	0.00 05-Sep-2014	2.00 05-Sep-2014		2.00 31-Jan-2020

Comments (achievements against targets):
Achieved: 100 percent. The achievements include the design and piloting the implementation of the long-term PES scheme in Caldas Department Agua Vivo Cuenca water fund (see Annex 6 – Box B.6.2.1 for details), to generate private sector incentives (energy company) for SPS conversion on watershed areas; and the design of a checklist to verify compliance with sustainable cattle ranching practices, as part of the green market dialogue led by the project via TNC. The check list was piloted through an agreement with ASOBRANGUS.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of focal plant species used/conserved in cattle ranching farms (25 of which are globally important	Number	0.00 06-Apr-2010	50.00 06-Apr-2010		50.00 31-Jan-2020

species)					

Comments (achievements against targets):
Achieved:100 percent. The project promoted the production and planting of 50 focal species with high productive and biological/conservation value. At closing, 1,269 focal plants species were identified and monitored in project areas.

Component: Strengthening subsector institutions and M&E efforts contributing to the broader adoption of environment-friendly SPS in Colombian c

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of strategic alliances established with key public and private, national and regional entities for the promotion of SPS in Colombia	Number	1.00 30-Jun-2014	3.00 06-Apr-2010	10.00 08-Mar-2018	11.00 31-Jan-2020

Comments (achievements against targets):
Target exceeded: 110 percent. This covers 11 agreements established with CORTOLIMA, Asocolflores, the Universidad of Talca (Chile), Instituto Humbolt, CIAT, PNUD, PNUMA, CONABIO Mexico, The Intersectoral Pact on legal wood and FUNTEC, SENA, Asoangus, Agribenchmark, IDEAM, WRI, etc. Through this alliance, the project participated in the National Round Table of Agri-environmental Financial Mechanisms led by FINAGRO together with the Global Green Growth Institute and the Earth Innovation Institute, supporting Vision Amazonia project, through this alliance the project supported the development of the financial mechanism being piloted by Banagrario in Caqueta.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
M&E system established and providing timely and relevant information on Project s direct and indirect impacts in aid of decision-making processes	Yes/No	N 06-Apr-2010	Y 06-Apr-2010		Y 31-Jan-2020

Comments (achievements against targets):
Achieved: 100 percent. The M&E system was established in Year 1 of implementation. From year 2 to closing the M&E system was effectively operating and was subject to continuous improvements. Several of the elements of the M&E system have been institutionalized. For example, the carbon sequestration factors to estimate carbon capture by SPS systems are applied in the context of national strategies such as the NAMA and on the estimation of the contributions of the Cattle Ranching sector to National Determine Contributions. The Carbon Calculator and the Participatory Planning Farm tools, developed by the project to monitor carbon and progress on a set of sustainability criteria, are also being adopted by project partners across initiatives supporting SPS-based transformations.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Communications strategy implemented for different target audiences (policy-	Yes/No	N 06-Apr-2010	Y 06-Apr-2010		Y 31-Jan-2020

makers and farmers)					

Comments (achievements against targets):
Achieved: 100 percent. Activities to disseminate, strengthen and position sustainable cattle ranching were successfully developed and performed during the life of the project. A Communications Committee (formed by the communication teams or press from TNC, Fondo Accion, UK Embassy, the World Bank and CIPAV) was created and worked to highlight the achievements of the project. A website was created: *http://ganaderiacolombianasostenible.co* A logo was also created, were all partners of CR were united under one same goal. The communication strategy also included the use of the twitter platform to disseminate information regarding sustainable cattle ranching in Colombia: @ganaderiasostenible and the hashtag #GanaderiaSostenible. In addition, other channels and social networks were also used, mainly Youtube and Facebook, to approach students, producers, institutions and other actors inside and outside Colombia to show the way to perform sustainable cattle ranching and provide training in areas that were not part of the project.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Information system in place for reporting farms adopting SPS, including those not directly participating in the Project	Yes/No	N 30-Jun-2014	Y 05-Sep-2014		Y 31-Jan-2020

Comments (achievements against targets):
Achieved: 100 percent. The project developed an Web App to allow the registration of farms with SPS in the country, beyond those benefiting from the project.

B. KEY OUTPUTS BY COMPONENT

Table A1.B.1: Key outputs by component, CMSCR Project[2]

Objective/Outcome (PDO) Objective/Outcome 1: Promote the adoption of environment-friendly Silvopastoral Production Systems for cattle ranching	
Outcome Indicators	1. Area under environment-friendly cattle ranching production systems implemented in project areas. **Target: 84,000 /Result: 100,522 (120%).** 2. Land area where sustainable land management practices have been adopted as a result of the project. **Target: 35,000 / Result: 38,390 (108%).**
Intermediate Results Indicators	**Component 1: Improving productivity in participating cattle ranching farms in project areas through SPS** 1. Area converted to intensive SPS in participating farms. **Target: 4,500 / Result: 4,640 (103%)** 2. Number of cattle ranching farmers sensitized and trained in SPS and sustainable cattle ranching production systems. **Target: 18,500 / Result: 24,416 (132%)** 3. Number of professionals and technicians trained in SPS establishment and management. **Target: 550 / Result: 691 (126%)** **Component 2: Increasing connectivity between eco-systems and reducing land degradation in participating cattle ranching farms, through differentiated PES schemes.** 4. Number of focal plant species used/conserved in cattle ranching farms. **Target 50 / Result: 50 (100%)**

[2] Indicators listed are the final versions reflecting all changes effected by the Additional Financing (2014) and subsequent restructurings in 2017 and 2018.

	Component 3: Strengthening subsector institutions and dissemination and M&E efforts contributing to the broad adoption of environment-friendly SPS in Colombian cattle ranching 5. Number of strategic alliances established with key public and private, national and regional entities for the promotion of SPS in Colombia. **Target: 10 / Result: 11 (110%)** 6. M&E system established and providing timely and relevant information on project's direct and indirect impacts in aid of decision-making processes. **Target: Yes / Result: Yes (100%)** 7. Communication strategy implemented for different target audiences (policymakers and farmers). **Target: Yes / Result: Yes (100%)** 8. Information system in place for reporting farms adopting SPS, including those not directly participating in the project. **Target: Yes / Result: Yes (100%).**
Key outputs by Component (linked to the achievement of the Objective/Outcome 1)	**Component 1: Improving productivity in participating cattle ranching farms in project areas through SPS** 1. Number of municipalities were CR beneficiaries are located. **No target / Result: 87** 2. Number of project professionals and technicians trained in SPS establishment and management. **No target / Result: 377** 3. Number of external professionals and technicians trained in SPS establishment and management. **No target / Result: 314** 4. Number of beneficiaries from the training and dissemination plan. **No target / Result: 12,204** 5. Number of training and dissemination events. **No target / Result: 457 events** 6. Number of participants in events. **No target / Result: 12,204** 7. Number of small cattle ranchers not part of the project sensitized through "technology brigades" (*brigadas tecnológicas*) for the use of sustainable cattle ranching technologies and tools. **Target: 3000 / Result: 2,807** 8. Number of trainings in access to credit for professionals of FINAGRO, *Banco Agrario* and other actors. **No target / Result: 6**

	9. Number of events on access to credit for cattle rancher beneficiaries of the project. **No target / Result: 38** 10. Number of cattle ranchers participating in events related to access to credit. **No target / Result: 588.** 11. Number of beneficiaries sensitized on land use. **No target / Result: 408** **Component 2: Increasing connectivity and reducing land degradation in participating cattle ranching farms through differentiated PES schemes** 12. Number of demonstration farms installed and strengthened (active until project closing). **No target / Result: 43** 13. Number of focal plants species identified and monitored in project areas. **No target / Results: 1,269** 14. Number of focal plants species produced and delivered (Mimosa tranae; Albizia saman; Erythrina spp; Escallonia paniculate; Crescentia cujete). **No target / Results: 3,100,713** 15. Number of hectares of natural forest enriched. **No target / Results: 3,466** **Component 3: Strengthening subsector institutions and dissemination and M&E efforts contributing to the broad adoption of environment-friendly SPS in Colombian cattle ranching** 16. Number of courses for technicians through the National Services for Learning – SENA. **No target / Result: 3** 14. Number of knowledge transfer events with SENA to strengthen capabilities in cattle ranching. **No target / Result: 3** 17. Number of knowledge transfer events with SENA to strengthen capabilities in cattle ranching. **No target / Results: 3.** 18. Number of instructors that participated in knowledge transfer events with SENA to strengthen capabilities in cattle ranching. **No target / Result: 100** 19. Development of a project website **100%**

	20. Number of testimonials of the project collected for the audiovisual library (images and videos). **No target / Result: 50**. 21. Number of publications. **No target / Result: 30**
Objective/Outcome 2: Improve natural resource management, and enhance the provision of environmental services	
Outcome Indicators	1. Improved presence of globally important biodiversity in project areas, measured by an increase in the ESI resulting from the adoption of environment-friendly SPS in participating farms, over baseline. **Target: 1,522,000 / Result: 1,410,875 (93%).** 2. Reduction of GHG emissions from avoided deforestation and forest degradation and increase in carbon sequestration at the farm level through the adoption of environment-friendly SPS in participating farms. **Target: 1,600,000 / Result: 1,565,026 (98%).**
Intermediate Results Indicators	**Component 2: Increasing connectivity and reducing land degradation in participating cattle ranching farms through differentiated PES schemes** 1. Area under PES1 (biodiversity) scheme in project areas. **Target 49,000 / Result: 60,158 (123%)** 2. Area under PES2 (carbon) scheme in project areas. **Target 4,000 / Result: 4,240 (94%)** 3. Number of cattle ranching farms benefitting from a PES1 (biodiversity) scheme. **Target: 1,700 / Result: 1,866 (110%)** 4. Number of cattle ranching farms benefitting from a PES2 (carbon) scheme in project areas. **Target: 1,255 / Result: 1,341 (107%)**. 5. Number of market-based / consumer initiatives designed (including large-scale PES mechanism) that could support the broader adoption of SPS by end of the project. **Target: 2 / Result: 2 (100%)** 6. Number of focal plant species used/conserved in cattle ranching farms (25 of which are globally important species). **Target: 50 / Result: 50 (100%)**

Key Outputs by Component (linked to the achievement of the objective/outcome 2)	**Component 2 Increasing connectivity and reducing land degradation in participating cattle ranching farms through differentiated PES schemes** 1. Number of contracts signed under PES1 scheme. **No target / Result: 1,595** 2. Design of local PES mechanisms financed by users with long-term payment. **No target / Result: Yes** 3. Number of contracts signed for exp-post payment under PES2 scheme. **No target / Result: 274** 4. Number of trees and forage produced and delivered to cattle ranchers. **No target / Result: 3,100,713** 5. Number of hectares under SPS using plant material. **No target / Result: 33,750** 6. Number of trees planted using light machinery. **No target / Result: 408,000** 7. Areas with implemented strategies of natural regeneration. **No target / Result: 18,603** 8. Land use M&E. **No target / Result: 127,307.97 hectares** 9. Socio-economic **M&E. No target / Result Yes** 10. M&E of Biodiversity in farms. **No target / Result: Yes** 11. Number of bird species identified and monitored. **No target / Result: 522** 12. Number of beetle species identified and monitored. **No target / Result: 230** 13. Increase of natural variety of species identified by monitoring. **No target / Result: 30%** 14. Design and development of a web application for biodiversity and carbon. **No target / Result: Yes** 15. Design and development of a web platform for modeling, and publication of geographic services INFOTNC. **No target / Result: Yes** 16. Design and implementation of a long-term PES scheme pilot (the Agua Vivo Cuenca Water Fund). **No target / Result: Yes** 17. Creation of a green market dialogue. **No target / Result: Yes** 18. Design of 12 criteria for sustainable cattle ranching. **No target / Result: Yes** 19. Number of participating farms where an analysis/evaluation of the sustainable cattle ranching criteria was performed. **No target / Result: 10**

	20. MoU with ASOBRANGUS to elaborate a business case for the implementation of good practices on sustainable cattle ranching.[3] **No target / Result: 1**
Objective/Outcome 3: Raise the productivity in participating farms	
Outcome Indicators	1. Increase in the production of milk per intervened hectare in participating farms. **Target: 10% / Result: 17% (170%).** 2. Number of cattle ranching farms benefitting from project instruments (technical assistance, PES or support for the establishment of on-farm nurseries). **Target: 4,000 / Result: 4,100 (103%).**
Intermediate Results Indicators	**Component 1: Improving productivity in participating cattle ranching farms in project areas through SPS** 1. Increase in stocking rate (LU/ha) in intervened areas in participating farms. **Target: 10 / Result: 15 (150%)**
Key Outputs by Component (linked to the achievement of the Objective/Outcome 3)	**Component 1: Improving productivity in participating cattle ranching farms in project areas through SPS** 1. Number of producers trained in sustainable management of their cattle ranching companies in production of milk and/or beef, including registry management. **No target / Result: 4,100** 2. Percentage increase in milk production in SPS farms. **Target 10% per hectare/ Result: 32.6%** 3. Percentage increase of animal load production in SPS farms. **Target 10% per hectare / Result 24.4%** 4. Increase of milk productivity in liters. **No target / Result: 1,708.5 per hectare**

[3] The MoU sought to generate value within the value chain, differentiating beef products with a green seal permitting their distribution with a higher value, achieving economic benefits for the actors in the chain.

	5. Percentage increase in milk quality. **No target / Result: 3%** 6. Percentage increase in forage supply. **No target / Result 24.8%**

C. CHANGES TO THE PROJECT OVER TIME, INCLUDING RESULTS FRAMEWORK

Table A1.C.1. Project Stages by Timeline with Descriptions

Theme	Project Stage
Revised PDOs and Outcome Targets	• **AF (December 2014):** The AF defined six PDO Outcome Indicators and all show an increase in their end-target values (and defined end-targets for new indicators) to reflect an increase in the number of project beneficiaries due to the AF[4]. End-targets also were calibrated according to the lessons learned from project implementation up to that date. • **First Restructuring (March 2017):** The end-target value was increased for the following PDO Indicator: "*Area under environment-friendly CR production systems implemented in project areas*"; and reduced for three others: "*Land area where sustainable land management practices were adopted as a result of project*"; and, the indicators related to biodiversity and carbon emissions: "*Improved presence of globally important biodiversity in project areas, as measured by an increase in the Environmental Services Index (ESI) resulting from the adoption of environment-friendly SPS implemented in participating farms in project areas, over baseline*"[5], and "*Reduction in greenhouse (GHG) emissions from avoided deforestation and forest degradation and increase in carbon sequestration at the farm-level through adoption of environment-friendly SPS in participating farms*".[6] • **Second Restructuring (January 2018)**: Target values were scaled up for the following: "*Land area where sustainable land management practices have been adopted as a result of the project*" (i.e., increase in the hectares converted under iSPS); and another increase in the end-target value

[4] For example, increasing the number of farms benefiting from project instruments (TA, PES, or support for credit access) from 2,000 to 2,700.
[5] The reduced target for the ESI in 2017 was a calculation error. There was no contextual reason to reduce the target value and the Restructuring of 2018 corrected the error, increasing the target value over two-fold to 1,522,000 points.
[6] Reductions are due to some of the basic assumptions supporting the original targets set by the AF not materializing. These assumptions include: (a) much lower land conversion potential of beneficiary farms than originally estimated resulting from smaller farm size in practice; and (b) the limited adoption of SPS by beneficiaries of TA, due to financial constraints to undertake the required up-front investment as well as limitations accessing credit (the assumption that conversion to SPS would be financed via FINAGRO resources delivered as credit to beneficiaries by regional first-tier banks, did not materialize).

	for "*Improved presence of globally important biodiversity in project areas, as measured by an increase in the Environmental Services Index (ESI) resulting from the adoption of environment-friendly SPS*". • **Third project restructuring (May 2019):** The PDO Indicator end targets were not revised.
Revised PDO Indicators	• **AF (December 2014): (a)** two new indicators were added to measure directly the area where land use was converted to a SPS "*Land area where sustainable land management practices have been adopted as a result of the project*"; and to capture a specific focus on climate change mitigation "*Reduction in GHG emissions from avoided deforestation and forest degradation, and increase in carbon sequestration at the farm-level through adoption of environment-friendly SPS in participating farms*"; **(b)** a sub-indicator was added denoting gender in the indicator "*Number of cattle ranching farms benefitting from project instruments (technical assistance, PES, or support for establishment of on-farm nurseries)*"; **(c)** two PDO Indicators were demoted to the Intermediate level and also reworded to "*Number of market-based / consumer initiatives designed, (including large-scale PES mechanism) that could support the broader adoption of SPS by the end of the project*" and "*Number of farms not directly participating in project adopting SPS*" (transferred to components 2 and 3, respectively); and, **(d)** a wording change eliminating the specific target value included in the text of three PDO indicators also occurred, one to account for the number of farmers who benefited from the project instruments (including technical assistance and PSAs); the increase in the production of beef and/or milk per intervened hectare in participating farms; and, another related to the land area with sustainable land management as a result of the project intervention[7]. • **First Restructuring (March 2017):** re-wording of the productivity indicator (which included "beef" production) to focus measurement only on milk productivity: "*Increase in the production of milk per intervened hectare in participating farms*"; and the PDO indicator "*Reduced soil erosion (tons/ha) induced by the adoption of SPS and measured in at least 2 pilot areas, over baseline*" was dropped[8]. • **Second Restructuring (January 2018)**: No changes were made to the PDO Indicators per se. • **Third Restructuring (May 2019):** No changes were made to the PDO Indicators per se.
Revised Components	• **AF (December 2014).** The changes by components were:

[7] "*50,500 ha of environment-friendly cattle ranching production systems implemented in 5 Project areas*" was reworded to "*Area under environment-friendly cattle ranching production systems implemented in Project areas*"; "*5 percent increase in the production of beef and/or milk per intervened hectare in participating farms, with a reduction of outside inputs*" was reworded to "*Increase in the production of beef and/or milk per intervened hectare in participating farms*"; and "*2,000 cattle ranching farms benefiting from Project instruments (TA, PES, or support for credit access)*" was reworded to "*Number of cattle ranching farms benefitting from Project instruments (TA, PES [1 or 2])*". The end target values of these indicators also increased during the AF, as mentioned in the previous section.

[8] The Bank and Client teams agreed that it was a higher-level impact indicator, not an outcome indicator.

	(a) **Component 1**: (i) To respond efficiently to farmers' needs for technical guidance, a pool of 100 expert professionals trained in SPS establishment and management was consolidated under the AF. Further, TA agents received training to support farmers' efforts to access credit, and "financial brigades" were deployed, charged with providing small and medium-scale landholders with personalized support; (ii) The AF expanded project activities into two additional geographical areas– La Guajira and El Meta—both of which were identified as national deforestation hotspots; and, (iii) The AF supported the development of market-based initiatives to promote broader adoption of SPS, e.g., emerging certification schemes[9]. (b) **Component 2**: (i) While the project's PES scheme was primarily focused on biodiversity conservation (hereafter PES1), the AF introduced a new PES scheme focused on carbon sequestration (hereafter PES2) to support adoption of the intensive SPS (iSPS). Both schemes would support PES (under both PES1 and PES2) based on land-use changes; (ii) The design and implementation of a local, long-term PES scheme in two river basins was down-scaled to include only their design during the project life cycle; (iii) New support was introduced for the production of plant material (high-quality seeds and seedlings) to participating farmers to facilitate their adoption of SPS; iv) Pilot "demonstration farms" would be set up in the different sub-regions covered by the project to promote on-site visits with beneficiaries to foster "peer-to -peer" land-use exchanges (c) **Component 3**: (i) The M&E tools established to monitor and measure environmental services (tree cover, soil and biodiversity), the contribution of SPS to climate mitigation (emissions of GHG at the farm-level, including its impact on deforestation trends), and the effects of the SPS on livestock productivity and poverty reduction (through socio-economic surveys) were strengthened; and, (ii) Project results dissemination to key stakeholders was strengthened. • **First Restructuring (March 2017).** The changes by components were: (a) **Component 1:** Piloting a complementary scheme to support producers benefiting from TA only. The complementary scheme combined TA with in-kind support. Such in-kind support would be provided in the form of electric fencing (and associated operating inputs) to a selected number of small- and medium-scale farmers. (b) **Component 2:** Established the necessary mechanisms to allow the project to overcome delays and accelerate implementation. The project's land conversion incentive framework was improved as follows: (i) an early assumption was that ex-post PES2 payment would be the main force driving land conversion towards iSPS. This wasn't the case in the field, leading to an increase in the proportion of ex-ante support offered while reducing the support provided through ex-post payments; (including providing the up-front in-kind support per converted area rather than per participant); (ii) some positive adjustments to the scoring of payments for different land conversion uses, e.g., the PES1 Biodiversity Scheme, were introduced; and, (iii) a new scheme was released combining TA with up-front, in-kind support to facilitate pasture management, as a first step in the conversion.

[9] One example is the "Global Roundtable on Sustainable Beef".

	(c) **Component 3:** Project support to the development of the livestock Nationally Appropriate Mitigation Action (NAMA) initiative and other government-related initiatives, particularly around capacity building on SPS. • **Second Restructuring (January 2018**): Activities supporting the achievement of the project's stated goals and objectives were strengthened. See "Other Changes" below. • **Third Restructuring (May 2019):** The UK/BEIS grant was reallocated among budget categories to support expenditures for payments to cattle ranchers for land-use changes towards sustainable cattle ranching practices under the PES1-Biodiversity Scheme. The reallocation also covered consultant services and operational expenses resulting from additional support to farmers during the project's extension phase.[10] The funds will be reallocated from deductions in the Categories: 1b Contract Payments for Carbon Sequestration PES (so called PES2- Carbon Scheme); Goods; and Non-consulting services & Training.
Other Changes	• **AF (December 2014).** Since the project was expected to reach a larger number of beneficiaries the project closing date was extended from September 23, 2015 to January 31, 2018. • **First Restructuring (March 2017):** Two existing/participating project areas were added as selected deforestation hotspots (lower Magdalena and the Andean region) to enhance the impacts of the project on forest conservation at the landscape level. • **Second Restructuring (January 2018):** A two-year extension was approved moving the closing date to January 31st, 2020, and minor changes were made to some Intermediate Indicators themselves and end-targets values (See Table 3. of Annex 1.C. for details). Extension of the closing date to January 31, 2020 was designed to: (i) achieve EOP targets by adding 1,000 new beneficiary CRs of long-term TA and PES; (ii) apply the newly-established capacity to demonstration farms, a network of commercial nurseries, and skilled TA services providers to increase project outreach by training a larger number of CRs (from 5,500 t0 18,500) and link this training with ongoing livestock-related projects and initiatives; (iii) contribute to sector policy-making by supporting MADS and MADR to design the NAMA (Livestock Nationally Appropriate Mitigation Action), consolidation of the emerging Roundtable for Sustainable Livestock and the development of strategic policy guidelines for the sector; (iv) adequately consolidate, systematize and disseminate knowledge and emerging lessons; and, (v) properly evaluate project results and impacts in terms of biodiversity conservation and carbon emission reduction. Grant proceeds were also reallocated from both TF096465 (GEF) and TF017041 (UK-BEIS) to cover the administrative costs during the extension and to finance training, capacity-building and dissemination events. • **Third Restructuring (May 2019):** All changes made by the restructuring are summarized under earlier sub-headings.

[10] In total, US$276,808 to Category 1a (Contract Payments for Natural Resources PES); US$ 461,334 to Category 3 Consultants' Services; and US$59,146 to Category Operating Costs.

Table A1.C.2: Original and Final PDO indicators

Theme	PDO Indicators as stated in the PAD	PDO Indicators at CMSCR Project Closing
1. Promote the adoption of environment-friendly SPS for CR	• 50,500 ha of environment-friendly CR production systems implemented in 5 project areas • Strategy for the broader adoption of SPS in Colombia validated and adjusted during project implementation, ready for adoption by FEDEGAN and other strategic allies' (e.g. National Planning Department (DNP), the Ministry of Agriculture and Rural Development (MADR) and the Ministry of Environment, Housing and Territorial Development Environment-MAVDT, etc.)	• Area under environment-friendly cattle ranching production systems implemented in project areas • Land area where sustainable land management practices have been adopted as a result of the project (**Bank Core Sector Indicator**).
2. Improve natural resource management	• Reduced soil erosion (tons/ha) induced by the adoption of SPS and measured in at least 2 pilot areas. (**)	(Indicator Dropped – see below)
3. Enhance the provision of environmental services	• At least two PES mechanisms financed by local users of environmental services, implemented by project • Improved presence of globally important biodiversity in project areas, as measured by an increase in the Environmental Services Index (ESI) resulting from the adoption of environment-friendly SPS implemented in participating farms in project areas. (*)	• Reduction in greenhouse (GHG) emissions from avoided deforestation and forest degradation and increase in carbon sequestration at the farm-level through adoption of environment-friendly SPS in participating farms • Improved presence of globally important biodiversity in project areas, as measured by an increase in the Environmental Services Index (ESI) resulting from the adoption of environment-friendly SPS implemented in participating farms in project areas, over baseline
4. Raise the productivity in participating farms	• 5 % increase in the production of beef and/or milk per intervened hectare in participating farms, with a reduction of outside inputs.	• Increase in the production of milk per intervened hectare in participating farms • Number of cattle ranching farms benefitting from project instruments (technical assistance, PES or support for establishment of on-farm nurseries)

Table A1.C.3: PDO Indicators, Timeline Extended with Explanation of Changes

Timeline	2010	2014	2017	2018
PDO Indicator	**50,500 ha of environment-friendly cattle ranching production systems implemented in 5 project areas.**	**Area under environment-friendly cattle ranching production systems implemented in project areas** Specific value was eliminated, and end target value adjusted to 63,000, reflecting scale-up under the AF. The indicator was revised, and a new indicator was created. (See next row/cell).	End target value adjusted from 63,000 to 84,000 to report the higher number for land area under sustainable use at baseline, than originally expected, and the land conversion changes expected as a result of the project. PDO Indicator #1 increased significantly because it covered total farm area, as the number of beneficiaries increased under the AF and with subsequent restructuring, the total area under sustainable management expanded (once the baseline was concluded), including forested area on beneficiary farms (conservation of existing forest/avoidance of cutting).	
PDO Indicator	---	**New Indicator:** **Land area where sustainable land management practices have been adopted as a result of the project** This new indicator was a World Bank Core Sector Indicator which related directly to PDO Indicator #1 above. While the above indicator included areas under natural eco-systems, the Core Indicator reported only on additional areas converted to SPS land-use as a result of the Project, i.e., directly linked to areas where there were expected land conversion changes as a result of the project. End target value was set to 48,000 ha. The reason for the "split" of this new indicator from PDO Indicator #1 was because as formulated, it did not include the intended project objective which was to ensure sustainable use of the entire farm-land area, not just pastures. This is why the monitoring at farm-level measured the totality of farm-land uses, delineated into 9 categories.	End target value was adjusted from 48,000 ha to 35,000 ha, a decline of 27% (13,000 ha). Reasons for target reduction: (a) initial calculation was based on larger farm size per beneficiary. However, both 1st and 2nd calls for expressions of interest showed unequivocally that responding farmers were mostly small-scale; (b) TA and PES1 instruments did not result in establishment of i-SPS as initially expected given high upfront costs of establishment and difficulty of accessing other sources of financing as credit; (c) assumption that SPS conversion would be financed by credit did not materialize; (d) adverse climatic conditions (El Nino) reduced the possibility of planting trees in 2015/part of 2016, and caused considerable damage to trees already planted. Climatic events also affected plantings and on-farm activities in 2018 and 2019.	Hectares increased by 500 ha (i.e., an overall net decrease of 12,500 ha). In alignment with the expanded outreach of the project and the strengthened emphasis of awareness creation, training and capacity building activities.
PDO Indicator	**5 percent increase in the production of beef and/or milk per**	**Increase in the production of beef and/or milk per intervened hectare in participating farms**	**Increase in the production of milk per intervened hectare in participating farms**	

	intervened hectare in participating farms, with a reduction of outside inputs.	Specific value eliminated. End target value adjusted to 10%. The indicator was linked to the objective of poverty reduction within the International Climate Fund (ICF) framework of the Department of Energy and Climate Change (DECC).	"Beef" eliminated. 90% of participating farms were producing milk and the meat production measurements would add complexity without providing additional value. Milk production on 1,532 farms is used as proxy for overall result estimation.	
PDO Indicator	**Improved presence of globally important biodiversity in project areas, as measured by an increase in the Environmental Services Index (ESI) resulting from the adoption of environment-friendly SPS implemented in participating farms in project areas.**	The PAD expressed the target value as 100%, but the AF Project Paper expressed the target as 750,000 ESI points. See next entry.	End target value was incorrectly adjusted/calculated by the 2017 Restructuring Paper from 750,000 points to 575,000 points for land area where sustainable land management practices had been adopted as a result of the project. The error was corrected by the 2018 Restructuring Paper, more than doubling the original target value.	Increase end target value from 575,000 to 1,522,000 points. This restructuring corrected an error in the estimation of the indicator at the time of the 2017 project restructuring.
PDO Indicator	**Reduced soil erosion (tons/ha) induced by the adoption of SPS and measured in at least 2 pilot areas, over baseline**	Indicator dropped. The reason is that the indicator was an impact rather than outcome indicator, and could not be measured/reported sequentially throughout project implementation. It was subsequently implemented as a research activity, generated on a sample of participating farms to permit understanding of the impacts of SPS on soil erosion and increase the body of scientific knowledge on the benefits of various SPS arrangements on soil erosion.	---	---
PDO Indicator	**At least two PES mechanisms financed by local users of environmental services implemented by project end**.	Transferred to Intermediate results (Component 2) and revised.	---	---
PDO Indicator	**Strategy for the broader adoption of SPS in Colombia validated and adjusted during project implementation, ready for adoption by FEDEGAN and other strategic allies (e.g. National Planning Department (DNP), the Ministry of Agriculture and Rural Development (MADR) and the Ministry of Environment, Housing and Territorial Development Environment (MAVDT), among others).**	Transferred to Intermediate results (Component 3) and revised.	---	---

PDO Indicator	**2,000 cattle ranching farms benefiting from project instruments (technical assistance, PES, or support for credit access)**	**Number of cattle ranching farms benefiting from project instruments (technical assistance, PES [1 or 2])** To eliminate the specific value and to reflect in the results framework the project restructuring under AF. End target value adjusted to 2,700 to reflect restructuring of original project and scale-up under AF.	**Number of cattle ranching farms benefiting from project instruments (technical assistance, PES or support for establishment of on-farm nurseries)** Addition of "establishment of on-farm nurseries".	End target value adjusted from 2,700 to 4,000. In alignment with the expanded outreach of the project and the strengthened emphasis on awareness creation, training and capacity building activities
PDO Indicator		**New Indicator** **Reduction in greenhouse (GHG) emissions from avoided deforestation and forest degradation and increase in carbon sequestration at the farm-level through adoption of environment-friendly SPS in participating farms** To provide information on the objective of climate change mitigation (under the ICF of the Department of Energy and Climate Change (DECC). End target value set to 2M t CO2ea.	End target value adjusted from 2M t CO2ea to 1.6M t CO2eq). The potential reduction was revised based on the potential for land use change in participating farms (issue of small farm size). The research commissioned by the Bank provided detailed evidence of the outcomes of the project in terms of emission reductions and avoided deforestation/forest degradation/increased carbon sequestration, based on Tier 3 carbon capture factors.	

Table A1.C.4: Intermediate Outcome Indicators Extended Timeline with Explanation of Changes

Timeline	PAD 2010	Additional Financing 2014	1st Restructuring 2017	2nd Restructuring 2018	3rd Restructuring 2019
Component 1	**12,000 ha of intensive SPS implemented in 5 project areas**	**Area converted to intensive SPS in participating farms** Specific value was eliminated, and to reflect the RF project restructuring in the Results Framework. End target value adjusted to 10,000 ha	End target value adjusted from 10,000 ha to 4,150 ha. TA and PES 1 instruments used by the project did not result in the establishment of iSPS areas at the scale that was originally expected, given high associated costs, limited financial resources of most participating farms, and difficulty in accessing other financing sources like credit. iSPS corresponded mainly to areas established through PES2 scheme (target of 4000 ha, to which were added the few Ha of iSPS established in TA and PSA1 farms).	Hectares converted under iSPS increase in 500 ha In alignment with the expanded outreach of the project and the strengthened emphasis of awareness creation, training and capacity building activities	
Component 1	**10% increase in average stocking rate (cows/ha) in intervened project areas**	**Increase in average stocking rate (cows/ha) in intervened project areas** To eliminate the specific value. Same end target value maintained (10%)	**Increase in stocking rate (LU/ha) in intervened areas in participating farms** The text was revised to ensure consistency with the methodology used. This methodology is based on monitoring activities conducted in all farms as part of participatory field planning using a well-defined procedure.		
Component 1	**30% decrease in the use of fertilizers and herbicides in participating farms in project areas**	**Dropped.** Measurement protocol for this indicator was complex and extremely expensive – project would not have been able to cover it	---	---	---
Component 1	**2,000 cattle ranching farmers trained in SPS and informed about availability of credit sources**	**Number of cattle ranching farmers sensitized on SPS and informed about availability of credit sources** To clarify the distinction between farms (PDO level indicator) and farmers/cattle ranchers who were informed and sensitized on SPS and credit options. End target value adjusted to 4,000 farmers/ranchers.	**Number of cattle ranching farmers sensitized and trained on SPS and sustainable cattle ranching production systems** To reflect awareness and capacity building activities. End target value changed from 4,000 to 5,500. Additional 1500 farmers would be sensitized and trained at national level (including beyond original project areas) through: farmers' fora; workshops; field trips; regional tours; information events on progress and results of the project. These would be additional to those already benefiting from the project instruments (TA and PES) and/or informed during past beneficiary selection process.	Target adjusted from 5,500 to 18,500 farmers In alignment with the expanded outreach of the project and the strengthened emphasis on awareness creation, training and capacity building activities.	
Component	**Training strategy**	**Number of professionals and technicians**	End target value adjusted from 100 to 500 to carry out	End target value adjusted from 500	

1	**designed and applied to prepare trainers, farmers and TA providers in environmental and productive good practices**	**trained on SPS establishment and management** Same end target value of 100. Initial indicator was believed too process-oriented.	activities of information and training more intensively. The project needed to train more professionals and technicians on sustainable CR production	to 550, in alignment with the expanded outreach of the project and the strengthened emphasis on awareness creation, training and capacity building activities	
Component 2	**38,500 ha under PES scheme in 5 project areas (15,750 ha of which are implemented in terrestrial and riparian connectivity corridors):** - 2,000 ha of degraded land recovered with vegetation cover - 31,500 ha of pastures with trees and live fences - 5,000 ha of remnant natural ecosystem conserved in cattle ranching farms in project areas	**Area under PES schemes in project areas (PES1 and PES2)** A new payment method for environmental services would be tested (carbon sequestration PES2) within the AF, which would complement the natural resources management scheme (PES1). The indicator would then be disaggregated to monitor both ways of payment. End target value adjusted to 41,600 (PSA1) and 4000 (PSA2)	End target value adjusted from 41,600 ha of PES1 to 49,000 ha. Unchanged for PES2. The baseline was established in all participating PES1 farms. The projections were revised based on the potential for land use changes by the end of the project. In case of PES2, the project would be able to reach a target of 4000 Ha in the then-current participating farms.	Hectares converted under iSPS increase by 500 ha In alignment with the expanded outreach of the project and the strengthened emphasis of awareness creation, training and capacity building activities	
Component 2		**New Indicator:** **Number of cattle ranching farms benefiting from a PES scheme (PES 1 or PES 2)** To complement the areas under PES scheme indicator (Component 2). End target value set to 1,700 (PSA1) and 1,255 (PSA2). This indicator was added as a	**Number of cattle ranching farms benefiting from a PES scheme (NRM or Carbon)**	**Number of cattle ranching farms benefitting from a PES scheme – PES1 (biodiversity) and PES2 (carbon)**	

		complement to the indicator above on areas.			
Component 2	**50 focal plant species used/conserved in cattle ranching farms, 25 of which are globally important species**	**Number of focal plant species used/conserved in cattle ranching (25 of which are globally important species)** Slight reformulation – specific overall target eliminated.			
Component 2	**50% of water springs and streams present in intervened project areas protected with riparian buffers**	**Dropped** Measurement protocol for this indicator was complex and expensive – project could not cover it	---	---	---
Component 2		**Number of market-based consumer initiatives designed (including large-scale PES mechanisms) that could support the broader adoption of SPS by end-project.**			
Component 3	**At least 3 strategic alliances consolidated with key public and private, national and regional entities for the implementation of proposed project instruments**	**Number of strategic alliances established with key public and private, national and regional entities for the promotion of SPS at the end of the project** Revised to be more specific. End target value adjusted to 5	End target value adjusted from 5 to 10. The increase would reflect further efforts to establish formal alliances with strategic partners/initiatives		
Component 3	**M&E system established and providing timely and relevant information on project's direct and indirect impacts in aid of decision-making processes**	**M&E system established and providing timely and relevant information on project activities and results** To make the indicator more specific and measurable Same end target "yes"		**M&E system established and providing timely and relevant information on project's direct and indirect impacts in aid of decision-making processes**	
Component 3	**SPS have been tested as a strategy for climate change adaptation in two pilot areas**	**Dropped.** The objective of the project was centered on mitigation. However, some activities related to this indicator would be carried out within Component 3	---	---	---
Component		**Number of farms not directly participating**	**Information system in place for reporting farms adopting**		

3		**in project adopting SPS** Indicator ("Strategy for broader adoption of SPS in Colombia … Environment") transferred from PDO level and revised. End target value set at 400. Reformulated to better capture the replication potential beyond the project and the transformational impact.	**SPS, including those not directly participating in the project** The definition of the indicator was not clear, thus, was revised to reflect its specific objective		
Component 3	**Communications strategy implemented for different target audiences (mainly policy-makers and farmers)**	**Continued**			
Component 4	**Project Implementation Team set up and working effectively to coordinate national and regional project execution**	This component was fully accomplished.			

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Juan Pablo Ruiz	Senior Natural Resource Mgmt Specialist (TTL)
Natalia Gomez	Rural Development Specialist
George Ledec	Lead Ecologist
Stefano Pagiola	Senior Environmental Economist
Pilar Larreamendy	Senior Social Development Specialist
Nicole A. Maywah	Consultant
Cornelis de Haan	Consultant
Monica Rodriguez	Consultant
Adriana Soto	Consultant
Brenna E. Vredeveld	Junior Professional Associate
Gabriel Penaloza	Procurement Analyst
Claudia Mylenna Cardenas	Consultant
Supervision/ICR	
Luz Berania Diaz Rios	Task Team Leader
Sandra Ximena Enciso Gaitan	Procurement Specialist
Antonio Leonardo Blasco	Financial Management Specialist
Stefano P. Pagiola	Team Member
Angel Alberto Yanosky	Environmental Specialist
Sanjai Prabu Govindan	Procurement Team
Mario I. Mendez	Procurement Team
Carlos Alberto Molina Prieto	Social Specialist
Julia Isabel Navarro Espinal	Procurement Team

Maria Margarita Zamudio Rojas	Team Member
Maria Teresa Becerra Ramirez	Team Member
Martha Sofia Mora Alvarez	Procurement Team
Olga Carolina Rojas Orjuela	Team Member
Lucia Veronica Amiri-Talesh Ramirez	Team Member
Maria Angela Ramirez Diaz	Team Member
Anna Roumani	Team Member
Jorrit Becking	Team Member

The Supervision/ICR table below reports all costs, including implementation support/supervision and technical support, technical studies commissioned by the Bank, ICR preparation and impact evaluation.

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY08	9.302	49,373.97
FY09	20.130	86,180.25
FY10	7.838	47,238.97
FY15	1.469	9,508.51
Total	**38.74**	**192,301.70**
Supervision/ICR		
FY10	1.680	4,822.80
FY11	13.456	54,726.22
FY12	12.747	62,655.68
FY13	20.739	133,655.61
FY14	12.889	64,874.45

FY15	6.966	52,487.70
FY16	47.032	236,714.54
FY17	41.332	319,748.35
FY18	32.845	340,256.46
FY19	22.713	430,719.12
FY20	31.596	688,968.72
FY21	0	927.29
Total	**244.00**	**2,390,556.94**

ANNEX 3. PROJECT COST BY COMPONENT

Table A3.1: Project Cost and Financing by Component (US$ Million)

Component and/or Activity	Initial Appraisal Amount (US M$)			Additional Financing (US$ M)				Actual at Project Closing (US$M)				Percentage of AF
	GEF	Counterpart	Total	GEF	BEIS	Counterpart	Total	GEF	BEIS	Counterpart	Total	(percent)
1. Improving productivity in participating cattle ranching farms	**1.68**	**29.29**	**30.97**	**1.79**	**9.54**	**9.48**	**20.8**	**3.27**	**9.15**	**25.47**	**37.88**	**182%**
1.1. SPS training to national, regional, and local TA providers	0.13	0.03	0.15	0.14	0.53	0.12	0.79	0.26	0.18		0.44	56%
1.2. Beneficiary selection and baseline assessments	0.23	0.05	0.28	0.3	0.2	0.45	0.95	0.35	0.09	0.16	0.60	64%
1.3. TA to farmers and implementation of SPS in the different regions	0.97	25.06	26.03	1.25	8.42	7.94	17.61	2.54	8.79	24.06	35.38	201%
1.4. Improving access to financial resources for SPS adoption		0.46	0.46		0.26	0.46	0.72		0.00	0.02	0.02	3%
1.5. Assessing and adjusting sector technologies applied in each project area	0.19	0.68	0.87	0.1		0.46	0.56	0.11	0.05	1.23	1.39	249%
1.6. Supporting marketbased instruments to secure longterm funding		0.07	0.07		0.12	0.04	0.16		0.03	-	0.03	20%
Component 1Physical Contingencies	0.17	2.93	3.1									
2. Increasing connectivity and reducing land degradation in participating cattle ranching farms	**3.82**	**2.61**	**6.42**	**3.63**	**7.87**	**2.79**	**14.29**	**1.95**	**6.67**	**1.04**	**9.66**	**68%**
2.1. Adjustment and implementation of a PES mechanism offering shortterm payments to SPS	3.26	1.51	4.78	3.43	4.68	2.2	10.31	1.42	3.82	0.97	6.21	60%
2.2. Design and implementation of local PES mechanisms financed by service users that would offer longterm payments	0.04	0.83	0.88	0.07	0.16	0.46	0.68	0.02	0.25		0.27	40%
2.3. Promoting the use of focal species in SPS / Trees reproduction for the promotion of SPS, enrichment and restoration of forests	0.13		0.13	0.13	2.31	0.06	2.5	0.51	0.63	0.07	1.21	48%
2.4 Demonstrative farms					0.73	0.07	0.8		1.97		1.97	246%
Component 2Physical Contingencies	0.38	0.26	0.64									
3. Institutional strengthening, dissemination and M&E efforts	**0.82**	**0.66**	**1.49**	**0.9**	**2.61**	**1.13**	**4.64**	**1.14**	**2.91**	**0.79**	**4.84**	**104%**
3.1. M&E of project activities	0.49	0.27	0.76	0.64	1.96	0.79	3.39	0.77	2.18	0.72	3.67	108%
3.2. Results dissemination to key stakeholders	0.26	0.28	0.54	0.26	0.65	0.3	1.21	0.37	0.73	0.05	1.15	95%
3.3. Strengthening producer associations		0.04	0.04			0.04	0.04			0.02	0.02	50%
Component 3Physical Contingencies	0.08	0.07	0.15									
4. Project management	**0.68**	**2.39**	**3.07**	**0.68**	**0.68**	**1.96**	**3.33**	**0.64**	**1.79**	**1.30**	**3.70**	**111%**
4.1. Operational costs	0.61	2.15	2.76	0.68	0.59	1.96	3.23					
Component 4Physical Contingencies	0.07	0.24	0.31									
Total Baseline Cost	6.3	31.45	37.75	7	20.7	15.36	43.06	7.00	20.53	28.60	56.08	**130%**
Physical Contingencies	0.7	3.49	4.19									
Price Contingencies												
Total	**7**	**34.95**	**41.95**	**7**	**20.7**	**15.36**	**43.06**	**7**	**20.53**	**28.60**	**56.08**	**130%**

Counterpart contributions: (i) Estimated in the PAD: by producers US$22M to be leveraged through FINAGRO credit lines and US$6M in-kind; contributions of project partners/FEDEGAN US$6.9 M; and, producer contributions US$6.0 M; and, (ii) Actual at closing: project partners/FEDEGAN US$6.73 M; and, producers US$21.85 M. See Table below.

Table A3.2: Grant Allocation – Original vs Actual (US$ million)

Grant Allocation per Component	Original	Additional Financing			Actual			% Variation Actual versus Allocations
	GEF	GEF	AF	Total	GEF	AF	Total	
Improving productivity in participating cattle ranching farms	1.68	1.75	9.54	11.29	3.27	9.15	12.42	+10.0
Increasing connectivity and reducing land degradation in participating cattle ranching farms	3.82	3.63	7.87	11.5	1.95	6.67	8.62	-25.0
Institutional strengthening, dissemination and M&E efforts	0.82	0.9	2.61	3.51	1.14	2.91	4.05	+15.4
Project management	0.68	0.68	0.68	1.36	0.64	1.76	2.4	+76.5

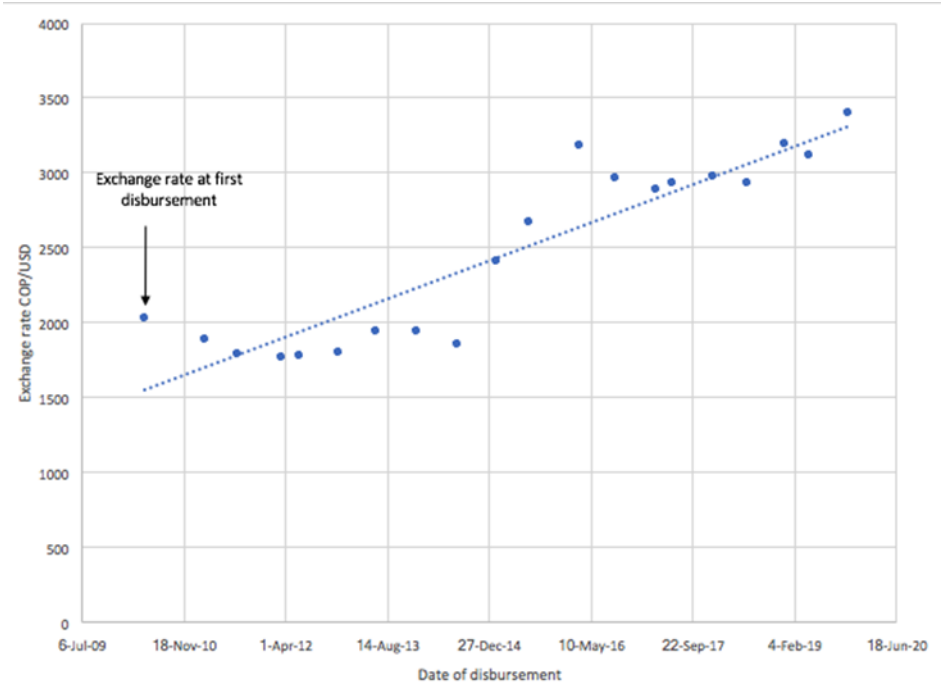
Table A3.3: Estimated Contributions by Producers to Costs of CMSCR Project (as at December 2019)

Costs	Non-Intensive SPS (Dispersed trees and live fences) (US$)	Intensive SPS (US$)	Total
Planted hectares (ha)	33,750	4,830	38,580
Investment by cattle ranchers (US$)	16,353,525	5,505,120	21,815,891
Investment by the project (PES and TA) (US$)	7,609,323	5,462,366	13,071,689
Total investment (US$)	**23,962,848**	**10,967,486**	**34,930,334**
Average investment (US$/ha)	710.01	2,270.00	
Contributions by ranchers (%)	68.2	50.1	
Contribution by the project (%)	31.8	49.9	

Table A3.4: Counterpart (Project Partner) Contributions

Counterpart	At closing (US$ 000s)
Fedegan–Fondo Nacional del Ganado	3,717
Fondo Acción	972
The Nature Conservancy	984
Center for Research on Sustainable Agricultural Production Systems	1,059
Total	**6,732**

Figure A3.1: Colombian Peso to US Dollar Exchange Rate vs Disbursements, 2010–20



ANNEX 4. EFFICIENCY ANALYSIS[11]

INTRODUCTION

1. The incremental efficiency analysis sheds light on the sizable economic and financial value created by the CMSCR Project. The incremental economic analysis results indicate the Project's economic internal rate of return (EIRR) ranges from 24.5 percent to 30.1 percent with a present value (NPV) ranging from US$1,650/ha to US$1,935/ha. At the project level, total economic value (Project NPV) is estimated in a range from US$63 to US$74M. From the financial analysis perspective, the results show that financial returns to investments in SPS far outstrip cash flows to conventional ranching. However, SPS improve farmers' profitability to a limited extent in some dual purpose and breeding farms located in regions where the agro-ecosystems and value chain fundamentals challenge the profitability of the cattle operation. In all cases, the SPS technology yields a substantial environmental impact which will contribute to the sustainability of the cattle ranching subsector in the long term. Also, the improvements in productivity resulting from SPS serve to shield producers from the worst impacts of climate variability. Producers adopting SPS would avoid losses in milk production valued at US$1.5M and losses in cattle production valued at US$483K. These are the revenues that cattle ranchers are most likely to protect in a context of growing climate variability. Also, the project leveraged private capital in the form of investments by cattle ranchers. It created economic and environmental value in the form of the incremental revenue obtained by project beneficiaries, the value of carbon captured over the project period (2010–20), and the value of carbon that is projected to be captured in the following ten years. The resulting estimate of the multiple of invested capital (MIC) indicates that the project has leveraged/created US$3.6 for every US$1 provided by funding agencies (GEF, BEIS) and project partners.

Ex-ante analysis

2. The ex-ante economic and financial analysis conducted for the CMSCR Project at the time of the AF confirmed that support provided by the project would make the adoption of SPS financially attractive to farmers. The analysis also concluded that PES would be a cost-effective way to increase biodiversity and farm productivity. It is worth noting that the economic and financial analysis described in the original PAD and the AF Project Paper were indicative, and no details were provided on the analytical methodology used to reach the conclusions. For that reason, it is not possible to know whether the methodology is comparable to the one undertaken for the ex-post efficiency analysis described in this annex.

Scope of the ex-post efficiency analysis

3. The CMSCR efficiency analysis covers four components: (i) an economic analysis, (ii) a financial analysis, (iii) a climate variability (resilience) analysis, and, (iv) a project leverage analysis. To complement the analyses, a project implementation efficiency analysis was also performed. This exercise provides a general view of whether the project was able to reach its milestones with the monetary resources assigned to it.

[11] The EFA was prepared by Mariangela Ramirez, World Bank Consultant.

Methodology

4. The economic and financial analyses were built upon an incremental cash flow methodology. This means that the analyses take into consideration the cash flows projected without the CMSCR project (conventional ranching) and compare such cash flows with those resulting from the adoption of SPS supported under the CMSCR Project. The incremental cash flows are projected for nine "archetypes," which can be thought of as farm profiles that are representative of the beneficiary farmers. The result of each individual archetype is then extrapolated to the total area intervened by the CMSCR project to assess the project-level results. The analyses modeled the economic and financial cash flows that stem from implementing a combination of non-intensive and intensive SPS, given that the project confirmed this arrangement allows for greater adoption while balancing the investment amount, operational efficiencies and environmental impacts.

Data sources

5. This assessment was based on information provided by FEDEGAN (the leading project implementing agency); the financial closing report for the project as of January 31, 2020; the matrix of Key Performance Indicators (KPIs) for the project; the study commissioned by the Bank to Technoserve on the business case for the implementation and expansion of SPS in Colombia; and, the case study on climate resilience of SPS, also commissioned by the Bank (see Annex 8, for full references).

Project funding

6. In 2011, the project funding plan included counterpart contributions from the key partners, the beneficiary farmers and FINAGRO credit. Total funding in the plan, excluding the beneficiaries' contributions accounted for US$34.9M as described in the table below:

Table A4.1: Project funding sources – excluding beneficiaries' contributions (USD)

Source	Budget 2011 (USD)
Partners*	6.945.575
FINAGRO	22.000.000
GEF	7.000.000
BEIS	-
Total	**35.945.575**

* FEDEGAN, Fondo Acción, CIPAV, TNC

7. In 2012, FEDEGAN issued the CMSCR project financing strategy as a means to support the US$22M credit-related financing objective set for the project. One of the key activities of this strategy included supporting producers with technical assistance jointly provided by the CMSCR project, Banco Agrario and FINAGRO. In this technical assistance structure, the CMSCR technical staff provided training to the project beneficiaries on iSPS management. This team was also in charge of conducting an assessment of the cattle ranchers' ability to comply with credit commitments, thus ensuring that only producers with appropriate conditions for debt repayment were financed. Banco Agrario and FINAGRO provided training on credit management.

8. Under this strategy, 588 cattle ranchers attended the training sessions and 229 trainees (39%) confirmed their interest in obtaining financing. Notwithstanding, only 14 credit applications were presented to Banco Agrario and 6 producers were financed by the end of the strategy execution in year 2015. The remaining applications were either rejected or not disbursed.

9. With the additional financing grant funds from BEIS, the project introduced a new incentive scheme (PES2-Carbon scheme), to partially compensate for the lack of access to finance and addressed several other gaps in service provision and capacities, to accelerate implementation. Therefore, BEIS funding supported valuable incremental achievements of the project that had to do with the efficiency results achieved, as follows:

- Establishment of 4,240 hectares of iSPS. This amount of land accounts for 87.6% of total area under iSPS planted under the project. It is worth pointing out that these intensive systems have the highest profitability and hence, propelled up the project economic and financial results as presented in the following sections.

- 87% increase in SPS areas versus the area established with the initial funding of US$7M. This area accounts for 16,223 hectares and contributed the largest share of carbon capture, which is one of the key drivers of socio-economic and financial value resulting from the project.

- Establishment of the methodology to estimate carbon capture from the various SPS systems. This methodology was the mean to assess the Project's environmental impact and socio-economic and financial value resulting from the Project.

10. The BEIS funding also supported greatly expanded outreach of training programs, demonstration farms, seed and plant multiplication and distribution strategies, expanding capacities of a larger number of technical professionals and deepening interaction with policy makers, all of which had a positive effect on the Project's overall economic and financial results and on the long-term sustainability of the project outcomes.

Archetypes and their use in this analysis

11. This analysis makes use of nine "archetypes," which can be thought of as farm profiles or representative, stylized farm types (Table A4.1). The archetypes are defined on the basis of several parameters that influence the economics and profitability of the production unit: the production model (specialized milk, dual purpose, breeding and fattening), location (department/region), farm size, herd structure, percentage of productive cattle, fertility rate, stocking rate, and productivity indicators (liters of milk per cow/day, and daily weight gain per animal).

12. These archetypes are used to assess the business case for traditional (conventional) cattle ranching versus sustainable cattle ranching with SPS as a means of evaluating the efficiency of the CMSCR Project. Because three of the five SPS systems promoted under the project represent 90 percent of the total area under SPS adopted through the project, the analysis focuses on those three systems, namely: dispersed trees in pastures, live fences, and the intensive systems (iSPS) that emphasize the provision of forage for animals. The CMSCR Project

supported producers to implement non-intensive and intensive SPS on 38,448 ha. Table A4.2 shows the area corresponding to each archetype

Table A4.2: Cattle ranching archetypes used to model the business case for conventional cattle ranching and sustainable cattle ranching with SPS in Colombia

Production center	Archetype	Region	Modal farm size	Estimated representation
				Total percentage of farms
Specialized milk	1	Cundiboyacence highlands (ACU)	13 ha	> 80%
	2	Antioquia (ANT)	23 ha	> 80%
	3	Nariño (NAR)	4.5 ha	> 80%
		Total specialized milk		**> 80%**
Dual purpose	4	Cundinamarca and Boyacá (C&B)	53 ha	17%
	5	Antioquia (ANT)(1)	81 ha	10%
	6	Caribbean/Atlántico (CA)(2)	28 ha	12%
	7	East, Center and South (OCS)(3)	107 ha	21%
		Total dual purpose		**60%**
Breeding	8	East, Center and South (OCS)(3)	107 ha	30%
Fattening	9	Caribbean/Atlántico (CA)(2)	100 ha	30%

Source: TechnoServe study on the implementation and expansion of silvo-pastoral systems for Colombian cattle ranches, 2018

Table A4.3: Area converted to SPS with CMSCR Project Support, by Archetype

Land converted	Dispersed trees	Live fenses	SSPi	Total	Share of total	Dispersed trees	Live fenses	SSPi	Total
Arq. 1	115	461	177	**753**	**2%**	15%	61%	24%	**100%**
Arq. 2	245	941	320	**1.506**	**4%**	16%	62%	21%	**100%**
Arq. 3	-	-	-	**-**	**0%**				
Arq. 4	361	1.074	330	**1.765**	**5%**	20%	61%	19%	**100%**
Arq. 5	1.544	2.491	802	**4.837**	**13%**	32%	51%	17%	**100%**
Arq. 6	14.655	4.194	2.093	**20.942**	**54%**	70%	20%	10%	**100%**
Arq. 7	1.960	2.337	536	**4.833**	**13%**	41%	48%	11%	**100%**
Arq. 8	713	852	191	**1.757**	**5%**	41%	49%	11%	**100%**
Arq. 9	940	869	246	**2.054**	**5%**	46%	42%	12%	**100%**
Total	20.533	13.219	4.696	**38.448**	**100%**	53%	34%	12%	**100%**

ECONOMIC ANALYSIS

13. The economic analysis projects cash flows for each archetype under two scenarios: (i) without the CMSCR project (conventional ranching); and, (ii) with the adoption of SPS supported under the CMSCR Project. This

implies that the economic analysis is based on an incremental analysis methodology. Using the shadow prices[12] listed in Table A4.3, the incremental cash flows resulting from the adoption of SPS (the second scenario) are projected up to 10 years, after which they continue into perpetuity. These cash flows are discounted at Colombia's social discount rate of 9 percent.[13] In estimating the cash flows with the project, each change in land use (dispersed trees, live fences, and iSPS) is assumed to occur on a share of the farm area, as shown in Table A4.4 for the nine archetypes.

Table A4.4: Colombia Shadow Prices for Revenues and Cost Drivers

Shadow prices categories	
Revenues	
Milk	0,904
Head of cattle	1,000
Costs	
Labor (non qualified)	0,904
Agricultural inputs	1,000
Animal feed	0,881
Animal medicines	0,904
Other costs	0,904
Cost of capital	14,60%

Source: Departamento Nacional de Planeación DNP

Table A4.5: Percentage of Farm Area dedicated to SPS supported under the CMSCR Project

Combinations

System	High lands	Low lands
Dispersed trees	4,0%	12,1%
Live fences	15,8%	13,2%
iSPS	5,7%	3,9%
Share of farm with SPS and iSPS	**25,6%**	**29,2%**
Archetypes	1, 2 and 3	4, 5 , 6, 7, 8 and 9

14. The combinations presented above are crucial for the overall economic and financial results of SPS and iSPS implementation. iSPS require the higher investments, but these also propel dramatic improvements in the farm operating indicators as presented below. This implies the iSPS has the highest potential to propel up the economic and financial returns on investments.

15. An important variable that determines the percentage of farm area converted into SPS is the investment required to adopt each system. Non intensive SPS such as dispersed trees and live fences require an average

[12] DNP, Precios sombra, agosto 2019.
[13] DNP, Documento 487. Dirección de Estudios Económicos, 8 de agosto de 2018.

investment of COP$2M/ha (US$625/ha), whereas iSPS require approximately COP$4–5M/ha (US$1,250–1,560/ha).[14] The investment is offset by eventual improvements in such variables as animal stocking rate, birth rate, milk productivity, daily weight gain, and operating costs. Intensive SPS drive significantly higher economic benefits but require a higher level of investment. Tables A4.6 and A4.7 present examples of changes in variables (animal stocking rate and milk productivity) driven by SPS and iSPS ("SPSi" in the tables).

Table A4.6: Increase in Animal Stocking Rate resulting from SPS, by Archetype

Increase in animal charge rate	Arch. 1	Arch. 2	Arch. 3	Arch. 4	Arch. 5	Arch. 6	Arch. 7	Arch. 8	Arch. 9
Dispersed trees	17%	35%	35%	17%	35%	38%	12%	12%	38%
Live fences	17%	31%	31%	17%	31%	53%	52%	52%	53%
SPSi	300%	86%	86%	300%	86%	189%	164%	164%	189%

Table A4.7: Increase in Milk Productivity resulting from SPS, by Archetype

Increase in milk productivity	Arch. 1	Arch. 2	Arch. 3	Arch. 4	Arch. 5	Arch. 6	Arch. 7	Arch. 8	Arch. 9
Dispersed trees	16.2%	22.1%	22.1%	16.2%	22.1%	28.5%	9.9%	9.9%	28.5%
Live fences	47.7%	26.4%	26.4%	47.7%	26.4%	24.8%	15.2%	15.2%	24.8%
SPSi	92.5%	50.2%	50.2%	92.5%	50.2%	124%	111%	111%	124%

16. More specifically, cash flows under the CMSCR Project are assumed to include: (i) the investment required to implement silvo-pastoral technologies and systems; (ii) the incremental cash flows driven by the operational efficiencies that stem from SPS; and, (iii) the value of the carbon captured as a result of the corresponding changes in land use. To value the carbon captured, a social price of US$40 per ton of carbon captured was used as indicated in the World Bank Guidance Note for the Shadow Price of Carbon in Economic Analysis. Also, the results of a CO_2 capture/removals study by The Nature Conservancy (TNC),[15] commissioned by the World Bank, were used to estimate the volume of carbon removed over 10 years in each project region (Table A4.8).

[14] Exchange rate used for the economic and financial analysis is COP$3,200 to US$1.
[15] The Nature Conservancy (TNC), 2019. Proyecto Ganadería Colombiana Sostenible (GCS), 2020. Informe final de estimación de la deforestación evitada y emisiones de CO2 evitadas por el Proyecto Ganadería Colombiana Sostenible. Commissioned by the World Bank.

Table A4.8: Estimation of Carbon captured by Region

CO2 Tones captured / year / hectare

System	Eje cafetero, Cundin. y Boyacá	Piedemonte Orinocense	Caribe
Dispersed trees	3,3	5,5	11,0
Live fences	2,9	3,7	8,5
SSPi	2,7	2,4	2,1
Archetypes	1, 2, 3, 4 and 5	7 and 8	6 and 9

Source: TNC carbon capture assessment for the CMSCR Project. Studies Commissioned by the World Bank

17. The incremental cash flows that result from SPS implementation, drive operational efficiencies that influence the top line and cost structure of a cattle ranch. These cash flows are realized gradually as the systems mature and produce monetized economic and environmental benefits. Table A4.9 presents the estimated incremental cash flows for each archetype.

Table A4.9: Estimated Incremental Cash Flows for each Archetype, CMSCR Project

Incremental cash flows per arquetype farm (USD, 000)

Archetype	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Arquetype 1	0,00	0,01	0,01	0,06	0,30	0,43	1,08	1,64	2,20	27,81
Arquetype 2	0,00	0,00	0,07	0,20	0,44	0,22	1,03	1,29	1,51	17,77
Arquetype 3	0,00	0,01	0,01	0,00	0,04	0,07	0,26	0,35	0,37	4,73
Arquetype 4	0,00	-0,23	-0,32	-0,07	0,58	0,84	1,22	1,55	1,40	20,03
Arquetype 5	0,00	-0,24	-0,53	-0,68	0,57	-0,96	2,25	1,44	1,69	21,08
Arquetype 6	0,00	-0,52	-0,60	-0,43	1,00	1,38	1,64	1,31	1,65	23,48
Arquetype 7	0,00	-0,83	-0,65	-0,50	1,69	-1,48	2,72	2,37	2,94	37,81
Arquetype 8	0,00	0,09	0,43	0,54	1,49	-1,77	2,27	1,68	2,27	29,64
Arquetype 9	0,00	-0,45	-0,12	1,80	2,83	0,39	3,66	3,47	3,65	39,20

18. Next, results of the economic analysis at the archetype level are extrapolated to estimate the value created across the entire area where land-use changes were driven by the project. To impel the change in land use from unsustainable CR to sustainable SPS, the project invested in TA, implemented mechanisms to pay for environmental services, provided planting material, developed and transferred knowledge through demonstration farms, strengthened institutions, and conducted dissemination and M&E activities. The total project investment in all activities was US$34.2M. The investment for each project component and subcomponent is shown in Table A4.10.

19. The economic indicators for the project are calculated for three scenarios. Scenario 1 includes all project investments, Scenario 2 includes investments under Component 1 (improving productivity) and Component 2 (increasing connectivity and reducing land degradation), and Scenario 3 includes only investments directly related to changes in land use (investments 1.3, 2.3, and 2.4 in Table A4.10). In parallel, these three scenarios were calculated taking out the price of carbon as a means for assessing the project's value created from carbon capture stand alone.

Table A4.10: CMSCR Project Investment by Component and Subcomponents

Component and subcomponents	Investment USD, M	Share
1. Improving productivity in participating cattle ranching farms	**16,0**	**46,8%**
1.1. SPS training to national, regional, and local TA providers	0,4	1,3%
1.2. Beneficiary selection and baseline assessments	0,6	1,7%
1.3. TA to farmers and implementation of SPS in the different regions	13,5	39,5%
1.4. Improving access to financial resources for SPS adoption	0,0	0,1%
1.5. Assessing and adjusting sector technologies applied in each project area	1,4	4,1%
1.6. Supporting market-based instruments to secure long-term funding	0,0	0,1%
2. Increasing connectivity and reducing land degradation in participating cattle ranching farms	**9,7**	**28,2%**
2.1. Adjustment and implementation of a PES mechanism offering short-term payments to SPS	6,2	18,1%
2.2. Design and implementation of local PES mechanisms financed by service users that would offer long-term payments	0,3	0,8%
2.3. Genetic material for SPS and forest	1,2	3,6%
2.4 Demostrative farms	2,0	5,8%
Component and subcomponents	**Investment USD, M**	**Share**
3. Institutional strengthening, dissemination and M&E efforts	**4,8**	**14,1%**
3.1. M&E of project activities	3,7	10,7%
3.2. Results dissemination to key stakeholders	1,1	3,3%
3.3. Strengthening producer associations	0,0	0,1%
4. Project management	3,7	10,8%
Total	**34,2**	**100,0%**

Economic analysis results

20. Table A4.11 presents the key results of the project economic analysis. The CMSCR Project creates sizable economic value, with returns of 24.5–30.1 percent and NPV per hectare of US$1,650-1,935, indicating that the project is an efficient investment that simultaneously creates monetary and social value. These results embed the global environmental value created by the project in terms of carbon capture, estimated at US$60M. The investments in SPS are repaid in the medium term (6 to 7 years), owing to the project investment structure and the nature of SPS (which take time to produce operational and environmental benefits). It is worth noting that Scenario 1 resulted in a negative NPV as it accounts for the sizable costs of knowledge generation incurred by the project and multiple project investments that are not directly related to land use changes

Table A4.11: Key Results of the Economic Analysis, CMSCR Project

Scenario	1	2	3
E-IRR	19,6%	23,1%	24,4%
NPV (USD/ha)	1.122,5	1.344,5	1.409,5
B/C ratio	1,8 x	2,1 x	2,3 x
Payback period (years)	8,5	7,8	7,2

21. As presented in the Table A4.5, under the CMSCR Project, the share of total conversion implemented in intensive systems was relatively low vis-à-vis the implementation of non-intensive systems, and the rates of return of the Project behaved accordingly. Notwithstanding, as iSPS gain share of total conversion, the returns would increase.

Sensitivity analysis

23. A sensitivity analysis assessed how the economic value of the project would respond to variations in (i) milk prices; (ii) cattle prices; (iii) production volumes; (iv) labor costs; (v) total costs; and, (vi) the social price of carbon. These variables were changed by +15 percent and -15 percent at 5 percent intervals, producing 30 scenarios for the analysis. Effects of changes in the social price of carbon from US$10 to US$60 at US$10 intervals added another 6 scenarios to the analysis. In all scenarios, returns to the project are positive. The variables with the greatest impact on project value are production volumes, and total cost variation, which could potentially drive returns around the social discount rate if they vary by more than 15 percent. In such cases, the project is at risk of not creating value and is no longer an attractive social investment (Table A4.12). Production volumes are affected by climate variability, and as the climate variability analysis shows, SPS systems, once fully established, can have important effects on reducing production losses. This contributes to the economic viability of cattle ranching activities, thus making a strong case for investing in SPS as a social investment.

Table A4.12: Sensitivity of EIRR to variations in revenue and cost variables

	Scenario		
Milk prices variation (avg. over 9 years)	1	2	3
15%	23,0%	26,9%	28,2%
10%	21,9%	25,7%	27,0%
5%	20,8%	24,4%	25,7%
0%	19,6%	23,1%	24,4%
-5%	18,3%	21,8%	23,0%
-10%	17,1%	20,5%	21,6%
-15%	15,7%	19,0%	20,2%

	Scenario		
Cattle prices variation (avg. over 9 years)	1	2	3
15%	26,1%	30,2%	31,6%
10%	24,1%	28,0%	29,3%
5%	21,9%	25,6%	26,9%
0%	19,6%	23,1%	24,4%
-5%	17,1%	20,5%	21,6%
-10%	14,3%	17,5%	18,7%
-15%	11,2%	14,3%	15,3%

	Scenario		
Volumes variation	1	2	3
15%	27,0%	31,1%	32,6%
10%	24,7%	28,6%	30,0%
5%	22,2%	26,0%	27,3%
0%	19,6%	23,1%	24,4%
-5%	16,7%	20,1%	21,2%
-10%	13,5%	16,7%	17,8%
-15%	9,9%	12,8%	13,9%

	Scenario		
Labor costs variation	1	2	3
15%	16,5%	19,8%	21,0%
10%	17,5%	21,0%	22,1%
5%	18,6%	22,1%	23,3%
0%	19,6%	23,1%	24,4%
-5%	20,5%	24,2%	25,4%
-10%	21,5%	25,2%	26,5%
-15%	22,4%	26,2%	27,5%

	Scenario		
Total costs variation	1	2	3
15%	10,9%	13,9%	14,9%
10%	14,1%	17,3%	18,4%
5%	17,0%	20,4%	21,5%
0%	19,6%	23,1%	24,4%
-5%	22,0%	25,7%	27,0%
-10%	24,3%	28,2%	29,6%
-15%	26,4%	30,5%	32,0%

	Scenario		
Social carbon price	1	2	3
10,00	12,0%	14,6%	15,5%
20,00	15,8%	18,8%	19,8%
30,00	19,6%	23,1%	24,4%
40,00	23,5%	27,6%	29,1%
50,00	27,5%	32,2%	33,9%
60,00	31,5%	36,9%	38,9%

FINANCIAL ANALYSIS

22. The financial analysis estimates the financial return to private investments in SPS. This analysis is important because it indicates the potential of silvo-pastoral technology and systems to be adopted at scale and deepen impact based on market forces. It also sheds light on the potential economic sustainability of SPS, and the public and private sector interventions required to achieve scale and impact.

23. The analysis builds upon the economic analysis to estimate cash flows and key financial indicators for each archetype, but cash flows are estimated in nominal terms based on market prices, discounted at the cost of equity of 14.6 percent for investments in Colombia.[16] The inflation rate used in the cash flow projections is 3.7 percent.[17] No shadow prices are used in this analysis. The analysis focuses on estimating the cash flows of a farm under conventional ranching (that is, without the CMSCR Project). These cash flows are then compared with those generated after implementing SPS (that is, with the CMSCR Project). The cash flow delta sheds light on the economic benefits that stem from switching from conventional ranching to SPS. To evaluate the financial return of implementing SPS, the cash flows were estimated under two scenarios: Scenario 1 estimates the financial return to investments in SPS. Scenario 2 takes the project's environmental benefits into account in estimating the financial returns to the cattle rancher. The environmental benefits are estimated based on the carbon price in Colombia's emerging carbon market.

Conventional cattle ranching cash flow

24. The cash flow for conventional cattle ranching was calculated for all nine archetypes based on the typical performance of a farm given its productive use (milk, beef, breeding, fattening). These cash flows highlight the challenges of conventional cattle ranching in Colombia as all conventional ranching archetypes except for those specializing in milk production generate subsistence-level value (Table A4.13). To some extent, these low cash flows to conventional ranching are explained by structural challenges that include: very low level of specialization characterizing cattle production in Colombia, the use of land that is unsuitable for ranching, lack of technical knowledge among ranchers, the highly fragmented value chain and high logistical costs. Low cash flows are also explained by operational inefficiencies such as the low animal stocking capacity of the land, high cost of feed and medicine, and poor feed quality or quantity (leading to low productivity).

25. It is worth noting that specialized commercial milk production (which excludes dairy/beef dual purposes systems), which is the operation that generates better results, accounts for 7 percent of the national herd and occupies a relatively small share of the land used for cattle ranching. The implication is that the low and negative cash flows to conventional ranching are associated with/typical of the large majority of the cattle ranching community in Colombia.

[16] Corficolombiana, Costo de Capital para Colombia.
[17] IMF database.

Table A4.13: Cash flows for conventional cattle ranching

Cash flows (USD/ha)

Arquetype	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Arquetype 1	325,5	325,5	326,7	327,6	326,5	325,1	324,0	322,9	323,1	320,6
Arquetype 2	216,0	216,0	216,8	216,9	216,0	215,2	214,7	214,2	214,5	212,8
Arquetype 3	325,8	325,8	325,4	325,9	326,4	326,9	327,4	327,9	327,7	328,8
Arquetype 4	80,5	80,5	85,0	85,8	85,6	85,3	84,9	84,5	84,1	83,6
Arquetype 5	81,6	81,6	81,6	80,8	80,6	80,5	80,3	80,0	79,8	79,5
Arquetype 6	157,2	157,2	165,4	168,3	168,0	167,4	166,7	165,7	164,6	163,5
Arquetype 7	84,1	84,1	84,1	84,1	84,1	84,1	84,1	84,1	84,1	84,1
Arquetype 8	63,1	63,1	68,3	66,7	66,7	66,4	66,0	65,3	64,6	63,9
Arquetype 9	44,2	44,2	53,7	51,3	46,6	53,1	50,1	48,2	52,3	49,6

Silvo-pastoral systems financial analysis – Scenario 1

26. Scenario 1 follows the approach in the economic analysis, in which operational efficiencies driven by SPS are incorporated into the estimated cash flows. Returns to all archetypes are positive, although returns to some dual-purpose and breeding archetypes are below the cost of capital owing to the prevailing structural challenges mentioned previously, particularly the low levels of specialization (Table A4.14). It is important to note that, if a farm is held to a higher level of specialization, including clear meat or dairy focus, genetic improvement, proper pest control strategies, and pasture management improvement, among other practices, the SPS would evolve synergistically and hence, the financial results stemming from their implementation would increase.

Table A4.14: Scenario 1 financial analysis results, by archetype

Arquetype	1	2	3	4	5	6	7	8	9
F-IRR	36,4%	25,4%	26,2%	11,2%	5,8%	21,7%	8,6%	7,2%	16,3%
NPV (USD/ha)	671	220	254	-47	-106	137	-79	-86	23
B/C (x)	4,2 x	2,1 x	2,2 x	0,8 x	0,5 x	1,6 x	0,7 x	0,6 x	1,1 x
Payback period (years)	8,3	9,0	9,1	12,6	14,9	9,8	13,7	14,2	10,1

27. Returns estimated under Scenario 1 indicate that silvo-pastoral cattle ranching system stave off the unfavorable cash flows of conventional cattle ranching in Colombia. The cash flows to SPS not only outstrip cash flows to conventional cattle ranching but point the way forward for Colombia to develop more profitable cattle ranching alternatives that can be sustained over the longer term while delivering important national and global environmental benefits. It is important to note that monetary incentives, or sector stimulus to consolidate the value chain will be required to mainstream SPS in archetypes for which returns, although positive, remain below the cost of capital (archetypes 4, 5, 7, 8, and 9).

Silvo-pastoral systems financial analysis - Scenario 2

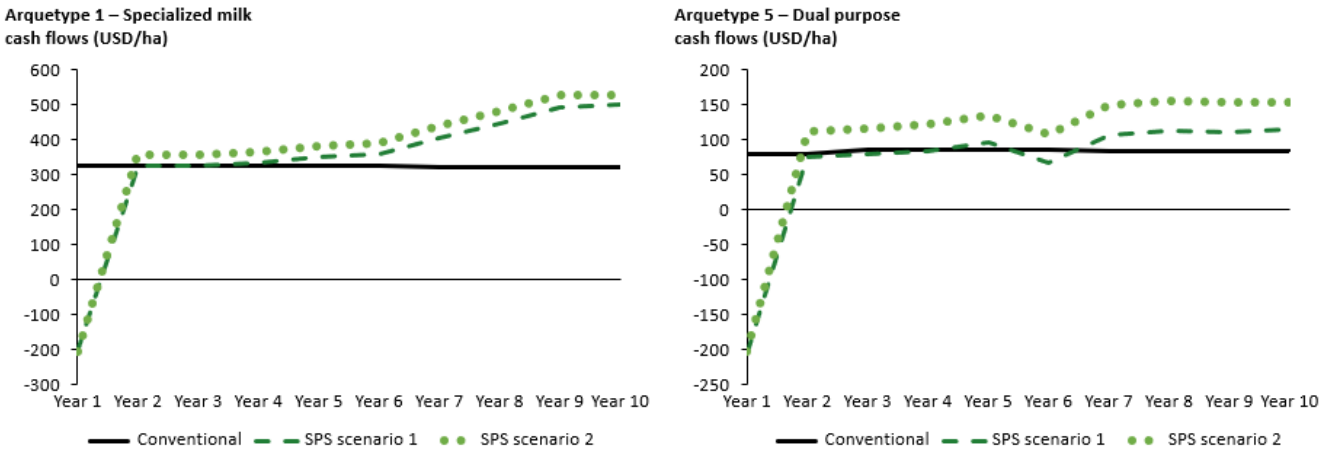
28. The returns under Scenario 2 showcase the potential value of the environmental impact of SPS (specifically, the carbon captured by SPS) (Table A4.15). Although producers have not realized the value of these impacts in practice, they are included in this analysis because they represent an additional economic upside of investing in sustainable cattle ranching. When the value of environmental impacts generated by SPS is included in the analysis, financial returns to all archetypes increase significantly, making a compelling business case for sustainable ranching if producers receive carbon payments.

Table A4.15: Scenario 2 Financial Analysis Results, by Archetype

Arquetype	1	2	3	4	5	6	7	8	9
F-IRR	38,2%	28,6%	28,6%	15,9%	11,5%	24,8%	13,6%	13,0%	20,8%
NPV (USD/ha)	727	309	309	18	-40	202	-14	-20	89
B/C (x)	4,5 x	2,5 x	2,5 x	1,1 x	0,8 x	1,9 x	0,5 x	0,9 x	1,5 x
Payback period (years)	8,0	8,6	8,6	10,7	12,1	9,1	11,5	11,6	8,9

29. The results in Scenarios 1 and 2 confirm the superior profitability of SPS compared to conventional cattle ranching. It is worth noting that in some dual-purpose archetypes as well as the breeding archetype, the value of carbon is the main driver of SPS' increased profitability, as depicted in Graph A4.01.

Graph A4.01 Profitability of SPS vs. Conventional cattle ranching



30. To estimate financial returns to the entire project, returns at the archetype level were extrapolated across

the entire area where land-use changes were driven by the project. For each archetype, the FIRR and other financial indicators were weighted by the percentage of area on which land-use changes were implemented. The results (Table A4.16) indicate that cattle ranching would take a large leap forward in long-term sustainability if SPS were scaled up across the country.

Table A4.16: Key Results of the Financial Analysis, CMSCR Project

Scenario	1	2	3
F-IRR	4,4%	18,6%	22,1%
NPV (USD/ha)	-1.955,1	243,3	468,1
B/C ratio	0,4 x	1,3 x	1,7 x
Payback period (years)	18,4	11,2	9,9

CLIMATE VARIABILITY RESILIENCE ANALYSIS

31. Cattle ranching in Colombia is exposed to climate variability, often in connection with severe climate events such as the El Niño and La Niña weather patterns. Although silvo-pastoral systems are vulnerable to climate events such as drought during their establishment phase (as shown by the reduction in area under iSPS during the 2019 drought - Annex 7), evidence indicates that once the SPS are established and mature, these are much more resilient to climate events than conventional systems. The analysis of climate variability resilience estimates the losses in revenue avoided on farms and land that have benefited from the support of the CMSCR Project to implement SPS. The analysis focuses on avoided losses because this variable is a good proxy of how the climate resilience of SPS creates economic value that strengthens the long-term sustainability of cattle ranching.

32. Table A4.17 outlines the results of the assessment methodology in terms of perceptions of climate variability risk for each region of Colombia in the event of a rise in temperature or a change in the rainfall regime. The perception of risk is scored on a scale from 1 to 10, in which a score of 10 indicates that the highest level of risk is perceived. Note that the climate variability risk analysis is a blanket exercise that covers all relevant cattle ranching regions in Colombia and is not limited to the regions where the CMSCR Project focused its efforts.

33. The climate variability resilience analysis looks at the impact of a climate event on farm productivity and revenue. The severity of the impact on an archetype farm is in a range from 20 percent to 50 percent (Table A4.18), depending on the farm's location (which reflects the risk perceptions shown in Table A4.17).

34. The revenue base to estimate the avoided losses is equivalent to 7.5 months of revenue, because 7.5 months is the average duration of a climate variability event in Colombia. The avoided losses are calculated as the

difference between the potential losses incurred on a farm with conventional cattle ranching and the losses incurred on a farm with SPS. On farms with SPS, the 25 percent improvement in milk productivity and 10 percent improvement in beef productivity compared to conventional ranching, act to shield revenues in times of climate variability. The revenues used for this exercise include years 2 through 10 as the SPS should be fully in place to drive the changes in productivity that serve as a shield for climate variability impacts. Over the projection period, the revenue loss avoided in milk production with SPS was valued at US$1.5M, and the revenue loss avoided in beef production with SPS was valued at US$483K (Table A4.19). This result is important, because these are the revenues that cattle ranchers are most likely to want to protect in a context of growing climate variability.

Table A4.17: Perceptions of Climate Variability Risk by Region, Colombia

Region	Risk perception (temperature increase)	Risk perception (rainfall regime alteration)
Arauca	6,6	5,5
Casanare	6,7	5,8
Meta	6,4	6,5
Nariño	5,0	5,5
Santander	5,9	6,0
Magdalena	7,9	6,7
Cesar	8,0	6,4
Córdoba	6,4	5,9
Guaviare	4,1	4,8
Antioquia	6,4	6,8
Caquetá	4,0	5,2
Cundinamarca	6,0	5,5
Boyacá	6,0	4,9
Valle del Cauca	5,9	6,7

Source: Climate variability case study for silvo-pastoral systems, December 2019. Commissioned by the World Bank

Table A4.18: Impact of Climate Variability Events on Revenues, by Archetype

Climate varibility impact by archetype		
Archetype 1	%	20%
Archetype 2	%	30%
Archetype 3	%	20%
Archetype 4	%	20%
Archetype 5	%	30%
Archetype 6	%	50%
Archetype 7	%	30%
Archetype 8	%	30%
Archetype 9	%	50%

Table A4.19: Estimated Losses in Revenue avoided through improved Climate Variability Resilience under SPS

US (000)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Milk revenues at risk	486,5	520,3	566,6	601,2	635,9	699,7	784,3	852,6	888,2
Avoided losses - milk production	-121,6	-130,1	-141,7	-150,3	-159,0	-174,9	-196,1	-213,2	-222,0

Avoided losses (annual average)	**167,6**
Avoided losses (cummulative)	**1.508,8**

US (000)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Beef revenues at risk	363,9	420,4	449,4	513,8	569,0	607,3	580,8	636,7	689,7
Avoided losses - milk production	-36,4	-42,0	-44,9	-51,4	-56,9	-60,7	-58,1	-63,7	-69,0

Avoided losses (annual average)	**53,7**
Avoided losses (cummulative)	**483,1**

PROJECT LEVERAGE ANALYSIS

35. This analysis estimates the multiple of invested capital (MIC) for the CMSCR Project. This multiple results from factoring out the economic and environmental value leveraged and created by the project with the funding provided by GEF, BEIS, and the project partners. The analysis builds upon the economic analysis to estimate the economic and environmental value leveraged and created. The investment provided by the cattle ranchers is considered private capital leveraged by the project. The incremental revenues of project beneficiaries, the value of carbon captured over the project period (2010–20), and the value of carbon that is projected to be captured over the next 10 years are considered as economic and environmental value created by the project. The social price of carbon is used in the cost-benefit analysis. The MIC estimated for the CMSCR Project (Table A4.20) indicates that the project leveraged/created US$3.6 for every US$1 provided by the funding agencies and project partners.

Table A4.20: Estimated Value Leveraged and Created by the CMSCR Project (multiple of invested capital)

(a) Project funding (USD, M)	
GEF	7.000
BEIS	20.490
Partners	6.733
Total	**34.222**
(b) Economic value created/leveraged by project	
Investment from cattle ranchers	26.151
Incremental revenue of project beneficiaries	2.626
Monetary value of carbon captured	46.951
Monetary value of projected carbon capture	45.821
Total	**121.549**
Project MIC (b/a)	**3,6 x**

IMPLEMENTATION EFFICIENCY

36. Implementation efficiency is assessed as substantial considering the following: The PDO indicators were met; most Intermediate Outcome level indicators were met or surpassed; and execution of grant funds reached 99 percent. Even though project start-up was delayed during the early years due to complex methodologies for verifying land uses, as well as coordination issues among implementing agencies, the project team was able to accelerate implementation during the AF phase, due mainly the key role of demonstration farms and tree production strategies. Given the pilot nature of PES schemes (e.g. PSE2), implementation flexibility was essential. Project implementation took two years longer than planned at the time of the AF, but this longer period enabled the project to demonstrate a high level of achievement on its PDO Indicators (partially a consequence of the devaluation of the Colombian currency).

ANNEX 5. RECIPIENT, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

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Department for Business, Energy & Industrial Strategy

1 Victoria Street
London SW1H 0ET

T +44 (0) 20 7215 5000
E www.beis.gov.uk/contact
www.beis.gov.uk

Luz Diaz Rios
The World Bank
1818 H Street N.W.
Washington
DC 20433, USA

4 December 2020

Dear Ms Diaz Rios,

Thank you for your email on 30 November 2020 inviting BEIS International Climate Finance to review the draft Implementation Completion and Results Report (ICR) for the *Colombia Mainstreaming Sustainable Cattle Ranching Project*. My colleagues and I in the BEIS Forests, Land Use and Carbon Markets team appreciate the opportunity to comment.

Having reviewed the document, we agree that it provides a comprehensive account of the problems the project was designed to address, the shape of the intervention that emerged to meet those needs, and the project's overall performance. In our own assessment of the project, in our equivalent to the ICR, we scored the project as 'A+: outputs moderately exceeded expectations'. This reflects the strong results delivered by this pioneering project.

As an intervention piloting innovative silvopastoral systems, the project conclusively achieved proof of concept for these techniques. It generated valuable evidence on the magnitude of the climate, biodiversity and productivity benefits their adoption can deliver. Overall, the project clearly showed that silvopastoral systems are effective nature-based solutions to climate change and biodiversity loss, feasible to implement on a large proportion of Colombia's cattle farms, and attractive to farmers when the right support is provided.

We note that results fell below expectations for some outcomes due to over-optimistic initial assumptions, but we recognise that this is understandable considering the novelty of testing innovative techniques at a reasonable scale. Indeed, the difficulty in meeting initial expectations revealed important 'real-world' lessons about the importance of technical assistance, demonstration farms, sufficient planting materials and up-front financial support, and the challenge of working with insecure land tenure and converting large areas of land by working with small-scale ranchers. We also note that the project's innovation and multi-partner delivery arrangement was hard-to-manage, yet we were satisfied by the manner in which the World Bank team worked with partners to adapt the intervention strategy and resolve early delivery challenges.

By the time of the project's completion, we were pleased to find that it had generated some early signs of sectoral transformation and impressed by its alignment with the priorities of the Government of Colombia. We are confident that the project played an important role in supporting the Government of Colombia's to increase its commitment to silvopastoral systems in its National Development Plan 2018-22; in its renewed Joint Declaration of Intent with governments of Germany, Norway and the UK; and in its recently enhanced Nationally Determined Contribution.

In its short history, the project successfully lay the foundations for the sustainable transformation for the Colombian livestock sector. Now, the collective challenge is to take the lessons and knowledge generated by the project on 0.26 percent of Colombia's cattle ranching land and apply them at scale. Likewise, it is

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vital that organisations involved with the project work together to maintain and enhance the progress that has been made to ensure an enduring legacy for the project in Colombia. With the right partnerships and commitment, we believe that the outlook for transitioning the livestock sector to sustainability is promising.

Lastly, we would like to thank you and all of the World Bank project team for your diligence and enthusiasm for the project. We look forward to renewing our productive relationship at some point in the future, if the circumstances arise.

Yours sincerely,

Maggie Charnley

Deputy Director, International Climate Finance: Forests, Land Use and Carbon Markets
Department for Business, Energy and Industrial Strategy

E maggie.charnley@beis.gov.uk

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Bogotá, Diciembre 14 de 2020 **OAI 8150-2-101**

Sra.
Luz Diaz Rios
Banco Mundial
1818 H Street N.W.
Washington -DC 20433, USA

Asunto: GEF 4 Colombia Mainstreaming Sustainable Cattle Ranching Project

Estimada Luz,

Agradecemos el envío del documento "Informe de Ejecución, Finalización y Resultados" del Proyecto GEF 4 de Colombia: "*Mainstreaming Sustainable Cattle Ranching Project*" con el fin de hacer algunos comentarios.

En primer lugar, queremos agradecer a los equipos del Banco Mundial y del *Department for Business, Energy and Industrial Strategy, International Climate Finance -BEIS Forests, Land Use and Carbon Markets* del Reino Unido, por su apoyo, acompañamiento y confianza con el desarrollo de este importante proyecto para el país, así como al ejecutor y los socios nacionales que hicieron posible este gran reto durante la última década en línea con los Planes Nacionales de Desarrollo.

En segundo lugar, es de resaltar que el modelo de Ganadería Colombiana Sostenible, es una apuesta conjunta entre el Sector Ambiente y Desarrollo Sostenible y el Sector Agricultura y Desarrollo Rural. De un lado con la institucionalización de la Mesa de Ganadería Colombiana Sostenible y de otra parte con la Estrategia Integral de Control a la deforestación y desarrollo forestal sostenible. Estas estrategias promueven llevar al nivel territorial, alternativas viables económica, social y ambientalmente en ecosistemas estratégicos. Igualmente, se enmarca actualmente en la implementación de los Planes de Desarrollo con Enfoque Territorial-PDET, especialmente en su pilar ambiental el cual promueve proyectos encaminados la reducción a la deforestación y la restauración para la conectividad.

Adicionalmente, es importante mencionar que en línea con el punto VI. sobre Lecciones y Recomendaciones, concordamos con la necesidad de catalizar el cambio transformador en el sector ganadero con un fuerte compromiso conjunto del sector público y privado, y la acción colectiva, que permita escalar la intervención de manera organizada y planificada liberando áreas de la ganadería extensiva y focalizando el desarrollo ganadero donde se puede garantizar la sostenibilidad ambiental y económica, adoptando la zonificación de la frontera agropecuaria para concentrar su producción en sistemas silvopastoriles.

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En el mismo sentido, consideramos que la expansión de la adopción de Sistemas silvopastoriles en Colombia va más allá de demostrar la mayor rentabilidad de estos sistemas, generando instrumentos económicos que les permita superar los costos iniciales. El sector financiero está llamado a entender la lógica de la promoción de dichos instrumentos y sus crecientes retornos en el largo plazo. La combinación correcta de incentivos y desincentivos que mantengan la flexibilidad operativa y técnica para adaptar los Pagos por Servicios Ambientales, de manera simple para que los productores comprendan los beneficios potenciales, es esencial.

Otro de los grandes temas se relaciona con la cualificación de la asistencia técnica con visión de sostenibilidad que debe llegar a los beneficiarios a través de las organizaciones y órganos colectivos para operar en forma de clúster a escala de paisaje en un ejercicio compartido de responsabilidades entre el sector público, sector privado y productores.

Finalmente, los productos de la ganadería sostenible deben contar con un mercado diferenciado y con pagos justos en relación con las inversiones y la cantidad y calidad del producto libre de deforestación. Esta diferenciación se puede potenciar con la generación de desincentivos a la ganadería insostenible en los diferentes eslabones de las cadenas.

Esperamos seguir contando con el apoyo de todos los socios internacionales, nacionales, públicos, privados y gremiales involucrados en este exitoso proyecto con la visión de escalar la intervención hacia otros productores (medianos y grandes) con la visión de transformar todo el sector ganadero y contribuir a sus productividad y reputación basada una cadena libre de deforestación en línea con el Acuerdo Cero Deforestación, en cadenas de carne y leche firmado con el Sector y base estructural para el desarrollo de la NAMA de Ganadería Sostenible en Colombia.

Saludos cordiales,

Firmado digitalmente por: OLARTE AMAYA
DAVID FELIPE
Fecha y hora: 14.12.2020 19:46:37

DAVID FELIPE OLARTE AMAYA

Punto Focal Operativo GEF
Jefe Oficina de Asuntos Internacionales
Ministerio de Ambiente y Desarrollo Sostenible de Colombia

cc: Carlos Correa, Ministro de Ambiente y Desarrollo Sostenible
Francisco Cruz, Viceministro de Políticas y Normalización Ambiental

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Bogotá D.C.

Doctora
LUZ BERANIA DIAZ RIOS
BANCO MUNDIAL
1818 H Street N.W.
Washington -DC 20433, USA

Asunto: GEF 4 Colombia Mainstreaming Sustainable Cattle Ranching Project.

Estimada Luz Berania:

A nombre del Ministerio de Agricultura y Desarrollo Rural, quiero manifestarle nuestros agradecimientos al Banco Mundial, al *Department for Business, Energy and Industrial Strategy, International Climate Finance -BEIS Forests, Land Use and Carbon Markets* del Reino Unido, y al Fondo Medioambiental Global (GEF), por el apoyo técnico y financiero brindado para la implementación del Proyecto GEF 4 de Colombia ***"Mainstreaming Sustainable Cattle Ranching Project"***, implementado en Colombia a través de la Federación Nacional de Ganaderos – FEDEGAN, con el acompañamiento de los Ministerios de Ambiente y Desarrollo Sostenible y de Agricultura y Desarrollo Rural, del CIPAV, TNC y Fondo Acción.

De igual manera, extendemos nuestras felicitaciones por el excelente trabajo realizado, cuyos resultados consideramos muy exitosos, oportunos y dignos de replicar a nivel nacional a través de los diferentes programas que el Ministerio lidera para la modernización y reconversión de las actividades productivas ganaderas hacia sistemas ganaderos climáticamente inteligentes.

Queremos destacar, igualmente, el apoyo brindado a través del Proyecto GEF 4 para el Diseño de la NAMA de Ganadería inscrita, en el año 2015, por el Ministerio de Agricultura y Desarrollo Rural ante la Convención Marco de Naciones Unidas sobre Cambio Climático. Gracias al apoyo, la NAMA de Ganadería es una realidad y hace parte de las medidas priorizadas por el Ministerio para el cumplimiento de los

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compromisos adquiridos por Colombia en el Marco del Acuerdo de París, en materia de Mitigación y Adaptación ante el Cambio Climático.

Finalmente, queremos resaltar la articulación y trabajo conjunto promovido por el Proyecto entre los Ministerios Ambiente y Desarrollo Sostenible y de Agricultura y Desarrollo Rural, en torno a una actividad productiva como la ganadería, que requería cambios fundamentales en su modelo tradicional hacia sistemas productivos sostenibles y climáticamente inteligentes, y que gracias al proyecto GEF 4 contamos con un referente para lograr tan anhelado sueño de modernizar la ganadería colombiana.

Cordialmente,

ANGELO QUINTERO PALACIO
Director de Innovación, Desarrollo Tecnológico y Protección Sanitaria.

Elaboró: N. Lozano

FEDEGAN

Bogotá D.C., 04 de diciembre de 2020

Doctora
LUZ DIAZ RIOS
Gerente proyecto
Banco Mundial
Washington D.C

REF: Respuesta Informe de Cierre de implementación ICR

Respetada Dra. Luz Diaz,

En respuesta a la comunicación recibida referente al Informe de Cierre e Implementación (ICR) por sus siglas de Ingles, número ICR00005139, preparado por el Banco Mundial, sobre el convenio de donación TF-96465 y la financiación adicional incluida en el convenio TF-17041 y luego de haber realizado las revisiones y análisis correspondiente por parte de la alianza conformada por FEDEGAN, CIPAV, The Nature Conservancy y el Fondo Acción, para la ejecución del Proyecto Ganadería Colombiana Sostenible, informamos que en nuestra opinión la calificación dada como Satisfactorio es positiva porque refleja el cumplimiento de todo lo acordado a lo largo del proyecto y en las diferentes misiones de seguimiento del Banco Mundial. Sin embargo, consideramos que el esfuerzo realizado y una serie de logros que desbordan los objetivos cumplidos nos alientan a sugerir respetuosamente que se eleve la calificación del proyecto a la de Altamente Satisfactorio.

Sustentamos la solicitud en las siguientes consideraciones:

1. El proceso de aprendizaje se constituye como lecciones para el país, para otros proyectos futuros de mayor escala en este tipo de implementaciones, referente a las áreas de transformación del uso del suelo (con unos porcentajes de ejecución calificados como sobresalientes) y donde el factor ambiental influye en los indicadores de resultados, impacto y evaluación. Ejemplo de ellos es la implementación de Pagos por Servicios Ambientales (PSA) por Biodiversidad y Carbono, con su escalamiento a PSA a largo plazo donde la empresa privada genera el componente de sostenibilidad a largo plazo, formación de técnicos en 12 departamentos del país, creación y fortalecimiento de red de viveros que permitieron no solo producir 3.5 millones de árboles, sino

Dirección : Calle 37 # 14 - 31 Bogotá D.C. Colombia
Teléfono : (057) 5782020 Fax : (057) 5782102
web : www.fedegan.org.co
e-mail : fedegan@fedegan.org.co

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cerra la brecha de implementación a gran escala y creación y consolidación de verdaderos núcleos dinamizadores en 5 regiones que se han convertido en la piedra angular de la fase de escalamiento.

2. En cuanto a los resultados del proyecto incluidos en los PDO, cuatro de ellos fueron cumplidos más allá de la meta establecida, Áreas bajo sistemas de producción ganadera amigables con el medio ambiente se establecieron en su totalidad con un 20% adicional, Áreas en donde se hayan adoptado prácticas sostenibles de producción se logró un 8% adicional, Aumento de la producción de leche por hectárea se logró con un 70% adicional y Número de fincas ganaderas que se beneficiaron con los instrumentos del Proyecto se cumplió con un 3% adicional.

3. El trabajo técnico-científico; de gestión y articulación institucional dado a la NAMA de Ganadería Sostenible, sitúa a Colombia en el liderazgo internacional de iniciativas frente al cambio climático. En los últimos días el anuncio del compromiso del país para reducir las emisiones de 20 hasta 51% para el 2030 en el Acuerdo de París y con el sector ganadero como uno de los principales actores de ese proceso, demuestra la utilidad e importancia de los productos de la NAMA realizados por el Proyecto Ganadería Colombiana Sostenible que ya tiene en la actualidad y para los próximos años.

4. El reconocimiento del Proyecto Ganadería Colombiana Sostenible por parte de los donantes del Gobierno Británico, como su programa bandero de Cooperación en Colombia y las diferentes manifestaciones de aceptación del mismo son un elemento fundamental que motiva esta solicitud, así como el contemplar una fase de escalamiento para este importante Proyecto.

5. Las lecciones aprendidas y los instrumentos generados son un referente por parte de los actores del MADS y MADR, para la formulación de políticas, programa y proyectos gubernamentales, desde donde se gestó por parte de la Presidencia de la República, la reconversión hacia la ganadería sostenible, como una política de estado precisamente al cierre del proyecto, la implementación de crédito desde FINAGRO y la banca estatal y comercial con líneas verdes y específicas como las líneas LEC de sistemas silvopastoriles.

6. El Proyecto Ganadería Colombiana Sostenible marcó un hito hacia los temas de compensaciones ambientales, la inclusión de los SSP como instrumento válido dado por la ANLA, para la movilización de recursos desde los sectores Minero energéticos y de Infraestructura hacia la conversión en sistemas ganaderos sostenibles.

Dirección : Calle 37 # 14 - 31 Bogotá D.C. Colombia
Teléfono : (057) 5782020 Fax : (057) 5782102
web : www.fedegan.org.co
e-mail : fedegan@fedegan.org.co

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7. Se alineó el SNIA a la creación de un Fondo para la ganadería sostenible con una amplia participación de los aliados y la presencia territorial de departamentos que priorizan la ganadería sostenible como su bandera de cambio, así como la incorporación en la Agencia de Desarrollo Rural de las políticas de ganadería sostenible y los SSP, sobre los cuales el Proyecto Ganadería Colombiana Sostenible generó un referente.

8. El proyecto contribuyo a los cambios transformacionales del sector ganadero hacia la sostenibilidad, con Fedegán como gremio cúpula de la ganadería, el Ministerio de Ambiente y Desarrollo Sostenible, el Ministerio de Agricultura y Desarrollo Rural, el Departamento de Planeación Nacional e Instituciones centrales, con lo que se han desarrollado avances, y sobre lo que se deben desarrollar trabajos en región.

Por todo lo anterior expuesto, le agradecemos considerar especialmente la calificación de Altamente Satisfactorio, como una solicitud válida por parte de esta alianza exitosa que lo implementó. Adicionalmente queremos manifestar nuestros agradecimientos al equipo del Banco Mundial por el apoyo que hemos recibido durante la ejecución del proyecto.

Cordialmente,

JAIME RAFAEL DAZA ALMENDRALES
Secretario General

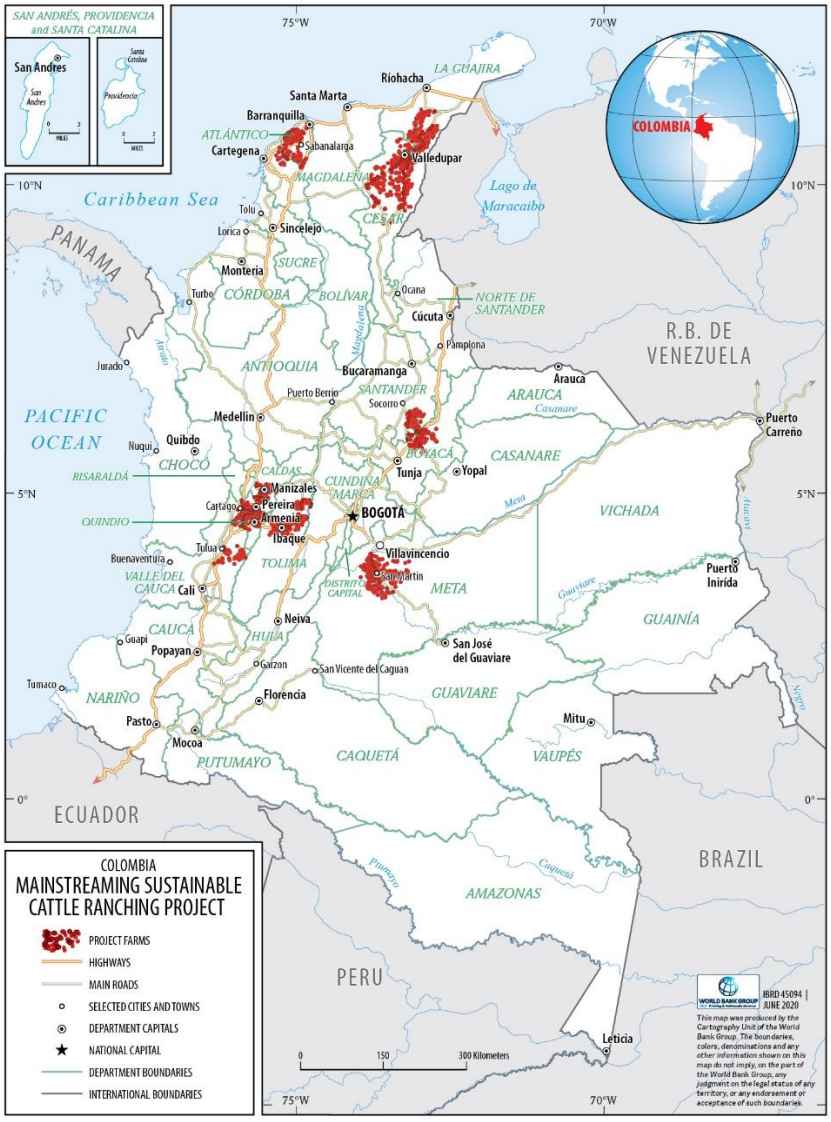
Dirección : Calle 37 # 14 - 31 Bogotá D.C. Colombia
Teléfono : (057) 5782020 Fax : (057) 5782102
web : www.fedegan.org.co
e-mail : fedegan@fedegan.org.co

ANNEX 6. SUPPORTING DOCUMENTS

**All photos presented under this section are property of the CMSCR Project (Proyecto Ganadería Colombiana Sostenible)*

Annex 6.1: CMSCR Project Areas

Map A6.1.1: Locations of CMSCR Interventions



Annex 6.2: CMSCR Project: Extension & Technical Assistance Strategy and PES

A. Extension and TA approaches

1. The Extension Services & Technical Assistance Strategy of the Colombia Mainstreaming Sustainable Colombian Cattle Ranching (CMSCR) project aimed to achieve a cultural change in the beneficiary community by implementing a shared learning process, transforming their traditional cattle-ranching practices towards sustainable production systems. A robust training scheme for regional teams in the field on aspects such as individual and group agricultural extension methods, adult education techniques (andragogy), and knowledge management models based on rural communities is the basis of the strategy. All participating farmers received training and TA focused on establishing SPS and iSPS and implementing good production practices following an integrated management approach that encouraged them to carry out activities for restoration, conservation, and management of natural resources.

2. Beneficiaries participating in the first and second calls received extension and TA through cycles of 5 weeks. Each period began with a two-day theoretical-practical training of the regional teams on a specific topic. Subsequently, the extensionist developed the theme with groups of 56 ranchers. The attention cycle consisted of: (i) personalized visits (individual visit to the farm of each rancher), (ii) Cattle-Ranching Improvement Groups - CRIG (a CRIG was composed of 4 ranchers located within a radius of approximately 7 kilometers), (iii) complete service cycle (personalized visits and meetings of the CRIG made in one period), (iv) trainings to half-attention units (groups of 28 ranchers), and (v) training of Service Unit (group meetings of 56 ranchers). The TA approach evolved for the participants in the third and fourth proposals, to more strategically targeting farmers with technical knowledge needed to undertake sustainable land-use changes.

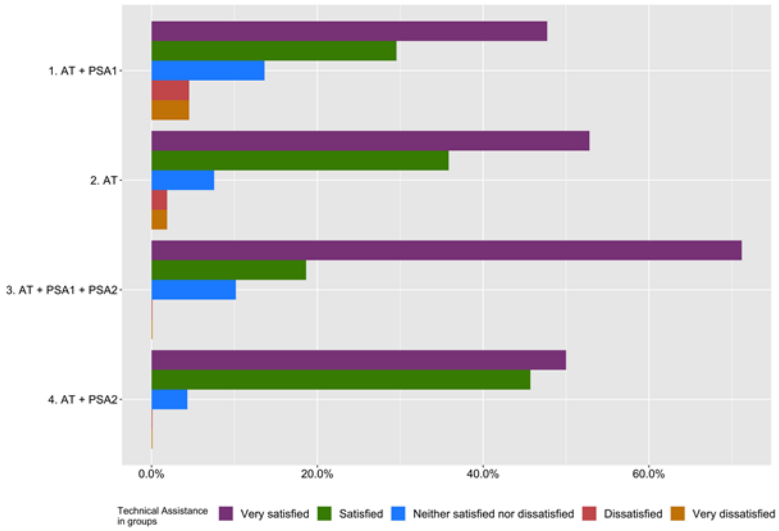
3. The project designed and executed a Training and Information Diffusion Plan – TDP (*Plan de Divulgación y Capacitación*, in Spanish). The plan included methods such as technical brigades, the establishment of regional knowledge networks, exchange workshops and field visits, and the design of SPS courses in alliance with institutions such as the International Center for Tropical Agriculture (CIAT) and the National Training Service (SENA). The projected goal for the TDP was 10,000 people, according to indicators 1.3 and 1.4 of the results framework. In the period between June 2017 and January 2020, 12,204 people were trained by the project under the TDP: 46 percent farmers, 32 percent students, 19 percent technicians, y 3 percent professional trainers. Activities of the training plan included 458 events, approximately 15 per month. Defined by regions, the TDP reached the highest number of people trained in the Coffee Ecoregion, followed by Amazon Foothills, Boyacá-Santander and Cesar River Valley regions, then Orinoquia, Lower Magdalena River Basin, Andina region, Flat Amazon, and the Caribbean regions.

4. The project expanded awareness creation activities to regions where the Government was planning to implement priority Programs, such as in the Amazon and Orinoquia regions. For example, the project supported the Amazon Vision Program and FINAGRO by providing training and information for the development of a financial and productive planning tool that was the basis for the design of an incentive to provide credit access for productive transformation in the Amazon.

The perception survey carried out at project closing highlights the relevance that beneficiaries (benefiting from a combination of instruments) have given to the technical assistance (TA) and the knowledge they have received from the project (Figure A6.2.1 and A6.2.2). When asked their preference for TA or PES, the beneficiaries largely preferred TA support (Figure A6.2.3).

Figure A6.2.1. Beneficiary Perception of the Technical Assistance provided by the Project (by Treatment)

a) TA to groups



b) Individualized TA

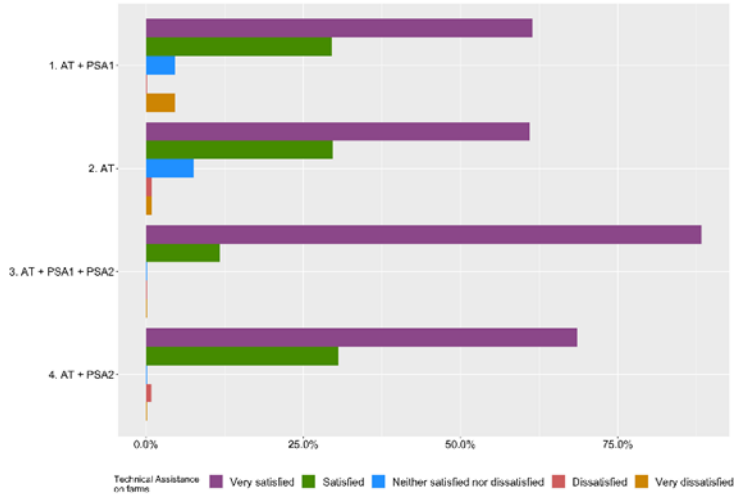


Figure A6.2.2: Beneficiary Perceptions on the most useful Support provided by the Project

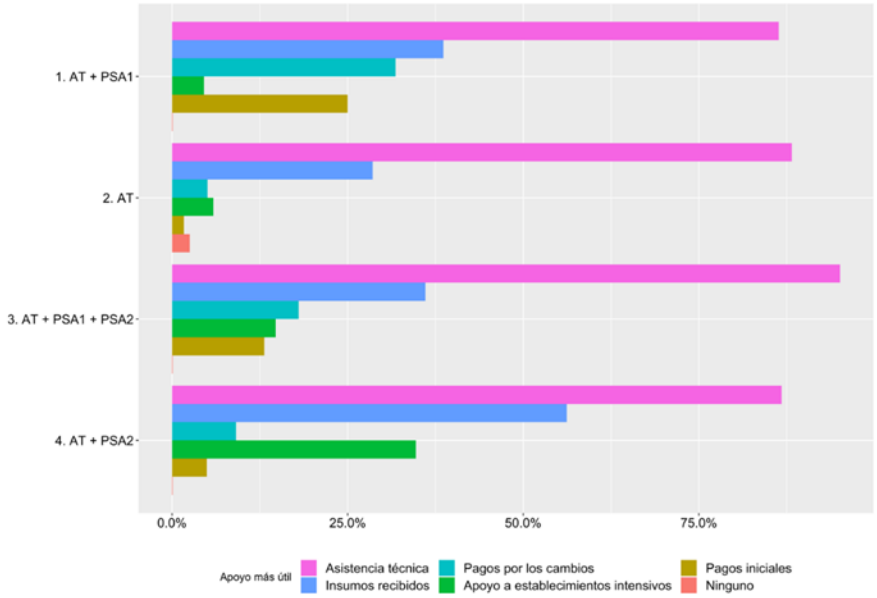
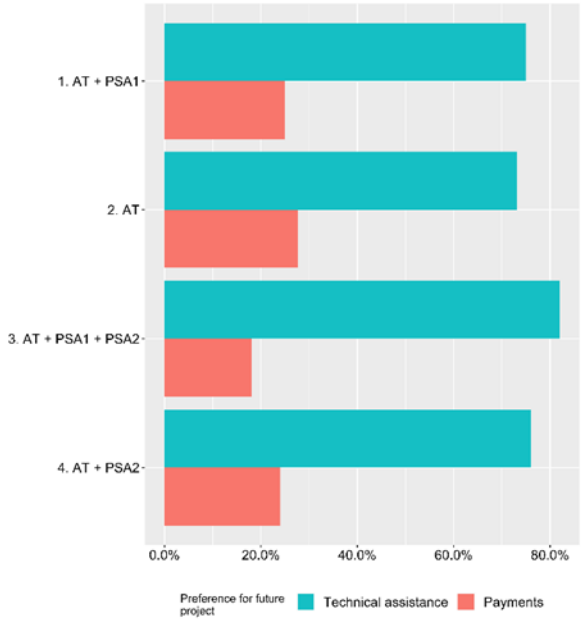


Figure A6.2.3: Beneficiaries Preference for TA or Payments in future Interventions



5. The project also relied on innovative planning and monitoring methods and tools for land transformation. The Participatory Property Planning (*Planification Predial Participativa*—PPP) tool developed by the project supported farmers in integrating and planning farm activities according to their production objectives and land

use transformation goals. The PPP promoted a self-assessment methodology for the sustainability of the production systems by each beneficiary farmer. The tool was applied through an initial assessment of the farm to identify its starting point in relation to 20 sustainability variables (6 environmental, 6 socioeconomic, and 8 productive), followed by the development of short, medium, and long-term farm goals, which were translated into a specific work plan for each farm (Figure A6.2.4).

Figure A6.2.4: Sustainability Criteria: Farm Participatory Planning Tool (PPP)

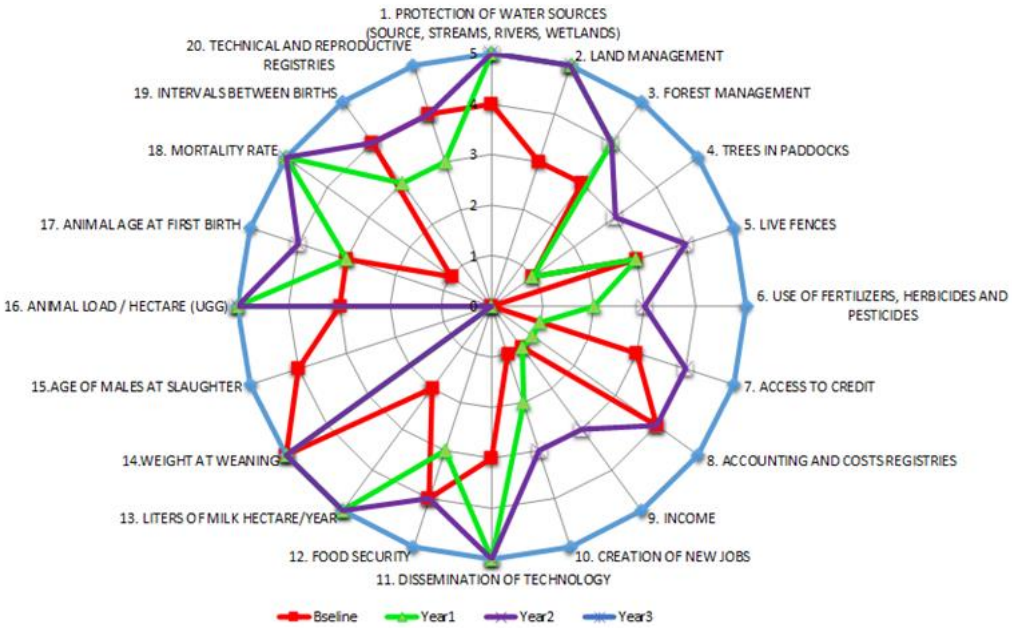
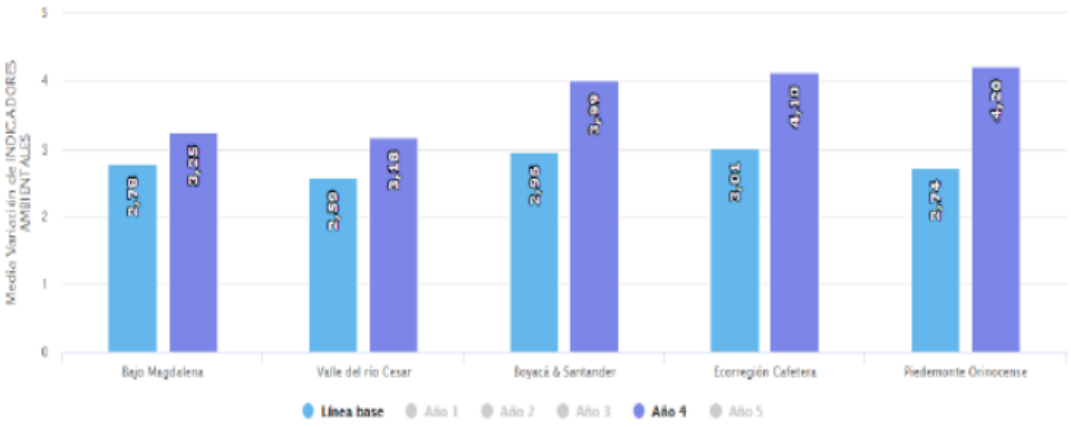
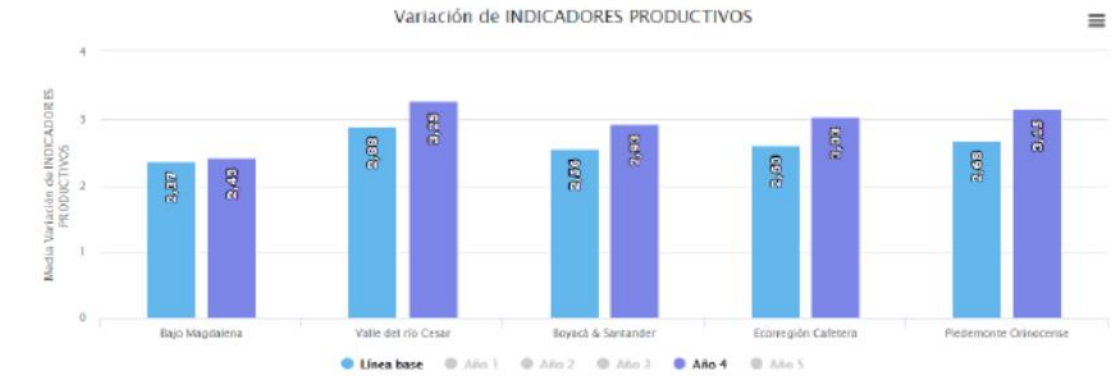
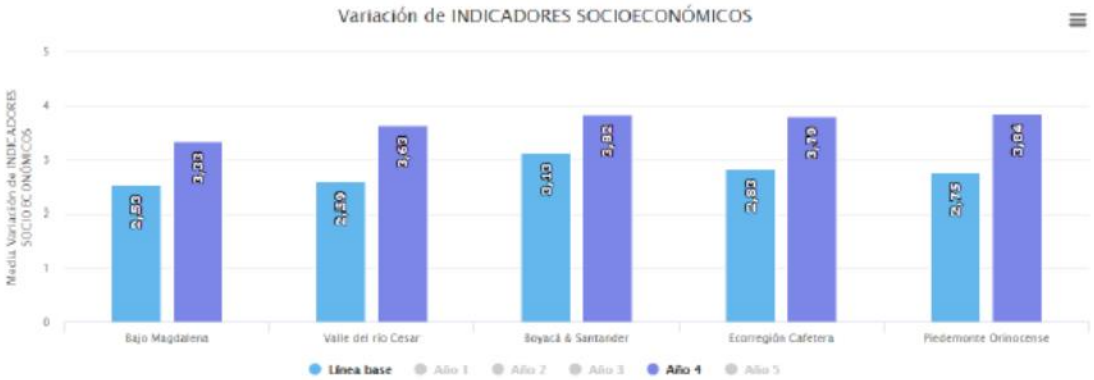


Figure A6.2.5: Variation, per Region, of Scores for Environmental, Productive and Socioeconomic Aspects using the PPP Tool







6. Economies of scale achieved in the extension and TA services were a driver of the project's ability to disseminate knowledge about environment-friendly CR production systems, and thus key to increasing coverage. Project activities to create awareness about the SSP and sources of financing reached 24,416 ranchers, technicians, and professionals, exceeding by 24 percent the established target (Indicator 1.3). This figure included 4,100 ranchers selected to directly benefit from the project via beneficiary engagement calls, around 10,326 producers who visited demonstration farms and 9,990 technical professionals, farmers and others, participating in presentations, promotional events, workshops, forums, congresses, and technology brigades.

7. **The project provided in-depth training to 691 professionals and technicians, (126 percent of the original target).** Some 377 (55 percent) of trained professionals were direct project staff, and 314 (45 percent) externally. Training programs included the design and establishment of sustainable production systems and SPS arrangements as well as the implementation of techniques and methods to support farmers to implement ecological restoration approaches, tree selection for CR production, land-use reporting and geo-referencing tools, among other aspects related to the implementation of good practices to reduce GHG emissions, improve productivity and reduce animal health risks.

8. **Training of children and youth**. Recognizing that shifting CR production patterns to sustainable approaches longer term would require behavioral changes, the project reached out in its final years to school children and youth in rural areas through its Herederos Sostenibles ("future sustainable cattle ranchers") program. Six workshops in rural schools informed 382 participants about the benefits of linking CR with biodiversity conservation, and related publications were produced/distributed to 51 rural schools in the five eco-regions.

Silvopastoral uses promoted by the CMSCR project

9. The project land-conversion effort towards sustainable land uses focuses on five type of silvopastoral arrangements implemented often in combination. The focus was on SPS systems that integrated agroforestry and livestock production, as shown in the table below.

Table A6.2.1: Description of Types of SPS Arrangements promoted by the CMSCR Project

SPS	Type	Function	Comments
Dispersed Trees (LU3)	Non intensive silvopastoral system	Trees established to generate environmental and productive benefits (tree shade, fixation of nitrogen, wood, fruits, firewood and fodder). The trees also function as a leap to biodiversity. The easiest method for implementation is to allow natural regeneration and make a selective control of species that coexist in the pastures, towards conserving the trees with timber value and/or as a source of fruits, seeds and tree shade. Another method would be through planting trees protected by strips with electric double fences	20 to 30 trees per hectare 
Live Fences	Non	Live fences are the most known and used	333 trees per hectare.

(LU5)	intensive silvopastoral system	silvopastoral system. It consists in planting or handling trees and bushes in replacement of dead wooden posts, as well as cement and any other material. Trees are set to high densities and great diversity of species, which in some cases can be fodder. Easy systems for dissemination and usually are established from live stakes and depend on regular pruning for forage formation and utilization. If live fences are not constantly pruned, they can eventually transform into biological corridors, contributing to the conservation of an important portion of biodiversity (facilitating the displacement of wildlife among the forest). As well, windbreak barriers can be designed in single or multiple strips of trees, in one or several strata, and planted with the main purpose of reducing negative effect of winds on pastures and animals; In addition, they can provide fodder, wood, firewood and fruits.	Trees are planted 3 m apart (so trees do not overlap) 
Forage Hedges **(riverside corridors and gallery forests) (LU7)**	Intensive silvopastoral system	Strips of vegetation that protect the water courses and are found along rivers, ravines and streams. The contribution of the riverside corridors to farms and to the region is evidenced in the decreased erosion of banks and sediments in the ravines and rivers, which facilitates the management of aqueducts and avoids or minimizes disasters such as avalanches and floods. Also decreases the negative effect of pesticides and organic pollutants such as animal excreta	
Mixed/multi-species Fodder Banks (LU7)	Intensive silvopastoral system	Crops where herbaceous species, tree and bushes of high nutritional value are associated, in order to obtain high quality forages, rich in proteins, minerals, sugars, fiber and vitamins for animal feeding.	

		Forages produced in a bank are cut, hauled and given to animals throughout the year. These forages are supplied fresh or can be dried to obtain flour and, likewise, ensile. They are associated with species for human consumption, as well as fruit trees and palms.	
Direct pruning through animal foraging (LU7)	Intensive silvopastoral system	Combines pasture with forage bushes in high density and wooden or fruit trees for commercialization, self-consumption and biodiversity protection. This system is also used to care of livestock under rational rotational grazing methods, as well as long rest periods and supply of permanent fresh water in each strip.	Lowland tropics: 5,000 bushes and 100 trees per ha Highland tropics: 2,000 bushes and 100 trees per hectare 

http://ganaderiacolombianasostenible.co/web/index.php/sistemas-silvopastoriles/

Demonstration farms

10. **The implementation of demonstration farms hosted by an influential group of innovative farmers was another key factor in the success of the extension and TA strategy.** This became a vital tool to scale up SPS and involve local farmers in implementing training activities and disseminating the benefits of SSP. The establishment of demonstration farms started in 2014, but was pushed forward through the AF, which included a strategy and specific funding to support the establishment of these demonstration farms, which included different types of production systems and areas for conservation and restoration. A total of 50 demonstration farms established by CIPAV (43 remained up active to the end of the project) and 12 were supported in Meta – Ariari River by TNC, which instructed interested producers on establishing SPS and increasing knowledge about their environmental, productive, and socio-economic benefits. Some demonstration farms were linked to local CR associations to attract and motivate neighboring farms to participate. This strategy created the initial conditions for evolving from demonstration farms to “demonstration landscapes” and promoting transformation processes in other areas. For example, with co-financing from The Nature Conservancy (TNC), the project supported 12 additional demonstration farms in the Ariari River basin that covered 197.6 hectares under conservation-production agreements, including 51.8 ha of SPS, 164.5 ha in-farm aqueducts (acueductos ganaderos) and 24.5 ha of forests and water sources under protection.

https://geo-cipav.maps.arcgis.com/apps/Cascade/index.html?appid=8282d40606044a2c89686d598a4404b3

Demostration Farm La Estancia. Silvopastoral Systems in Highlands for small scale producer with double purpose production system. Belen Municipality, Boyaca.

Demonstration Farm Camagüey. Silvopastoral Systems in Piedmont in the Orinoquia. San Martín, Municipality, Meta Department.

Demonstration Farm Palmarito (external-to support awareness activities in priority areas for the Government of Colombia). Silvopastoral Systems for the Flat Amazonia as a strategy to reduce deforestation. El Retorno Municipality, Guaviare Department.

Water and grasslands management

11. To increase the adoption of sound sustainable practices, the project promoted technologies and good management practices for water and soil. These included the rotation of paddocks, silage technologies for the conservation of fodder, protection of water sources, implementation of in-farm aqueducts, and management of risks associated with climate stress. Project activities resulted in 72.9 percent of farmers adopting practices to protect water sources, 85.6 percent are implementing technologies for the proper management of paddocks, 33.2 percent apply fodder conservation technologies, and 43.4 percent use organic fertilizers, a very high percentage taking into account that national adoption percentages are around 3 percent.

Photo: Ecological restoration in and out watersheds

Photo: Grassland management

Landscape connectivity

Management of plant species

12. Thanks to the project, the country's cattle-ranchers have access to specific technological packages that include proven and particular plant species and varieties according to the characteristics of lowland and highland tropics, flooded zones, and acid soils. As part of TA, the project supported seed and planting of tree species in live fences and arrangements of dispersed trees in paddocks, complemented by natural regeneration processes. Due to the absence of sustained production of plant material essential for the establishment of SPS, the project established a network of 116 plant nurseries (60 located in situ at CR farms, and 56 privately commercially operated). Nurseries supported the propagation of forage species and the incorporation of native tree species, producing around 3.1 million fodder trees delivered to project beneficiary farmers. More than 50 percent of species planted contributed to environmental conservation and connectivity restoration purposes. Also, the project carried out the genetic analysis and built knowledge regarding the contribution of fodder trees such as leucaena (*Leucaena leucocephala*), mexican sunflower (*Tithonia diversifolia*) and tilo (*Sambucus peruviana*) to farm productivity and the reduction of GHG emissions (On this regard, the project produced several technical publications).

https://geo-cipav.maps.arcgis.com/apps/Cascade/index.html?appid=8282d40606044a2c89686d598a4404b3

(i) Seed Banks & Seed Packing & Distribution

(ii) Plant nurseries

(iii) Focal Species (Native)

Anacardium excelsum (Bertero & Balb. ex Kunth) Skeels

Swietenia macrophylla King,

Retrophyllum rospigliosii C.N. Page (Pilg)

Ceroxylon quindiuense (H. Karst.) H. Wendl.

Caryodendron orinocense H. Karst.

Publication: Native Trees for Cattle Ranching Farms: Focal Species of the Sustainable Cattle Ranching Project. *http://www.cipav.org.co/ArbNatPreGan/descargar.php*

Table A6.2.2: Trees of 50 focal species used or conserved in cattle ranching.

Scientific Name	Common Name	Total
Anacardium excelsum (Bertero & Balb. ex Kunth) Skeels	Caracolí	10634
Astronium graveolens Jacq.	Diomate, abejón, quebracho	0
Spondias mombin L.	Hobo, jobo, ciruela, cocote	0
Aspidosperma polyneuron Müll. Arg.	Carreto	4232
Aiphanes horrida (Jacq.) Burret	Palma de corozo	154
Attalea butyracea (Mutis ex L. f.) Wess. Boer	Palma de vino	0
Ceroxylon alpinum Bonpl. ex DC.	Palma de cera cafetera	800
Ceroxylon quindiuense (H. Karst.) H. Wendl.	Palma de cera	430
Copernicia tectorum (Kunth) Mart.	Palma sará	20
Mauritia flexuosa L. f.	Moriche	50
Sabal mauritiiformis (H. Karst.) Griseb. & H. Wendl.	Palma amarga	800
Syagrus sancona H. Karst.	Palma zancona o sarare	91
Crescentia cujete L.	Totumo, calabazo, mate	47136
Tabebuia chrysantha (Jacq.) G. Nicholson	Guayacán amarillo, cañagüate	76039
Tabebuia coralibe Standl.	Lumbre, coralibe	0
Tabebuia rosea (Bertol.) DC.	Guayacán rosado, roble, ocobo	240679
Cordia gerascanthus L.	Móncoro, solera	7520
Terminalia amazonia (J.F. Gmel.) Exell	Macano	3900
Escallonia paniculata (Ruiz & Pav.) Roem. & Schult.	Tíbar, tobo, chilco colorado, rodamonte	38257
Caryodendron orinocense H. Karst.	Cacay	8500
Croton magdalenensis Müll. Arg.	Sangregado, drago	100
Albizia guachapele (Kunth) Dugand	Iguá	79383
Albizia saman (Jacq.) F. Muell.	Samán, algarrobillo, campano	19179
Caesalpinia ebano H. Karst.	Ébano	1757
Enterolobium cyclocarpum (Jacq.) Griseb.	Orejero, caro	280
*Erythrina spp. (*Erythrina poeppigiana (Walp.) O.F.	Cámbulo, cachimbo, písamo,	44714

Cook, *Erythrina fusca* Lour., *Erythrina edulis* Triana ex Micheli)	chachafruto, búcaro o bucare	
Hymenaea courbaril L.	Algarrobo	3083
Inga spp.	Guamos, churimos	8063
Mimosa trianae Benth.	Yopo pelú	280449
Pithecellobium longifolium (Humb. & Bonpl. ex Willd.) Standl.	Suribio, guamo playero, guamo de río, chípero	1825
Quercus humboldtii Bonpl.	Roble	43608
Juglans neotropica Diels	Cedro negro, nogal	11929
Vitex cymosa Bertero ex Spreng.	Aceituno	2560
Lauráceas nativas (*Aiouea, Aniba, Beilschmiedia, Nectandra, Ocotea, Persea* y otros géneros)	Laureles	9835
Cariniana pyriformis Miers	Abarco	3426
Bombacopsis quinata (Jacq.) Dugand	Ceiba tolúa	390
Ceiba pentandra (L.) Gaertn.	Ceiba	55
Sterculia apetala (Jacq.) H. Karst.	Camajón	52
Cedrela montana Moritz ex Turcz.	Cedro de clima frío	31951
Cedrela odorata L.	Cedro, cedro rosado, cedro rojo	43854
Guarea guidonia (L.) Sleumer	Bilibil, trompillo, zambocedro, cedro macho, cartagüeño	0
Swietenia macrophylla King	Caoba	28551
Ficus spp.	Higuerones y lecheros	160
Maclura tinctoria (L.) D. Don ex Steud.	Dinde	10052
Nageia rospigliosii (Pilg.) de Laub.	Pino romerón	471
Podocarpus oleifolius D. Don ex Lamb.	Pino colombiano	1390
Chrysophyllum argenteum Jacq.	Caimo morado, caimito	336
Pouteria sapota (Jacq.) H.E. Moore & Stearn	Sapote costeño	50
Pourouma cecropiifolia Mart.	Caimarón	614
Bulnesia carrapo Killip & Dugand	Guayacán carrapo, guayacán de bola, guayacán blanco	3240

B. Payment for Environmental Services

13. The project piloted a range of Payment for Environmental Services (PES) schemes, as follows:

(i) **PES1-Biodiversity Schemes.** Eligible cattle ranching farms in the five Project areas could qualify for short-term payments if they voluntarily entered into PES contracts that reflected land use planning agreements reached with the Project. Under this PES scheme, which was based on that used in the previous ISEAM project, farmers received payments based on the difference in ESI points between the initial land use and the silvopastoral use they adopted, so that payments were proportional to the expected increase in environmental services. Land use changes in priority connectivity corridors and/or that used native species received bonuses. These payments were made after verification in the field that farmers had

effectively adopted the proposed land uses. Farmers also received an initial payment based on their baseline ESI points. Environmental Services Index (ESI) used is described in the table below.

Table B6.2.1: Environmental Services Index (ESI) for PES1 scheme

			Additional ES points	
No	*Land Use*	*ES Score**	*Location in Connectivity Corridors*	*Use of* native species
1	Mature forests and private wetlands	100	0	0
2	Secondary forests	95	0	0
3	Pastures with high tree density and managed ecological succession	70	10	10
4	Agroforestry crops (at least 2 strata)	55	20	10
5	Live fences and wind barriers	50	10	10
6	Agricultural and livestock lands with over 80% vegetative cover	10	0	10
7	iSPS: including MFB w/ and w/o woody species	70	0	10
8	Other agricultural and livestock practices (temporary crops, forest plantations)	0	0	10
9	Degraded soils and degraded pastures	0	0	0

(ii) PES2-Carbon Scheme. The payment for environmental services scheme 2 (PES2) was a pilot instrument created to promote the establishment of intensive silvo-pastoral systems (iSPS) by small and medium scale producers[18]. The PES2 scheme, as defined in the project paper for the AF, provided ex-post payments for environmental services, represented in annual payments of up to US$200 per hectare converted to iSPS, for a maximum of three years and for a maximum of 5 hectares converted per beneficiary. In other words, if a farmer converted more than 5 hectares, he/she would not receive benefits from scaling-up beyond the defined ceiling of 5 hectares. The ex-post payments were preceded by upfront in-kind support equivalent to US$600 per beneficiary farmer, independent of the converted area, which would represent an initial incentive to motivate farmers to start moving into conversion. The implementation experience of the project demonstrated that such proposed distribution of project support did not constitute sufficient incentive to motivate farmers to initiate the conversion or conduct it at scale. Furthermore, the short implementation period of the Additional Financing phase did not provide enough space for farmers undertaking conversion, to fully benefit from the three proposed annual payments per hectare converted. The scheme was, therefore, adjusted in the restructuring that took place in 2017, to provide a higher level of up-front support to compensate for the high costs of conversion to iSPS. The adjusted scheme provided the in-kind support (equivalent to US$450) per hectare converted, up to a total of 10 hectares per beneficiary, plus a single post payment of up to US$150/ hectare (paid a year later after conversion has taken place). The up-front, in-kind support was to include

[18] The project had initially planned to rely on credit provided by FINAGRO to encourage adoption of iSPS and help farmers finance the initial investments, and a dedicated contract modality was developed in cooperation with FINAGRO. However, several factors constrained access by farmers to Finagro's credit incentive.

the same types of goods and services as in the original scheme, but support would also be expanded to cover land preparation.

(iii) ***Payments for Water services (Long-term PES).*** Some environmentally-desirable land use changes require long-term payments. Short-terms payments and other forms of temporary support can induce the adoption of productive practices such as silvopastoral practices, but they have a much-limited impact on inducing of land uses whose primary functions are protective. For such land uses to be adopted, long-term payments are needed. Such payments cannot be financed from grants, however. The project thus worked to develop pilot long-term PES schemes in areas that are important for water services, as water users have an incentive to provide such long-term payments. Several potential long-terms schemes were developed, and one is now under implementation (see Box A6.2.1).

Box B.6.2.1 Long-term PES Pilot: The Agua Vivo Cuenca water fund

In Caldas Department, the CMSCR Project piloted the design and implementation of a long-term PES scheme to operate at the local level, with long-term funding provided by the environmental service users. The project developed a scheme that would compensate producers for establishing SPS that protected watersheds and benefited the downstream water users. This scheme worked through the establishment of a water fund, partially capitalized by the savings from a reduction in the cost of treating water flowing through the local aqueduct, owing to the wide adoption of SPS in riverine areas. The Agua Vivo Cuenca water fund was implemented through a partnership between private and public institutions such as *Aguas de Manizales*, EMAS CHEC, and *Corpocaldas* in the Chinchina River watershed, which supplies drinking water to the city of Manizales. The project developed the operating manual for the PES payments, created the hydrological monitoring plan, and designed a protocol for monitoring land-use changes. Unfortunately, a new national government degree compromised the successful implementation of the *Agua Vivo Cuenca* fund by stipulating that all participants in PES schemes must pay the same amount. Building on the lessons learned from PES implementation worldwide, the Manizales scheme had planned to offer differentiated payments tailored to the value generated and costs incurred by each participant. In complying with this new decree, the water fund experienced lower than expected participation rates, which limit its ability to support SPS adoption.

Annex 6.3: Monitoring and Evaluation System

1. The Monitoring and Evaluation System (MES) offered information on results of measurable and reportable indicators (management, process, results, and impact) useful to improve project's strategies and systemize learning at all different scales. The main tools included were:

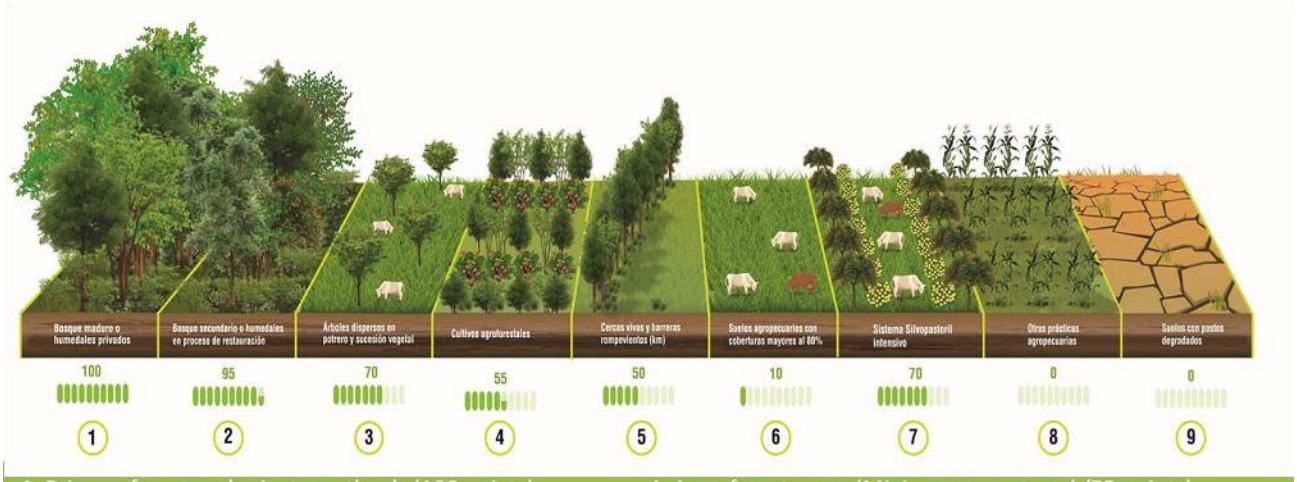
(i) Land-Use Monitoring & Results: The project designed the land-use monitoring system, which helped to evaluate land-use changes at farm level attributable to the project interventions and also constituted a tool to calculate the payments to be received by farmers based on a number points assigned to each land-use type. To generate unified criteria for regional identification, a land use manual was designed including the nine land-use types and 21 subtypes defined by the project as well as the points assigned to each of them[19] (Figure A6.3.1).

2. To monitor land uses the project implemented two methodologies: the full geo-referencing methodology (FULL) and the self-reporting methodology (AUTO):

- **The full methodology** consisted of geo-referencing the properties and land uses and capturing of information directly in the field from spatial analysis elements such as polygons and polylines. Based on this methodology the project defined the minimum amounts for payments in the PES-1 strategy, taking into account that the minimum areas and lengths of measurement should be 1,500 square meters (m2) for polygons and 15 meters for linear arrangements. Using this methodology during the years 2012 and 2013 the project undertook the first baseline surveys of 860 properties located in the PES-1 areas. However, despite the fact that the information collected had good precision and quality, the long time in the field for the surveys generated delays in farmer's payments to farmers, demanding the implementation of a new methodology "AUTO".
- **The self-reporting methodology** was based on a survey and was also carried out by Fedegan extension agents, who together with the ranchers prepared an illustrated sketch of the land uses that were found, indicating the area (hectares) and lengths (meters) of the production arrangements. The sketch made was signed by the extension agent and by the rancher, as a way to certify that the information contained therein was an acceptable approximation of the reality of his farm. The information collected was consolidated in Excel under the same information collection structure used in the FULL methodology. The AUTO methodology was applied for the baseline survey and verification of all the properties, except the properties that were initially raised with the FULL methodology.

[19]Additionally, the Project defined a 10 type of land-use representing the farm area occupied by infrastructure.

Figure A6.3.1: Land-use types defined and punctuation assigned for calculation of PES



1. Primary forest and private wetlands (100 points)
   - Mature Forest
   - Private wetlands
   - Riparian Forest
   - Wasteland vegetation

2- Secondary forest (95 points)
   - Secondary forest
   - Private wetlands
   - Riparian Forest
   - Paramo

3. Dispersed trees in pasture lands and vegetal succession (regeneration) (75 points)
   - Trees scattered in pasture
   - Plant succession (stubble)
   - Private wetlands
   - Riparian Forest
   - Paramo

4. Agro-forest crops (Minimum two strata) (55 points)
5. Live fences and natural wind breaks (km) (50 points)
6. Agriculture lands (>80% cover) (10 points)
   - Enhanced and natural pastures
   - Perennial and semi-perennial crops (coffee, banana)
   - Paramo
   - Natural savannahs

7. Intensive sylvopastoral systems iSSP (>5.000 trees or shrubs/ha) (70 points)
   - iSSP (> 5,000 trees or shrubs ha)
   - Mixed forage banks
   - Feed hedges

8. Other agriculture practices (0 points)
   - Transitory crops
   - Forest plantations

9. Degraded pasture-lands (0 points)

Table A6.3.1: Sustainable Land Use (%) in CMSCR Project Areas between Baseline and Final Verification

LU	Land use (LU)	At baseline (ha)	At last verification (ha)	Δ Change (ha)
LU6	Agricultural lands>80%	63978	47088	-22853
LU9	Degraded soils	5499	2713	-2786
LU3	Dispersed trees in pasturelands, and regeneration	38307	58840	20533
LU4	Agroforestry crops	289	342	53
LU5	Live Fences*	4975	18192	13217
LU7	Intensive silvopastoral systems	310	4950**	4640
LU1	Primary forest, private wetlands	5884	5870	-14
LU2	Secondary forest	12367	12708	341
LU8	Other agricultural practices (transitory crops, plantation forests)	4225	4192	-33
LU0	infrastructure	868	987	119

* Live Fences: considering the lineal nature of this agroforestry arrangement, it is no added to the total land area.
** The table presents hectares planted and consolidated.
Uses LU3, LU5 and LU7 were the SPS uses promoted by the CMSCR project.

Figure A6.3.2: Regional Distribution of Area converted to SPS under the CMSCR Project

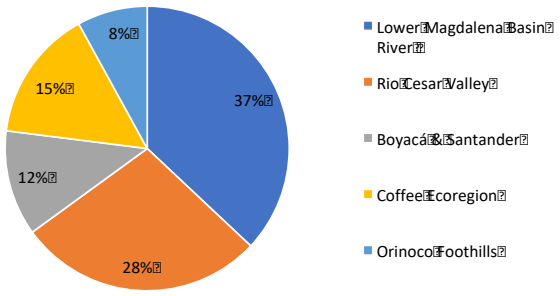


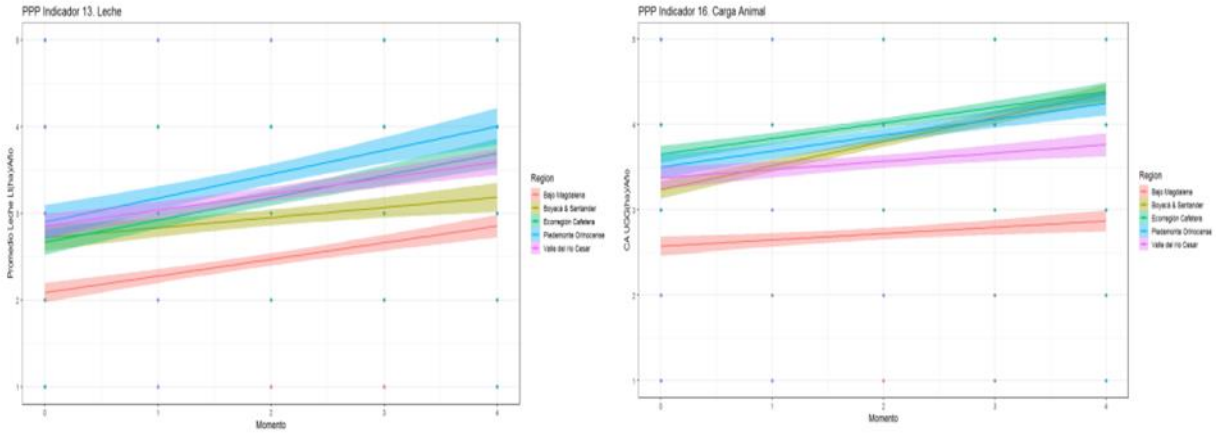
Table A6.3.2: Number of Beneficiary Farms, CMSCR Project, by Region and average Farm Size

Region	Number of farms	Average farm area (ha)
Lower Magdalena River Basin	608	16
Boyacá and Santander (linked to the Andean Oak Forest Corridor)	705	14
Coffee Ecoregion	1,169	40
Low foothill region in the eastern cordillera of Southern Meta (Orinoquía Region)	684	51
Cesar River Valley	934	63
Total	4,100	39

(ii) **Productivity monitoring**

3. **Monitoring of sustainability indicators, including productivity.** Through the Participatory Property Planning (PPP) tool described earlier, the project followed up on the dynamics of productivity variables (measured at five moments during the project implementation period). The systematic analysis of data, including the last reporting, shows that in all regions, improvement in milk production (liters/ha/year) were observed, reaching an average of 29 percent, in the case of stocking rates (UGG/ha /year) the average increase was estimated at 21.9 percent.

Figure A6.3.3: Productivity Improvements (Left milk production liter/ha/year; Right stocking rates UGG/ha/year)



4. **In-depth assessment of productivity (quasi-experimental approach).** Productivity improvements as a result of different SPS arrangements were measured through an exercise based on a probabilistic sample of 101 farms selected across the 5 project regions (control lots were identified within each farm which received traditional management methods). The production variables measured included milk production (quantity/quality) and stocking rates. Data were collected from sample farms twice per year (to account for seasonal effects on productivity) over three years (2016, 2017, 2018), the results are the following:

- Stocking rates were 32.6 percent higher in parcels with SPS than those without SPS system (Standard error of 2.04 percent)
- Milk productivity increased 24.4 percent (Standard error of 3.09%)
- Biomass increases were 6.47 percent higher in parcels with SPS.

5. A more robust statistical analysis[20] of the data set from the quasi-experimental evaluation of SPS arrangements on productivity confirm the positive impacts reported above. Milk yield/cow/day and milk yield/ha

[20] A background analysis was commissioned by the World Bank on the data emerging from the quasi experimental exercise on productivity. A total of thirteen variables associated with milk yield, milk quality, feed quality and biomass quality were analyzed using Linear Mixed-Effects and Generalized Linear Mixed-Effects Models introducing the Farm as random variable.

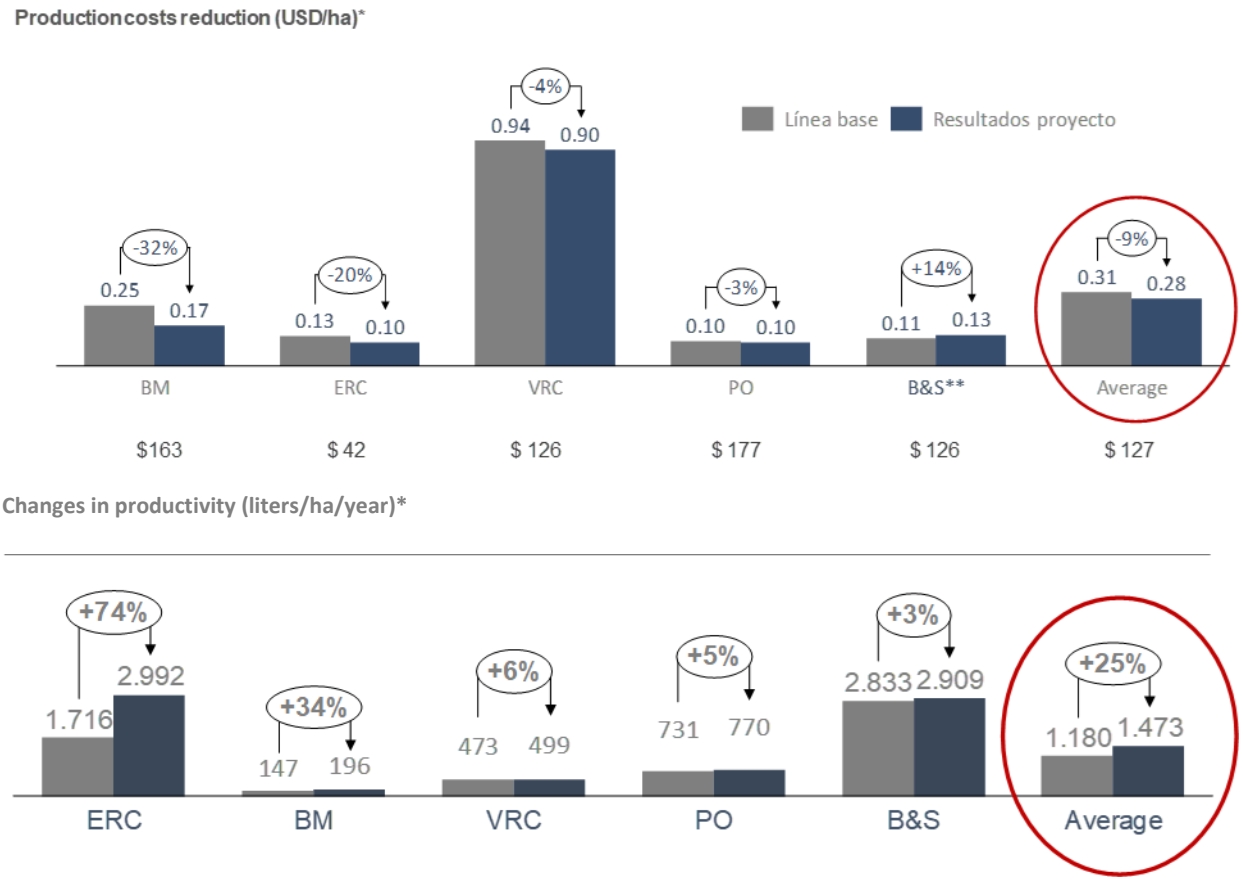
/day show positive impacts for land uses LU5 (Live fences) and UT7 (iSPS), and these impacts have different magnitudes across project regions. In terms of milk quality, the results showed positive results for total solids, with significant differences for UT5 compare with controls. For feed quality, main quality variables were positively affected by the land use treatments, for variables Crude Protein and Neutral Detergent Fiber, the effects are at higher and lower values, respectively, for uses UT7 and UT5, showing a great potential of these SPS arrangements to improving the diets of the animals by increasing digestibility of the forages. The result on biomass yield showed only significant differences and considerable higher biomass yield in the UT7 which demonstrate the high potential of this land use to enhance productivity.[21] In the case of the UT3, results do not show significant differences for LU3, which diverge from the results obtained from the analysis of the data using average comparisons at 90 percent confidence interval, which demonstrates a positive variation of 13 percent on biomass per hectare for LU3 versus control parcels. Furthermore, it was observed that forage quality and quantity in areas under the influence of the established trees (LU3) increased by 10 percent in comparison with forage areas without tree influence.

6. An analysis of total protein per hectare (applying a linear regression model), comparing the with and without situation, based on data from the socio-economic surveys (carry out at baseline and endline), suggest the project had a positive impact by indirect relations in terms of supplementation, reproductive management and some managerial capacity scores like the use and comprehensiveness of the record keeping systems, suggesting that project extension activities could have positively affected these management factors. Regarding links between land uses and total protein, the analyses showed positive impacts on productivity for UT5 and UT7, but with no clear effects on LU3 (dispersed trees).

7. **Business case.** The World Bank commissioned a study[22] to assess the profitability of SPS systems versus traditional production by archetypes/region and associated with the specific land use changes promoted by the project. Average cost reduction was estimated at 9 percent attributed to improved animal nutrition, productivity, and fertility and lower incidence of animal death and disease and average productivity gains in average milk production increases in liters/ha/year were estimated at 25 percent.

[21] As the sample was proportional to the land uses of the project, therefore, the sample unit for UT7 (iSPS) was small for all variables analyzed, which limited the possibility of reaching robust conclusions.
[22] Commissioned by the World Bank from Technoserve; see http://documents.worldbank.org/curated/en/324381569396107123/Mainstreaming-Sustainable-Cattle-Ranching-Project-Business-Case.

Figure A6.3.3: Costs and Production Improvements from SPS



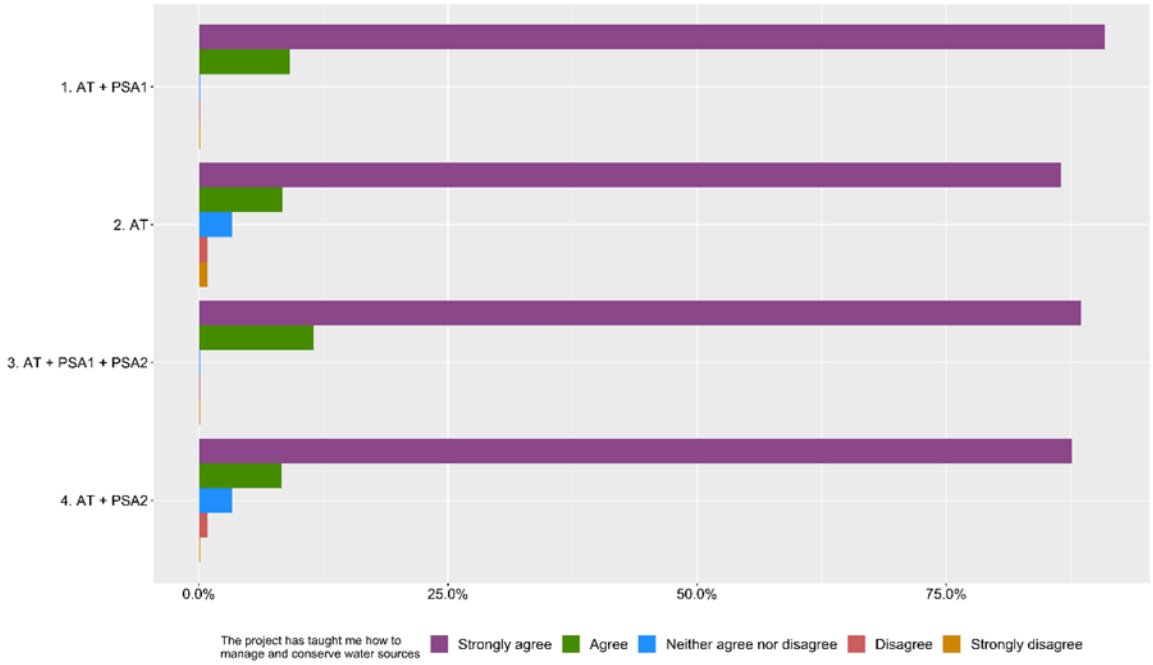
8. **Carbon and biodiversity monitoring**. The project monitor and assessed the effects of silvopastoral systems on conservation of natural ecosystems activities on the presence of fauna and flora in each of the project's regions as well as the effects of land conversion on carbon capture (See Annex 6.6 for details).

9. **Socioeconomic monitoring.** This survey was implemented to evaluate socioeconomic trends of the participating farmers and assess accomplishment of goals and objectives set by the project. It includes general information on farms, characteristics of the composition and management of cattle ranching, pasture management practices, and other variables related to productivity and animal health, as well as environmental, social and financial information. These surveys were applied among project beneficiaries at the baseline and also at the end-line. The discussion is presented in Annex 8.

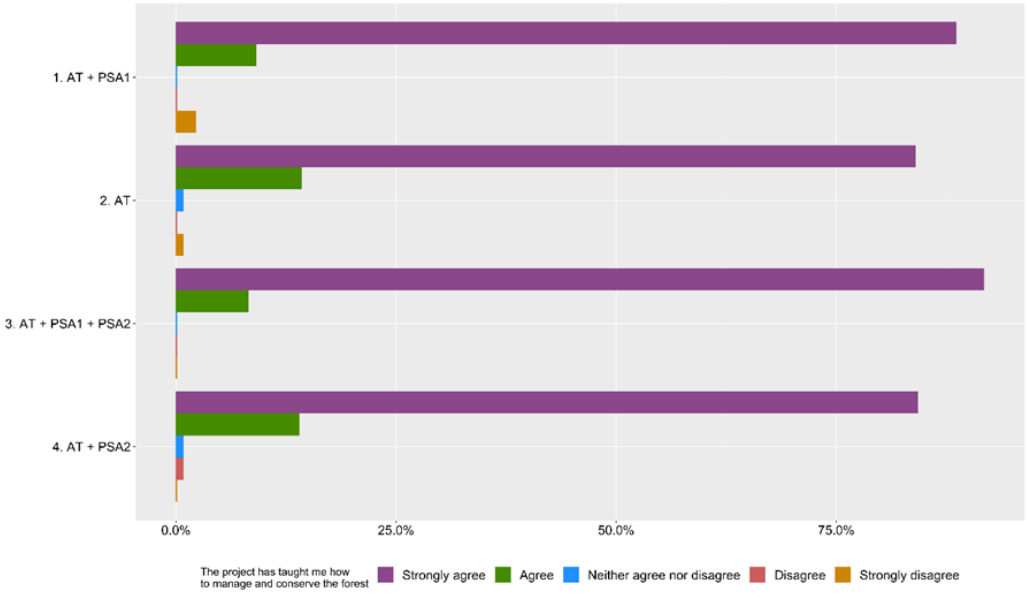
10. **Perception survey.** An analysis of participant perceptions was undertaken at the endline, with the objective of documenting motivations to undertake land-use changes, as well as perceptions about environmental practices and socioeconomic benefits, and to record levels of satisfaction with the project. This survey was applied to 685 farms. Main results include the following:

Figure A6.3.4: Results of Perception Survey (Highlights)

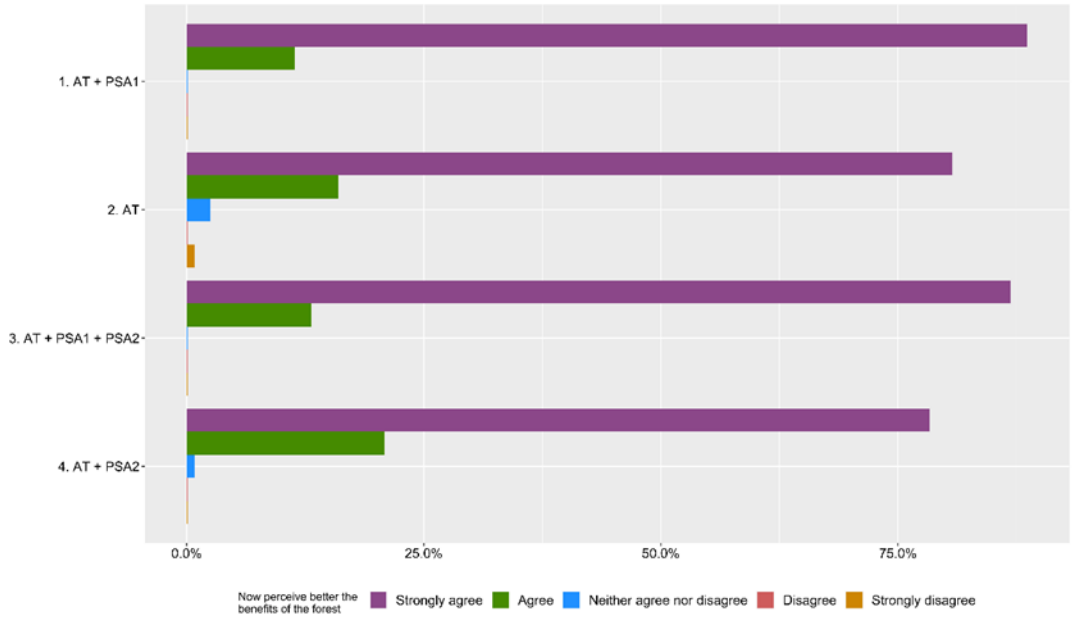
(a) *Perceptions of learning regarding water management and conservation as result of participating in the Project (per Treatment)*



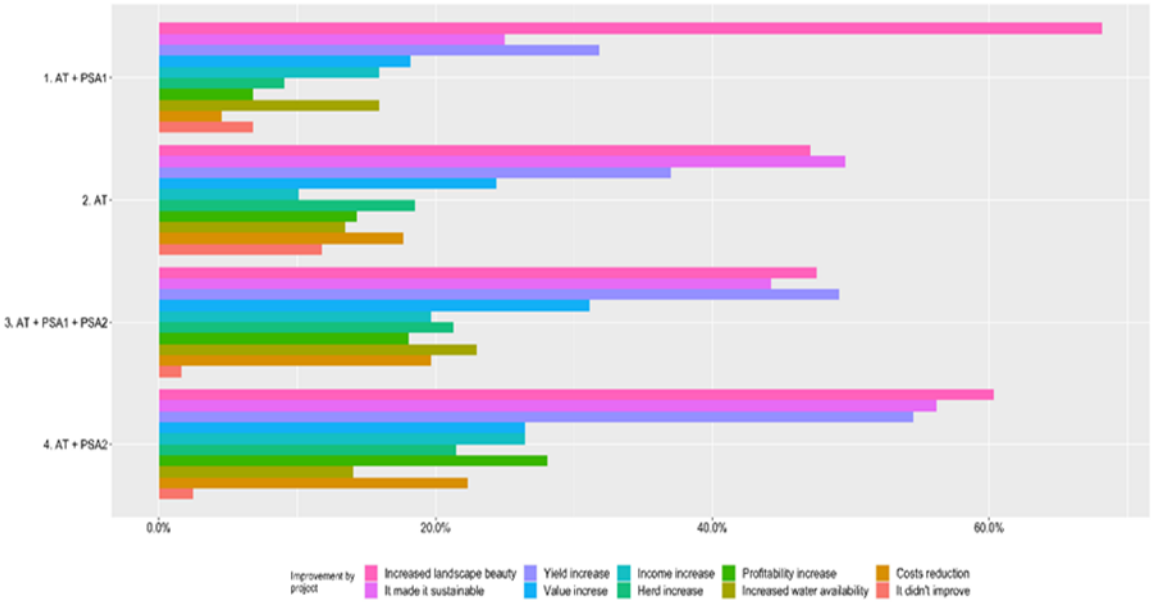
(b) *Perception of learning regarding Forest Management and Conservation as a result of participating in the Project (per Treatment)*



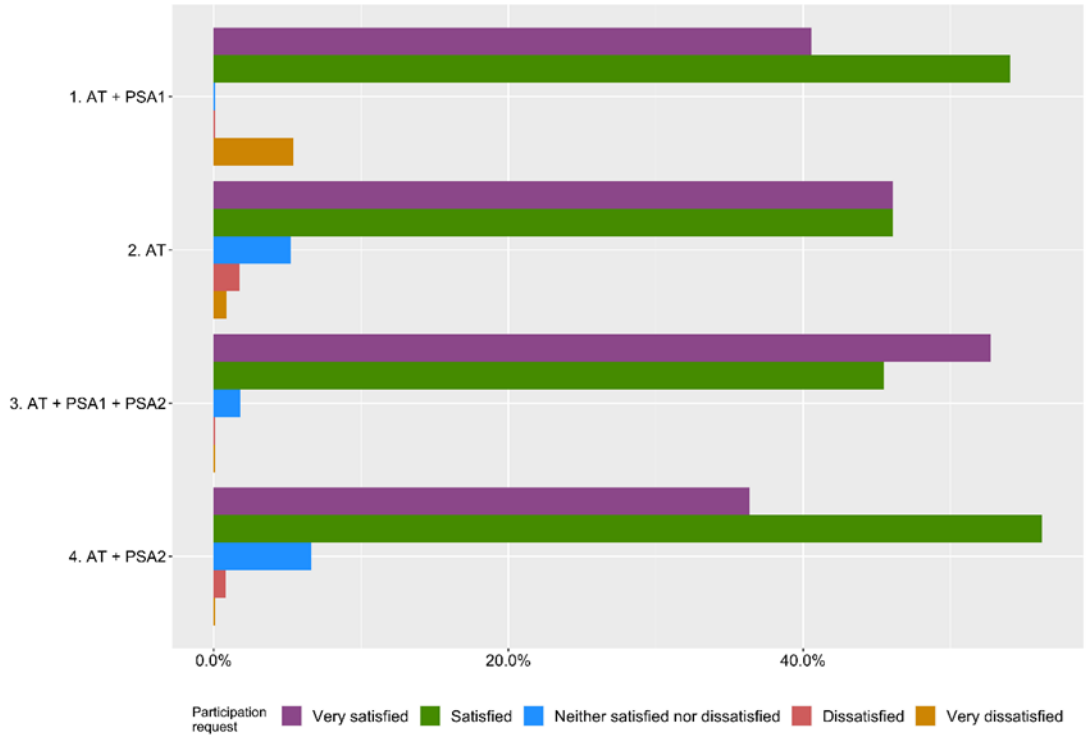
(c) *Perception of improvements in the perception of the benefits of the forest as a result of the project*



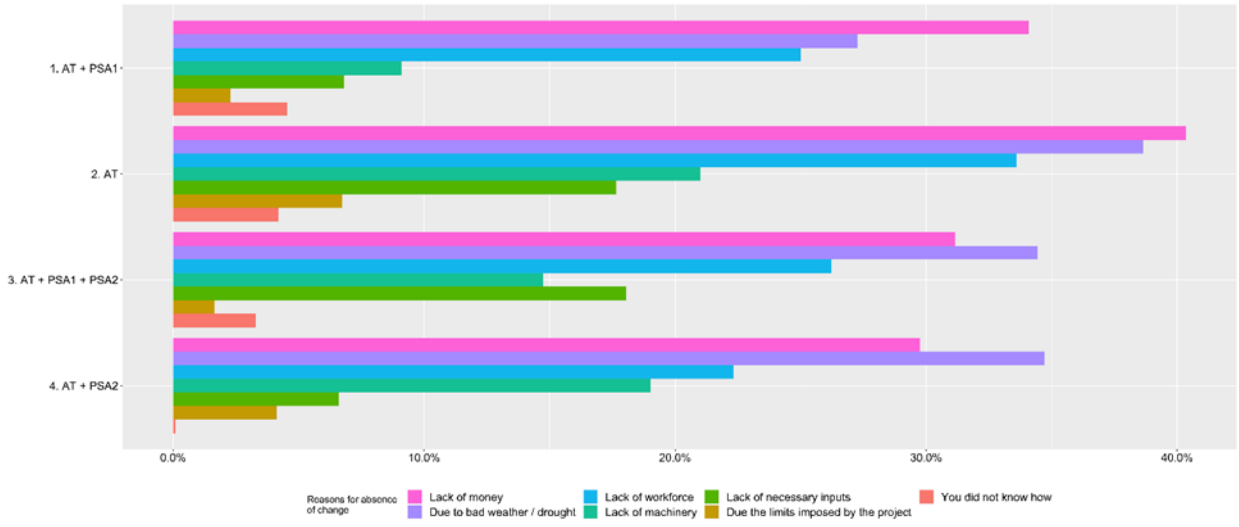
(d)*Perception of the benefits generated by the Project, by treatment*



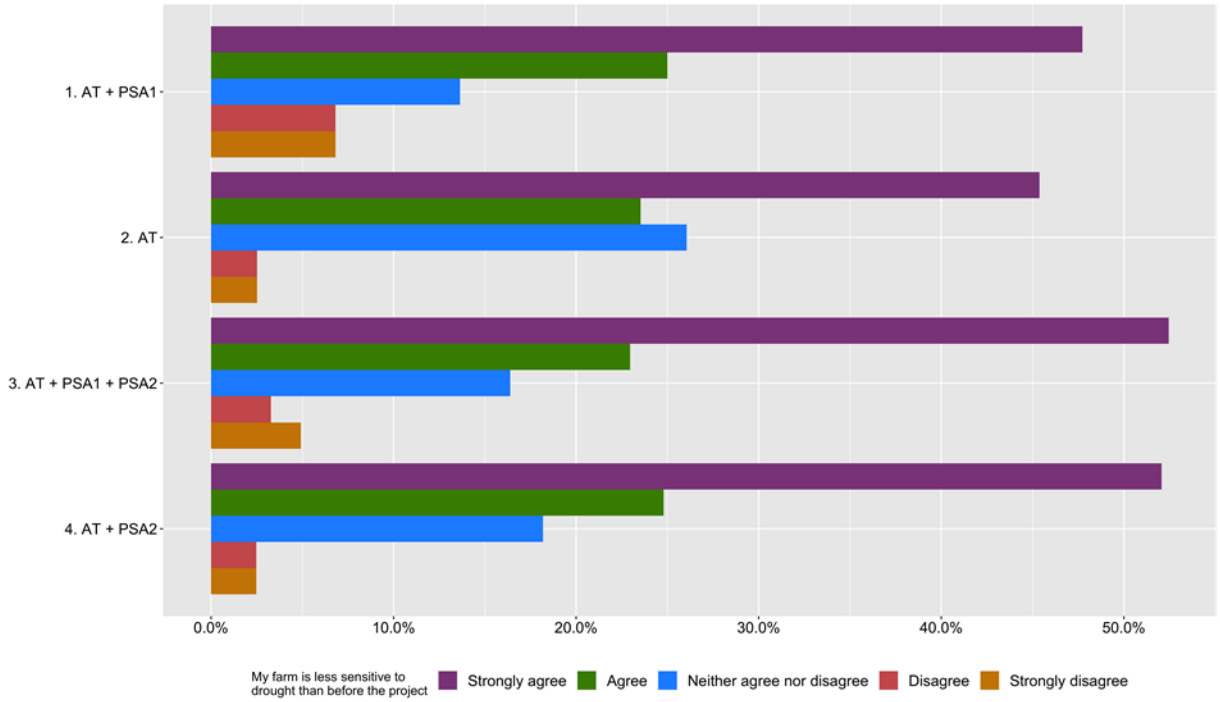
(e) *Satisfaction of participating in the project by treatment*



(f) *Perceptions of the reasons for not adopting SPS systems*



(g) *Perception of the reduction in the impacts of droughts after participating in the Project*



Annex 6.4: Carbon and Biodiversity Monitoring

A. Biodiversity Monitoring/Mainstreaming

1. Biodiversity loss is a major threat to nature and the services it provides affecting humans and their well-being. Habitat fragmentation due to agricultural practices puts biodiversity in jeopardy by negatively affecting species and their intrincate relationships. There is an urgent need to mainstream biodiversity into the productive landscapes and different efforts are being conducted[23] for this, thus contributing to the general knowledge of the discipline. Agricultural production and biodiversity conservation have been considered antagonistic[24] though both can be benefitted with increased understanding of the underlying relationships between both, which is the focus of the Colombia Mainstreaming Sustainable Cattle Ranching Project.

2. A science-based protocol for biodiversity monitoring was proposed for the project[25] to verify changes promoted by the silvopastoral interventions on biodiversity and to quantify services provided to the cattle systems. The elements selected to be monitored were vegetation, beetles, birds and bats with differentiated methods of information capture. Information on biological collections have been provided[26]. An index for environmental services was improved based on a previous experience[27] that measured natural coverage among soils with degraded grasslands (0) to climax forest or wetlands (100) valuing intermediate states with habitat improvements. Biodiversity monitoring was carried out by CIPAV at the site based on the farm, and by TNC at the ecosystem level based on the landscape scales. The variables evaluated changes in biodiversity levels (in plants, dung beetles and birds) when implementing different arrangements of silvopastoral systems. Methods for biodiversity monitoring were based on abundance, density and richness for both plants and animals, coverage for plants and also functional guides for additional animals.

On-farm monitoring

3. The Project carried out soil-scale biodiversity monitoring from the use of three indicator groups: plants, beetles and birds. Monitoring was carried out in the five regions defined by the Project: Coffee Ecoregion, Bajo Magdalena, Valle del Río Cesar, Piedemonte Orinocense and Boyacá-Santander. The following variables were used for each indicator group:

[23] Blanco-Garcia A., Diaz-Rodriguez B., Gomez-Romero M., Lindig-Cisneros R., 2012. Filling the Gap: Restoration of Biodiversity for Conservation in Productive Forest Landscapes. Ecological Engineering. Volume 40. Pp 88-94.*https://doi.org/10.1016/j.ecoleng.2011.12.017*

[24] Seppelt R., Beckmann M., Ceasu S., Cord A., Gerstner K., Gurevitch J., Kambach S., Klotz S., Mendenhall C., Phillips H., et al. 2016. Harmonizing Biodiversity Conservation and Productivity in the Context of Increasing Demands on Lanscapes. BioScience. Volume 66. Issue 10. Pp. 890-896. *https://doi.org/10.1093/biosci/biw004*

[25] Lizcano D., Proyecto Ganadería Colombiana Sostenible. Monitoreo de la Biodiversidad en el Proyecto Ganadería Colombiana Sostenible – Protocolo de monitoreo de biodiversidad en sistemas ganaderos sostenibles. The Nature Conservancy. *https://tnc.app.box.com/s/i566dxccip2pqct1gwg8lwz6tp7r115v*

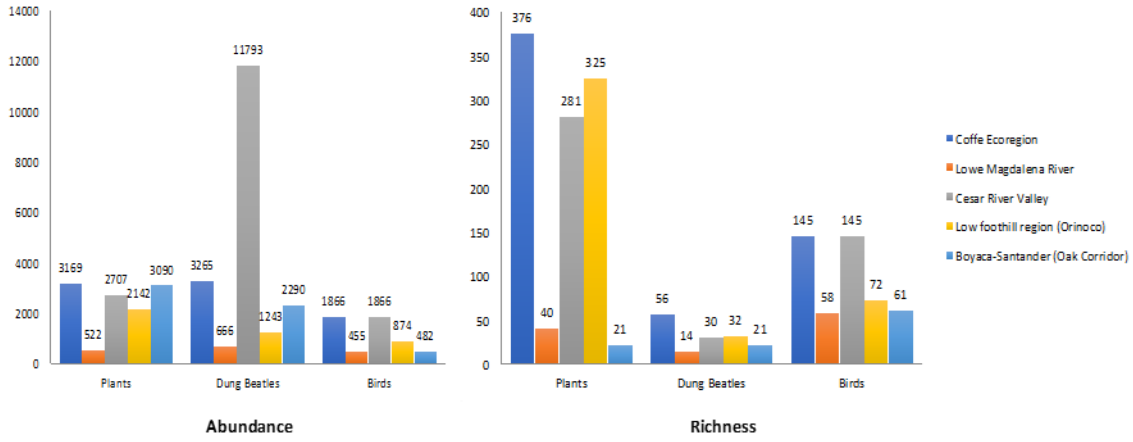
[26] The Nature Conservancy. Plantilla de Registros 3.4. Escarabajos Unillanos. Sistema de Informacion sobre Biodiversidad de Colombia. *https://tnc.app.box.com/s/n6vyu5mblrvvua88f3cskhvssq1ouek1*

[27] Enfoques silvopastoriles integrados para el manejo de ecosistemas (Regional Project), developed between 2002 and 2007.

Vegetation	Dung beetles and birds
Number of species per plot - Density of foliar strata - Soil coverage - Canopy coverage - Stem density - Diameter and height distribution	Richness - Abundance - Diversity (q0, q1, q2) - Functional groups

4. The information collected in different farms in the five regions showed that the small fragments of forest and the riparian corridors are fundamental to conserve the species of plants, dung beetles and native birds of each studied region. However, it was also shown that ecological rehabilitation based on silvopastoral systems (in their different modalities), generates greater habitat heterogeneity which contributes to maintaining mixed assemblages of species, including species from natural systems and open areas. Silvopastoral systems efficiently complement the biodiversity conservation function of forests and together contribute to the recovery of local fauna and flora in the areas of livestock use in each region. Project areas registered 58–145 bird species, with the greatest numbers in the Coffee Ecoregion and Cesar River Valley Region, showing the importance of good practices in improving biodiversity, including species of high importance (see the figure below).

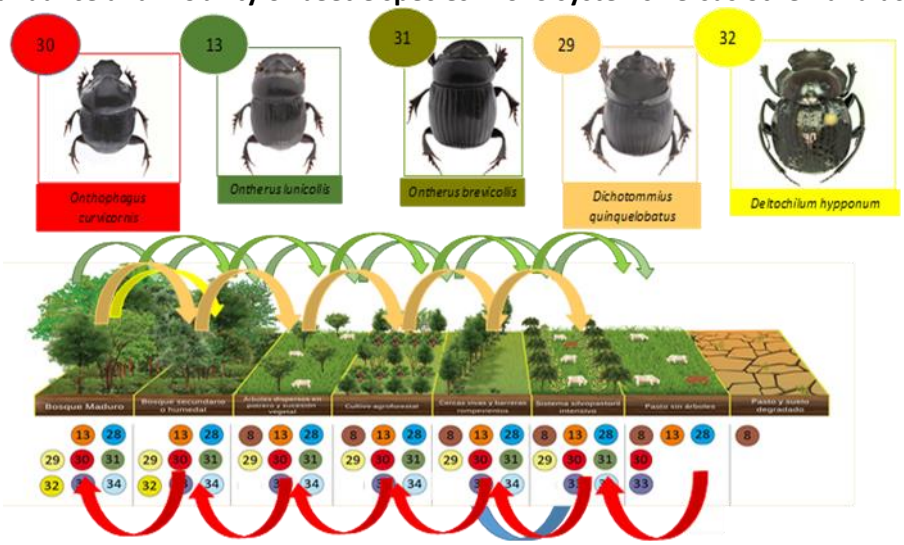
Figure A6.4.1: Abundance and richness of plants, dung beetles, and birds by Region



Landscape biodiversity monitoring

5. The project undertook monitoring of birds and Bats ussing telemetric techniques, and the capture and recapture of beetles in the Coffee and Orinoquia Piedemont ecoregions. The results of this monitoring shows that of SPS (trees, live fences) act as bridges or steppingstones for dung beetles and birds to move from one forest fragment to another.

Figure A6.4.2: Abundance and mobility of beetle species in SPS systems versus other land uses



Bird populations increased by 32 percent in project areas where the landscape monitoring took place (so did populations of plants and dung beetles). Project areas registered 522 bird species and 230 species of beetles. Silvo-pastoral systems were critical to the mobility of 65 percent of the species monitored. 15 percent of species were found to be exclusive to the forest and 20 percent remaining can cross through the paddocks.

Monitoring the number of bird species with respect to established SPS found that the use of land with the greatest abundance of birds was the live fences (1143 individuals), followed by forests (923) and paddocks with scattered trees (930). The systems with the least abundance of birds were the secondary forest (BS) and the silvo-pastoral systems (iSPS), with 140 and 152 individuals respectively. The diversity of birds decreases logistically from 580 meters away to the SPS and reaches a second turning point (low) from 930 meters of the silvo-pastoral system.

Research supported by the project indicates most species of insectivorous bats were encountered more frequently in areas with SPS than in areas where traditional ranching occurred, suggesting that bats might reduce the prevalence of livestock parasites in SPS compared to the conventional.

6. Baseline information for the avifauna has been collected in key sites and landscapes with different land uses giving information which will allow future monitoring to evalute the evolution of the different guilds and taxa[28]. Silvopastoral systems are important in restoring the edaphic biodiversity of dung beetles and preliminary data and modelling suggest that relations between carbon content and dung beetle richness and abundance vary

[28] Lopera A., Lizcano D., Rodriguez R., Rosero Y., Proyecto Ganadería Colombiana Sostenible, Evaluación de la Comunidad de Aves – Aves en paisajes ganaderos con herramientas silvopastoriles. The Nature Conservancy (TNC)
https://tnc.app.box.com/s/3an3vo4dl5n7e8hs55rlk039f0moh6zq

depending on land cover[29]. Connectivity and biodiversity in terms of birds, bats and beetles have provided information on species and individual movements in farms which are relatively isolated in terms of native habitats[30].

7. Biodiversity knowledge for local people, farmers and ranchers is of utmost importance and the project has provided practical field guides[31] for birds, bats and mammals which facilite the identification and recording (and reporting) of these species at the farm and landscape level. Shrubs and trees have resulted in being so important in the farm's health systems that field guides by species files have also been provided[32]. Training of youth and especially those living on the farm is also important and the project provided the sustainable explorer's blog[33]. The information sharing in terms of cutting-edge technology was provided in the Academia and a basis for training on innovative monitoring mechanisms [34] [35]. Story-telling based on scientific evidence has been also addressed by this project in the book "The Living Farm" giving information on soils, water and biodiversity at the farm level. The project used scientific evidence from around 9 publications in peer reviewed journals (or in process) and 7 books to prepare educational materials such as six videos[36], 12 banners on birds and dung beetles, 4 field manuals (on soils, water, dung beetles and monitoring of focal tree species).

8. Preliminary analysis among different biodiversity variables (bird, beetle and plant richness and abundance) were developed[37] in demonstration farms with different types of interventions. All the **information collected and its analysis are web-enabled,** open and easily accessible[38] which provides sustainability for future monitoring.

9. The project contributed with 50 focal species, which were trees and plants of biological and global importance for conservation and at the same time of productive use for the benefit of the ranchers[39] to improve their sylvocultural systems[40]. These focal species are rare, vulnerable, flagship or endemic but representative of cattle agri-landscapes and which by their presence benefit the productive system. Focal species were promoted

[29] Becerra M., Lopera A., Lizcano D., Navarrete D., Yanosky A. 2020. Soil compaction as determinant of soil organic carbon and beetle richness. The Nature Conservancy (TNC). *https://tnc.app.box.com/s/tjlsd8uwxor8u08iu55b5b881qsvq4o9*

[30] The Nature Conservancy (TNC). Proyecto de la Ganadería Colombiana Sostenible – Monitoreo de la Biodiversidad. Telemetría de aves, bioacustica de murciélagos y captura-recaptura de aves, murciélagos y escarabajos. *https://tnc.app.box.com/s/so6026h5ok3t95uqfcnhpwckuj36ocix*

[31] The Nature Conservancy (TNC). Plegables de aves, mamíferos y murciélagos. *https://tnc.app.box.com/s/1i42nh362d4ydhyfn69tsthtosukw65a*

[32] Danzo A., Melo A., Gomez J., 2019. Los Árboles y la Ganadería – Guía Ilustrada de Árboles y Arbustos del Proyecto de Ganadería Colombiana Sostenible. Bogota. The Nature Conservancy, FEDEGAN. *https://tnc.app.box.com/s/987of688qykcbxo5ohsviwf3getfr2lx*

[33] Proyecto Ganadería Colombiana Sostenible. Bitácora del Explorador Sostenible *https://tnc.app.box.com/s/grdu0y4ks5de1ei3aq8qil7vt1o8qqov*

[34] Lopera A., Lizcano D., Paqui M., Rosero Y., Rodriguez R., Sanchez F. Proyecto Ganadería Colombiana Sostenible. Informe de Socialización. *https://tnc.app.box.com/s/h2uzqnm6v3lbt6pisqheaunwv0y9mqhf*

[35] The Nature Conservancy. Proyecto Ganadería Colombiana Sostenible. Capacitación de estudiantes de la Universidad de los Llanos en temas de monitoreo de biodiversidad. https://tnc.app.box.com/s/nnkzd63rqwa615m2e1of2kc9xg3hswle

[36] On water, soil, trees, agrochemicals, environmental services and intensive silvopastoral systems

[37] Ayala A., Giraldo C., Gomez M., Lizcano D., Navarrete D., et al. 2018. Análisis Integrado productividad-diversidad *https://rpubs.com/dlizcano/correl_bio_prod*

[38] The Nature Conservancy. *http://tnc-visor.dreamgis.com/visor.html*

[39] Calle Z., Murgueitio E. 2020. Árboles nativos para predios ganaderos: Especies focales del proyecto Ganadería Colombiana Sostenible. Editorial CIPAV, Cali. 346p. ISBN 978-958-9386-95-8.

[40] Calle Z., Giraldo A., Cardozo A., Galindo A., Murgueitio E. 2017. Enhancing biodiversity in neotropical silvopastoral systems: use of indigenous trees and palms. EN: Montagnini F. (Ed). Integrating Landscapes: Agroforestry for Biodiversity Conservation and Food Sovereignty. Advances in Agroforestry 12. Springer, Dordrecht. ISBN: 978-3-319-69370-5.

to integrate: (a) shade on-farm, (b) trees for forage hedges and banks of mixed forage, (c) nut-producing silvo-pastoral systems, and (d) stubble enrichment, secondary and riparian forests.

10. Key hypotheses were addressed and are contributing to general knowledge[41] such as: (a) increase of forest areas, and protection of the existing ones, is a fundamental strategy to favor the natural regeneration of native plants and, in this way, increase their diversity in the natural ecosystems present in these lands; (b) the increase in silvopastoral areas has a positive effect on the number of species that can be found in these areas; (c) the conservation of small relicts of forest is essential to favor beetle populations at the local level. There is a tendency for the number of beetle species and bird species richness to decrease when the area is treeless pastures; (d) the abundance of beetles and the richness of bird species, which increases with the abundance of forest plants, and larger forest patches hold higher species richness; (e) the presence of dispersed trees in pasture lands contributes to a higher biodiversity in terms of birds; (f) bird diversity is higher in areas of the farm where intensive silvopastoral systems are present and also where living fences have been set up. In terms of farm productivity under conventional production schemes, such as milk, there is a positive relationship between milk produced and the presence of intensive silvopastoral systems, while beef production in treeless pastures is smaller. According to productivity analysis, increases in carrying capacity were found compared to areas without silvopastoral systems. Intensive silvopastoral systems allow a higher carbon sequestration at both leaf and root levels. In general, this study provides evidence that the beetle and bird abundance and richness promote higher environmental services.

11. The different interventions at the farm level for maintainng natural areas (by means of measuring maximun values in natural coverage of climax forests or wetlands) or improving the woody species in the farms, especially those with degraded grasslands, have provided the means to maintain or enhance connectivity or restore the connections lost. The increase in multi-stratified living fences has allowed connectivity between natural ecosystems and productive areas, thus permitting resources for the maintenance of the local fauna.

12. This project has shown the importance of production landscapes where crops and cattle are managed with increasing biodiversity measured in terms of flora and fauna. Projects like this one not only contribute information to the general hypothesis, but also give rise to basic knowledge such as new records[42] or ecology[43] [44] Mainstreaming biodiversity conservation and its use into Colombian production landscapes in biodiversity rich areas is a complementary contribution and a key strategy to secure the objectives of the Convention of Biological Diversity (CBD) and as a major objective for projects financed by the GEF[45]. This project shows the importance of

[41] Proyecto Ganadería Colombiana Sostenible 2019. Relación entre usos de la tierra, biodiversidad y productividad en las fincas del proyecto "Ganadería Colombiana Sostenible". FEDEGAN, The Nature Conservancy (TNC) and CIPAV
https://tnc.app.box.com/s/nhfhmj8gg1lpr182978n9ee15smbdjwg

[42] Zúñiga M.C., Giraldo L., Calero H., Ramírez Y.P., Chará J. 2014. Anacroneuria caraca Stark y A. jewetti Stark (Insecta: Plecoptera: Perlidae): Primeros registros para los andes orientales y el piedemonte de la Orinoquía Colombiana. Boletín del Museo de Entomología de la Universidad del Valle 15: 12-19.

[43] Zúñiga M.C., Giraldo L., Ramírez Y.P., Chará J., Ramos B. 2015. Neoatriplectides (Trichoptera: Atriplectididae) en Colombia: Notas sobre su taxonomía, ecología y distribución en el Neotrópico. Revista Colombiana de Entomología 41(1): 149-152. Enero-Junio de 2015. ISSN 0120-0488. http://www.scielo.org.co/pdf/rcen/v41n1/v41n1a23.pdf

[44] Montoya-Molina S., Giraldo-Echeverri C., Montoya-Lerma J., Chará J., Escobar F., Calle Z. 2016. Land sharing vs. Land sparing in the dry Caribbean lowlands: a dung beetle´s perspective. Applied Soil Ecology, 98, 204-212. doi.org/10.1016/j.apsoil.2015.10.017

[45]United Nations Environment Programme (2018). Mainstreaming Biodiversity in Production Landscapes.

integrating biodiversity considerations into the policies, strategies and practices that impact, or depend, on biodiversity. From practical and validated solutions, this project provides the Government, the private sector and civil society with scientifically credible and independent, up-to-date assessments of available knowledge for better evidence-informed policy decisions and action at the local, national, regional and global levels, as mandated by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). At the same time, the project contributed to the goals for conserving and sustainably using nature and achieving sustainability, which cannot be met by current trajectories, and may only be achieved through transformative changes across economic, social, political and technological factors[46].

B. Carbon Sequestration, Avoiding Deforestation and Carbon Balance

13. **Change in Greenhouse Gas (GHG) emissions as a result of the project**. Estimates of the net-GHG emissions attributed to the project are calculated based on the estimation of CO_2 removals resulting from the implementation of project activities and avoided emissions from conservation of natural forest. At AF appraisal, when the indicator was included in the project's Results Framework, its estimation was based on available literature on removals associated with SPS systems. The project undertook an exercise to estimate Tier 3 removal factors for different SPS arrangements. Therefore, since January 2018, the reporting of this indicator is based on Tier 3 emission factors calculated by the project, both for aerial biomass and soil carbon, which are presented in the table below.

Table A6.4.1: Coefficients of CO2 Removals/Sequestration for the different land uses by Ecoregion Carbon (Tier 3, established by the Project)

Eco-region	Removal of CO_2 year/ha (t CO_2e ha^{-1} yr^{-1})		
	Live Fences	iSPS	Dispersed Trees
Altiplano cundiboyacense	2.9	2.7	4.7
Antioquia, Eje Cafetero y norte del Valle	2.9	2.7	4.7
Caribe seco	8.5	2.1	12
Orinoquia	3.7	2.4	12
Sur de Bolívar, sur de Cesar y Santanderes	8.5	2.1	12
Suroriente	3.7	2.4	12

https://www.bioversityinternational.org/fileadmin/user_upload/AA_Publications/Mainstreaming_Biodiversity_in_Production_Landscapes-UNEP_publication.pdf

[46] IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages.

14. **Results**: The net accumulated CO_2 removals resulting from the conversion from pastures to dispersed trees, live fences, intensive silvo-pastoral systems (SPS) and secondary forest conservation in the five regions of the project are estimated at 1,131,056 t CO2e at Dec 30, 2019, corresponding to 91 percent of the end of project target (1,600,000 t CO2e).The distribution of CO_2 Removals by region and by land type is presented in Table 1. When the estimation of this indicator is done applying the assumptions made at the time of the AF, the total removals by the project reach 1,826,000 t CO2e, largely surpassing the revised estimated target. The estimates correspond to the implementation of SPS systems on about 34,704.8 hectares, representing areas that become SPS and iSPS in land uses type 3, 5 and 7 (see Table 1, below). A total of 29,938.2 Ha were planted through activities involving distribution of plant material, technical support and natural regeneration + 4,464.6 Ha in UT # 7. This indicator does not report 3,811.8 ha of SSP that have not been monitored.

15. **Hectares where deforestation and degradation have been avoided through project support**. As part of the report commissioned by the World Bank to TNC, a first analysis of the KPI 8 was carried out for the period between 2010 and 2016. For this reporting, radar images ALOS PALSAR were used to measure the change in land coverage, as well as a spatially explicit modelling of coverage land changes developed in the "DINAMICA EGO" software. Although these analyses showed that the accuracy of the TNC forest/no-forest product is superior to the existing products/information in the SPS project areas, the results also indicated that there was a tendency to exaggerate the rate of predicted deforestation. This justified the calibration of a new deforestation model for the 2010-2016 period as well as the recalculation of the KPI 8 for 2016. On the other hand, for years 2017 and 2018, deforestation measurements using radar images were costly, therefore, the available national deforestation rates were used without losing consistency with the TNC forest/no-forest product generated for 2010 and 2016.

16. The results of the estimates indicate:
- In the project's farms, the avoided deforestation was estimated at 1,205 ha during the period 2010-2016.
- Considering only the active farms for 2017, the estimated avoided deforestation reached 1,372 ha and 1,543 ha for year 2018.
- The reduction in emissions associated with deforestation avoided during 2010 to 2018 by the project was 433,970 tons of CO2e, which added to the changes to sustainable uses (KPI6) (fences scattered trees and SSPIs, as well as forest conservation (successions) which was estimated at 1,131,056 Tons of CO2e, results in a total of **1,565,026** tons of CO2e, achieving 98 percent of the proposed target.

Table A6.4.2: Cumulative Removal of Carbon Dioxide by Land Use and Region, CMSCR Project (as of December 2019)

Region	Secondary forest (t CO_2e)	SPS (t CO_2e)	Cumulative CO_2 removal (t CO_2e)	Land-use change area (ha)
Lower Magdalena River Basin	1,353	162,065	163,418	4,153
Cesar River Valley	7,703	513,469	521,172	13,635
Boyacá and Santander (linked to the Andean Oak Forest Corridor)	6,325	32,307	38,632	2,945
Coffee Ecoregion	123,383	138,861	262,243	17,095

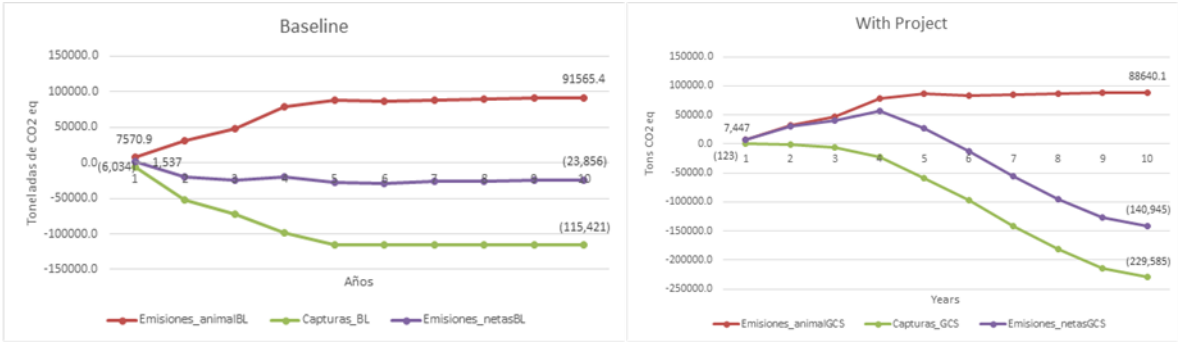
Low foothills in the eastern cordillera of Southern Meta	46,497	99,093	145,591	9,300
Total	**185,261**	**945,795**	**1,131,056**	**47,128**

Table A6.4.3: Deforestation avoided by Region, CMSCR Project, 2010–18

Region	Forest type	Cumulative avoided deforestation 2010–18 (ha)
Lower Magdalena River Basin	Tropical dry	10.1
Boyacá and Santander (linked to the Andean Oak Forest Corridor)	Humid montane	398.4
Coffee Ecoregion	Humid montane	1.9
Low foothills in the eastern cordillera of Southern Meta	Humid tropical	289.4
Cesar River Valley	Tropical dry	842.8
Total		**1,542.5**

17. **Carbon balance.** Preliminary analysis commissioned by the World Bank to understand the carbon balance of the project suggests very positive results in terms of total emission reductions by the project. For the assessment of the carbon balance, data on carbon captures generated by the project were combined with GHG emissions generated by cattle in participating farms. This was done using data on cattle diets generated by FEDEGAN as well as other secondary sources on predominant forage species for each zone, complemented with bromatological analysis of 273 samples carried out by the CMSCR project, which led to a set of 173 cattle diets generated (using Agrosavia's ALIMENTRO system). All these data sets were analyzed through the RUMINANT model. The emerging results suggest a reduction of animal emissions of 3.2 percent in relation to the baseline, and a significant reduction of total net emissions in project beneficiary farms, in the baseline scenario versus the project situation (see figures below). These analyses are very preliminary and would be subject to further analysis and quality control in the next few months.

Figure A6.4.3: Carbon balance CMSCR project



C. Integrated monitoring of biodiversity and carbon

18. The project designed a web application that relates and allows simulations of change of use on the project's premises with biodiversity and carbon. View app in: https://thenatureconservancy.shinyapps.io/GanaderiaSostenible/ (see screen below).

19. The application is very simple and intuitive, starting with the coverage areas of each of the regions of the project, for which there are different emission factors and species relationships. After entering the type of land uses, once can visualize results of real or simulated implementation in terms of bird wealth for biodiversity and carbon capture projections.

Annex 6.5: Project Partnerships

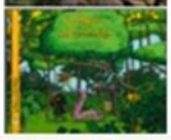
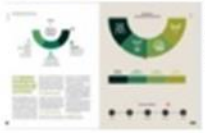
Table A6.5.1: Partnerships developed by Project Partners and related to Sustainable Cattle Ranching Activities

Partner	Partnership/Project Name	Description	Value in USD millions
TNC	Tropical Forest Alliance (TFP)	Public-private alliance to reduce tropical deforestation associated with palm oil, soybeans, the meat, paper and the pulp sectors	n.a
	Productive Sustainable Colombia	Global Economic Forum	n.a
	FOLU coalition (WRI)	FOLU is an autonomous coalition composed of more than 30 organizations established to transform the world food and land use system	n.a
	Zero Caquetá Deforestation Pact	Initiative led by the departmental committee of CR of Caquetá (CDGC) that seeks to promote sustainable land uses changes	n.a
	Sustainable Orinoquia Pact	Foster a dialogue between different actors to achieve collective actions to support sustainable rural development	n.a
	Water funds	The water funds seek to protect and restore river basins located in CR areas to have available drinking water	n.a
FA	TFCA	A conservation of tropical forests agreement that promotes conservation, restoration and sustainable development actions Santander and Boyacá departments and the Orinoquia region	0.97
	La Minga	Initiative for the financial sustainability of protected areas in Pacific Colombian regions	0.69
	Wildlife Project	Initiative led by WCS, and with support from Ecopetrol, for the conservation of landscapes and species of Magdalena Medio, Llanos Orientales and Piedemonte Andino Amazónico regions	0.27
	Colombian low carbon development strategy	Implementation of the Colombian low carbon development strategy at the regional level	3.24
	Connected landscapes	Curtail the drivers of forest degradation and deforestation through strategies that improve local communities' income and livelihoods, as well as well-being and strengthening local governance	6.47
	Sustainable Colombia fund (supports the REDD + Portfolio in Chocó)	Increase governance and empowerment related to conservation and sustainability actions in REDD+ projects	2.53
CIPAV	IKI 2018 - C-106-18 Subgrant Agreement	Implement a sustainable agriculture and livestock system for the definition of targets related to forest conservation, climate change mitigation (REDD +) and peacebuilding in Colombia	1.63
	Technoserve 2018 - Subaward No. S-CIPAV01	Share experiences of dual-purpose and intensive SPS	0.19
	WCS 2019 - Framework for inter-institutional cooperation and technical assistance	Generate a sustainable livestock culture in Carare-Barbacoas that seeks to foster natural regeneration and long-term survival of threatened and valuable native trees	0.14

	NASCA 026-2019	Carbon monitoring in the municipalities of San José del Fragua and Belén de los Andaquies, Caquetá, Colombia	0.06
	PATRIMONIO 194 2019	Capacity building through training producers and technicians, the establishment of a network of farms with agro-SPS in prioritized corridors of the Andean-Amazon foothills of Caquetá	0.61
	Fundemas Salvador	Development of a technical study as input for the project "harvesting resilience: design and implementation of sustainability strategies"	0.06
	COLCIENCIAS 424 2019 - Financing contract for contingent recovery 80740-424-2019	Carrying out a postdoctoral study for a professional with a doctorate involved in a research proposal named "Valuation of environmental services measured by biodiversity on the farms of the CMSCR project"	0.02
	COLCIENCIAS 423 2019 -Financing contract for contingent recovery 80740-423-2019	Carrying out a postdoctoral study for a professional with a doctorate involved in a research proposal named "Valuation of the effect of the establishment of SPS on the protection of biodiversity in areas near deforestation hotspots in Colombia"	0.02
	EUROCLIMA INTA 2019 - Technical cooperation agreement	Increase resilience and adaptive capacity (agro-ecological and organizational) of local food systems in areas of high vulnerability to climate variability and change	0.000055
	CARDER 389 2019	Introduce SPS in Pereira and Santa Rosa de Cabal	0.04
	GEMAS PANAMA 2019- donation contract FA-190302-PS 002	Introducing sustainable CR measures to adapt to climate change in the middle and lower basin of Santa María River	0.21
	VON HUMBOLDT 2019 - Contract and audit No. 19-14-331-207PS	Provide sustainable CR services in areas selected by the Alexander Von Humboldt Institute, a sustainable CR forum for SPS within the context of the "Paramos, biodiversity and water resources in the Northern Andes" project (Grant contract DCI-ENV / 2014 / 346-637)	0.03
	ICF PROJECT - Subsidiary cooperation agreement	Joint efforts to consolidate regional and local capacities in research, implementation, management and monitoring of SPS	7.19
	IADB AGROLAC 2018	Support regional dairy industries and livestock associations, so that they may access Sustainable Colombia Facility (GN-2865) and the Sustainable Colombia Fund loan (CO-L1166) resources approved by the IADB. Transfer knowledge generated to CR supported by the project "Livestock reconversion for the sustainability of milk producers in Caquetá"	0.40
Fedegan	Sustainable Colombia Program	Introduce sustainable CR practices to a group of participating farms in some municipalities of Cesar and Guajira	1.57
	Ecopetrol	Support producers in Meta Department associated with Ecopetrol to establish SSP	0.80
	Geo Park	Strengthening capacities towards sustainable livestock farming in two municipalities of Casanare department	0.42
	Sustainable Colombia Program for Yondo municipality	TA in SPS to support Caño Bodegas community with 69 CR families	n.a
Total			**27.54**

n.a: not applicable

Annex 6.6: Print Publications of the CMSCR Project

Publication Name	Cover	Publication Name	Cover
Establecimiento y Manejo de Sistemas Silvopastoriles		Escarabajos del estiércol en paisajes ganaderos de Colombia	
Cortadoras Invencibles		La travesía del escarabajo	
Fincas Demostrativas proyecto Ganadería Colombiana Sostenible		Manejo integrado de insectos herbívoros en sistemas ganaderos sostenibles	
Manual de Usos de la tierra		Servicios ambientales: tus amigos invisibles	
Bitácora del Explorador sostenible		Infografías interactivas de monitoreo	
Guía de Estándares Nacionales para la Implementación y Promoción del Uso de la Tecnología UAS/Drone en el Sector Ambiental		Guía de ilustrada de árboles y arbustos "Los árboles y la ganadería"	
Folleros para el servicio de asistencia técnica: **Alternativas de conservación para época crítica: Ensilajes** **Alternativas de conservación para época crítica: Bloques multinutricionales** **Alternativas de conservación para época crítica: Cosecha de agua** **Arboles dispersos en potrero a través de la regeneración natural** **Establecimiento de Cercas Vivas** **Abonos orgánicos**			

Annex 6.7: Communication Strategy

1. Activities to disseminate, strengthen and position sustainable cattle ranching were successfully developed and conducted during the life of the project. A Communications Committee (formed by the communication teams or press from TNC, Fondo Acción, UK Embassy, the World Bank and CIPAV) was created and worked to highlight the achievements of the project. A website was created: *http://ganaderiacolombianasostenible.co* A logo was also created, where all partners of CR were united under one same goal. The communication strategy also included the use of the twitter platform to disseminate information regarding sustainable cattle ranching in Colombia: @ganaderiasostenible and the hashtag #GanaderiaSostenible. In addition, other channels and social networks were also used, mainly Youtube and Facebook, to approach students, producers, institutions and other actors inside and outside Colombia to show how to conduct sustainable cattle ranching and provide training in areas that were not part of the project.

2. Moreover, a virtual library was created, registering more than one thousand images of the project as well as testimonials. Printed material with information related to the project was designed and distributed. Publications were also designed and published for cattle ranchers as inputs and a tool for consultation to implement the project' strategies to transform traditional cattle ranching into a sustainable and environment-friendly activity.

Image A6.7.1: CMSCR Project Website: *http://www.ganaderiacolombianasostenible.co/web/*

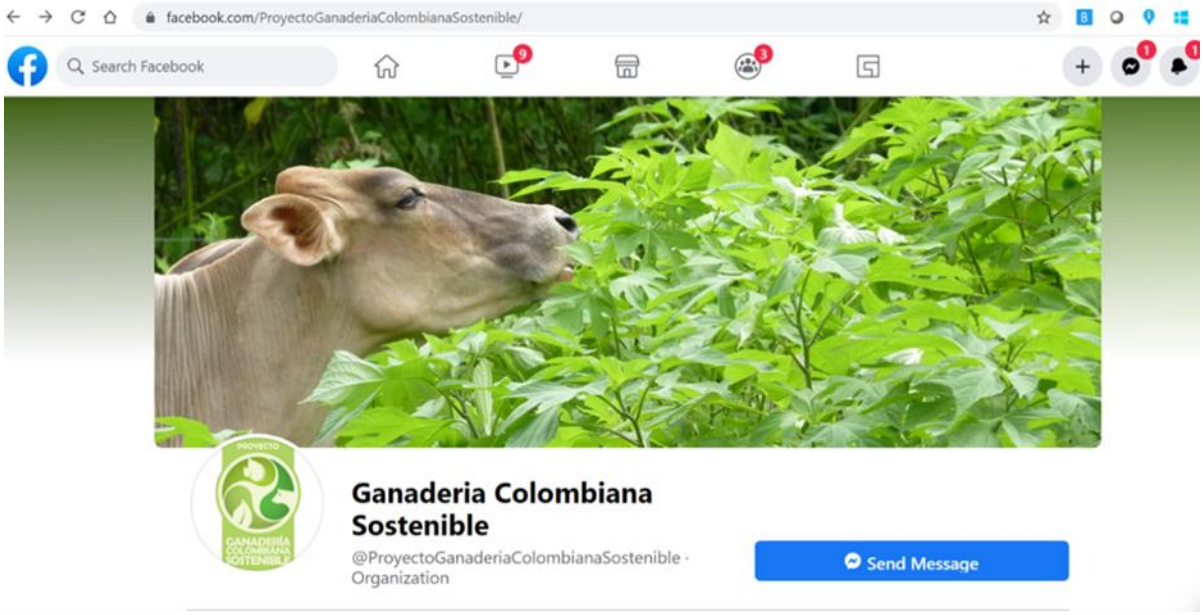
Image A6.7.2: CMSCR Project logo

Image A6.7.3: CMSCR Project Twitter account

twitter

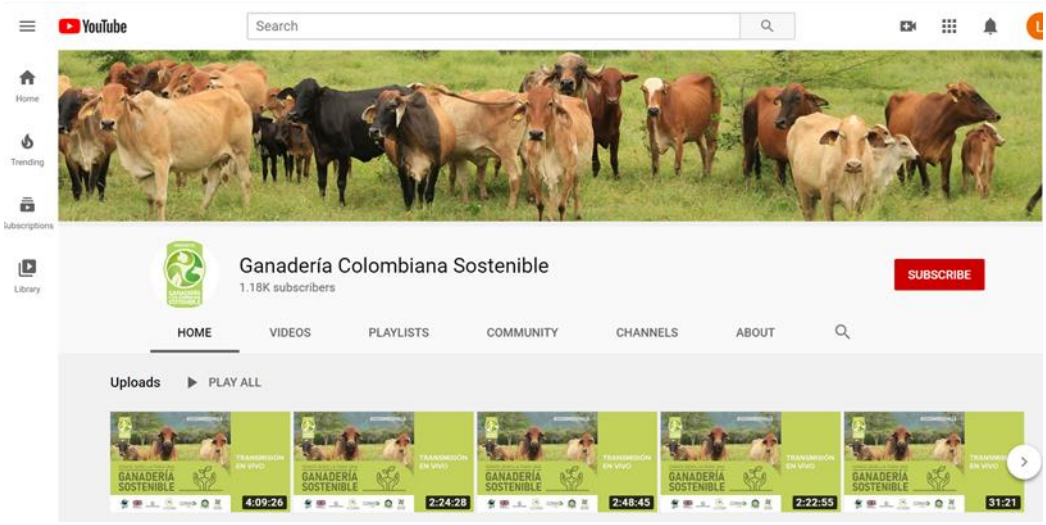
@ganaderiasostenible
#ganaderiasostenible

Image A6.7.4: CMSCR Project on Facebook



Under the leadership of the World Bank, a 60-page special feature on the project was included in the June 2019 edition of Semana, one of Colombia's most prominent business magazines. Results of the project were also highlighted at the Semana-organized Sustainability Summit (*Cumbre de Sostenibilidad*) attended by 1,500 people. The project's results reached audiences even further afield through the World Bank website, BBC World Service, and BBC website.

Image A6.7.5: YouTube channel: *"Ganaderia Colombiana Sostenible"*




YouTube
Search
Ganadería Colombiana Sostenible
4,536 views • Feb 1, 2018
75
4
SHARE
SAVE
Ganadería Colombiana Sostenible
1.18K subscribers
SUBSCRIBE
Conozca qué es el Proyecto Ganadería Colombiana Sostenible y qué significa hacer ganadería sostenible, qué y cuáles son los arreglos silvopastoriles y los beneficios productivos y ambientales para el sector ganadero.

Annex 6.8: Testimonials from CMSCR Project Beneficiaries

During the CMSCR Project, the team recorded more than 50 testimonials of project beneficiaries. *Voces de la Sostenibilidad* (available on the project website, *http://ganaderiacolombianasostenible.co/web/voces-de-la-sostenibilidad/)* served to provide input from beneficiaries as well as to provide inspiration for other cattle ranchers. Examples of those testimonials follow.

- **MERCEDES MURILLO- SAN MARTIN, META (Cimarron Farm)**

"Before the project I did not know anything on SPS. Thanks to the project's technical assistance, I made changes in my farm".

Mercedes states that she has noted changes in the amount of milk from her animals and that she is now aware that before she had more cows but less milk. She also has acquired quite a bit of knowledge from each training and workshop and recognizes the importance of conservation and planting more trees on her farm. Now Mercedes has iSPS with *botón de oro* and trees planted 3x3 m.

- **JOSE ROMERO- VALLEDUPAR, CESAR (El Arca Farm)**

"Before the project, my farm was abandoned. Thanks to the project, I started to make changes and realized the economic changes. Before, I was making 15 kilos of cheese, now I do 30 kilos".

In his farm, Jose has a mix forage bank with cut Grass. Thanks to the SPS, his cattle were sustained during the summer season. He has implemented feeders, live fences and intensive systems with *Leucaena*, accompanied with *Totumo* trees, which helps support milk production in summertime. Thanks to the project, Jose is conserving his water sources and planting native trees for their protection.

Annex 6.9: Leaflet Supporting the Call for CMSCR Project Participants

The printed material for each of the calls contained images and information related to the project and the importance of sustainable cattle ranching. A leaflet was designed for the promotion of the calls, which contained information related to the project, contact information, requirements and documentation, benefits and an explanation of each of the SPS.

ANNEX 7. IMPACT EVALUATION (SUMMARY)

1. To better assess the impacts of the project on land use change, productivity, and well-being, the project conducted an impact evaluation.[47] As many factors outside the project's control affect land use, productivity, and well-being, a simple before-and-after comparison may be misleading. The evaluation compared participants to a control group of non-participants, and also compared sub-groups of participants (for example, with different treatments) to each other. This evaluation faced considerable difficulties, particularly because participants were distributed over five different regions, each with very different characteristics, resulting in a small number of observations for each site. There was also substantial heterogeneity within each site (e.g. in farm size, initial conditions, etc.). Moreover, participants were very dispersed within these regions, which led to very high data collection costs, forcing the use of a cheaper data collection procedure for part of the sample, which further reduced the size of comparable samples, as the results of the two procedures proved not to be directly comparable. Participants also entered and exited the project at different times, requiring the comparisons across participants to be done on a per-year-treated basis (noting that in addition, due to farm-size differences, comparisons are actually on a per-hectare-treated-per-year basis). Severe climatic shocks, including in the final year of the project, further complicated some of the comparisons within the evaluation (as one of the data-collection methods was undertaken later).

2. The impact evaluation is based on (i) socio-economic surveys of all participating and control group farms, carried out at the time they enrolled in the project (baseline) and at project end; (ii) detailed measurements of land use changes by participating farms and control group farms; and (iii) a survey of participant perceptions carried out at project end. Although initial plans had called for a randomized control trial (RCT), this proved infeasible because of low initial take-up, and a control group was selected using propensity score matching (PSM), matching on observable farm characteristics in Fedegan's database.

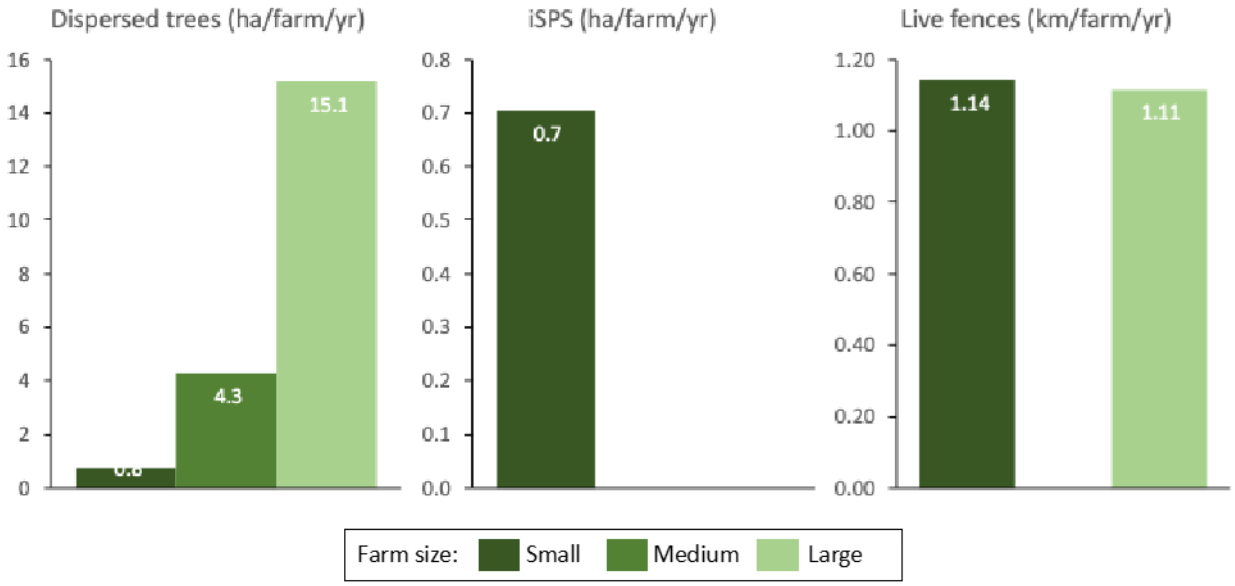
3. Within these constraints, the impact evaluation found that the project had resulted in substantial adoption of SPS: by the end of 2020, treatment farms had adopted some kind of SPS on almost 9,200 ha more than for the control group (6,700 ha of dispersed trees in pastures and 2,500 ha of iSPS) as well as implementing 5,000 km more of live fences than for the control group, showing that the project's treatments significantly increased adoption of SPS.[48] Figure A7.1 shows establishment of various silvo-pastoral practices on a per farm per year basis, while Figure A7.2 shows total annual results for each farm

[47] An impact evaluation conducted on the previous RSPS/ISAEM project in Quindío had shown that it had resulted in substantial land use change, and that participants had retained these changes several years after the project had ended (Pagiola and Rios, 2013; Pagiola and others, 2014).[48] The area under SPS had declined by the end 2019, however, due to the severe drought that struck in that year. A survey of 285 farms receiving PES2, for example, found that the area under the most recently planted iSPS systems had fallen by 45 percent between the end of 2018 and the end of 2019. Although some measures showed that established SPS were more resilient to drought than traditional pastures, these results indicate that SPS are vulnerable to climate change in their initial years.

[48] The area under SPS had declined by the end 2019, however, due to the severe drought that struck in that year. A survey of 285 farms receiving PES2, for example, found that the area under the most recently planted iSPS systems had fallen by 45 percent between the end of 2018 and the end of 2019. Although some measures showed that established SPS were more resilient to drought than traditional pastures, these results indicate that SPS are vulnerable to climate change in their initial years.

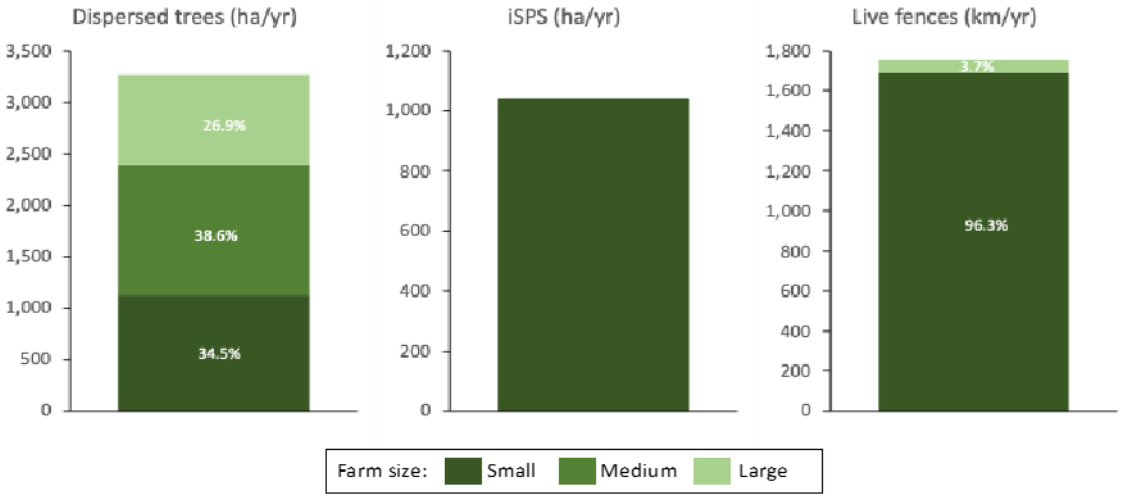
size group. Figure A.7.3 shows the resulting impact on environmental services, calculated according to the project's Environmental Services Index (ESI). The changes adopted by small farms dominate the results, even though each such farm only adopted silvo-pastoral practices on a small area.

Figure A7.1: Estimated project impacts on farm-level adoption of silvo-pastoral practices, by farm size group



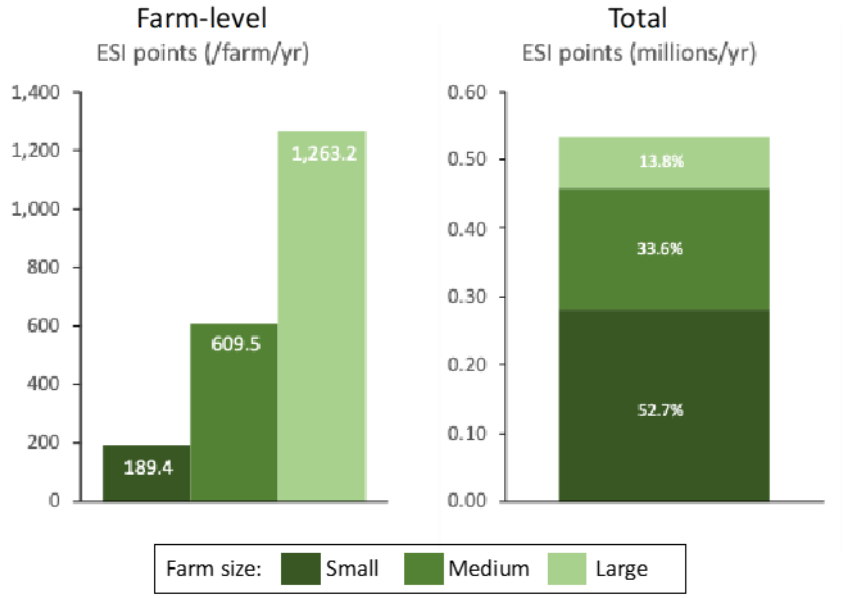
Notes: Only impacts that are statistically significant at 10% or less are shown
Results shown are changes in excess of those adopted by the control group
Results shown are per year of participation; eg a small farm who participated in the project for 3 years would adopt 2.1 ha of iSPS in total

Figure A7.2: Estimated total project impacts on adoption of silvopastoral practices



Notes: Only impacts that are statistically significant at 10% or less are shown
Results shown are changes in excess of those adopted by the control group
Results shown are per year of participation; eg if small farms participated in the project for 3 years, they would adopt 3,000 ha of iSPS in total

Figure A7.3: Estimated project impacts on environmental services



Notes: Only impacts that are statistically significant at 10% or less are shown
Results shown are changes in excess of those adopted by the control group
Results shown are per year of participation; eg if small farms participated in the project for 3 years, they would increase their ESI by almost 600 points in total

4. The impact evaluation also showed that:[49]
   - Providing TA by itself often resulted in substantial land use change; small farms who only received TA, for example adopted changes that increased environmental services by 7.4 ESI points/farm/yr, compared to 9.9 ESI points/farm/yr for farmers who received both TA and PES.
   - Dispersed trees in pastures were the most popular practice, with participants adopting them on about 3,200 ha/yr. Many did so with TA alone, and PES2 further increased adoption among small producers.
   - Participants adopted intensive silvo-pastoral systems (iSPS) on about 1,040 ha/yr[50], in some cases by participants receiving TA alone but especially by participants receiving PES2 (which was specifically designed to support iSPS adoption). Only small farmers were eligible to receive PES2, so they account for almost all adoption of iSPS.
   - Participants established almost 1.8km of live fences per year, with adoption being particularly high by small producers in the Ecorregion Cafetera and the Piedemonte Orinocense. Adoption was greatest among producers receiving only TA and those receiving PES2, with participants receiving PES1 preferring to focus on other practices.
   - There was practically no establishment of forest. This is not surprising, as forest would not generate much income for farmers, unlike silvo-pastoral practices. The same result had been found in the ISEAM pilot project.
   - Project impact improved over time. Participants who enrolled after 2016 increased their environmental services generation by 9.5 ESI points/ha/year, compared to 8.2 points/ha/yr for all participants.
   - Overall, there was a substantial, statistically significant increase in environmental services generated by participants, as measured by the ESI, of about 500,000 points/yr.

[49] All the values cited are in terms of additional hectares of the specified practice adopted by participants compared to the control group and are statistically significant at the 5 percent level or better.
[50] Note that the area is small in absolute terms because of the high cost of establishing iSPS but contributes disproportionately to productivity increases.

ANNEX 8. BIBLIOGRAPHY

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Implementation Support/Supervision Aide Memoires (2010-2020)
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Restructuring Papers: 2017 (No: RES25027), 2018 (RES30919) and 2019 (No: RES36448)
Social and Environmental Safeguards reports
Project Impact Evaluation Report
Project Perception Survey (Background Analysis)
Mid-term Review Report: FEDEGAN, TNC, FA and CIPAV (2020): “Proyecto Ganadería Colombiana Sostenible - Informe Técnico Final 2010- 2015”

RECIPIENT/CLIENT DOCUMENTS:

Recipient/Client Completion Report (RCR): FEDEGAN, TNC, Fondo Acción and CIPAV (2020): “Proyecto Ganadería Colombiana Sostenible - Informe Técnico Final 2010- 2020”
Project Biannual Progress Reports.

ANNEX 9: STUDIES PRODUCED BY THE PROJECT

A. STUDIES COMMISSIONED BY THE BANK

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ANNEX 10: ENDNOTES

1. At appraisal, the production value of cattle ranching was several times greater than that for poultry (2-fold), coffee (3-fold), flowers (5-fold), rice (6-fold), potatoes (8-fold) and the pig industry (9-fold), which demonstrates the economic relevance of the CR sector.

2. At appraisal, cattle ranches with over 500 ha represented 1.1% of all ranch land in Colombia; mid-sized holdings from 50–500 ha represented 16.9%; and, holdings from 1-50 ha represented 82%. Small-scale ranches produced mostly milk or engaged in mixed beef/dairy production.

3. The PAD stated that deforestation provoked by cattle ranching accounted for 9 percent of emissions.

4. Due to RSPS (ICR, Report #0000875, November 2008), the Ministry of Agriculture and Rural Development (MADR) set up the Rural Capitalization Incentive (RCI) for farmers interested in implementing iSPS. FINAGRO (*Fondo para el Financiamiento del Sector Agropecuario*) and FEDEGAN also formally agreed with MADR to improve the integration of credit and TA for cattle ranching, including SPS.

5. As required by the ICR Guidelines, the ToC reflects the project design and objectives set out in the PAD.

6. The ICR uses "PDO" throughout - rather than Global Environmental Objective (GEO) – consistent with the Grant Agreement.

7. The project was long underway by the time the Colombian Peace Agreement was reached (2016). The five sites were selected in part because they did not pose significant security issues, so the eventual peace accords did not affect them as much as other areas. See also Sections IIA and III B.

8. A robust monitoring and evaluation (M&E) system was intended to assess progress regularly, providing the evidence on which to base timely adjustments throughout project implementation.

9. Farmers' counterpart contributions at approval were estimated at US$6M (in-kind) plus US$22M of farm investments via access to credit.

10. The original Grant of US$7.0 M was the GEF contribution to a wider program led by FEDEGAN-FNG (National Livestock Fund – FNG) totaling US$42.0 M. FEDEGAN-FNG and project partners (Center for Research on Sustainable Agricultural Production Systems (CIPAV), Environmental Action and Childhood Fund (*Fondo Acción)* and The Nature Conservancy (TNC)) contributed US$13.0 M via parallel co-financing, and FINAGRO earmarked US$22.0 M equivalent in credit and RCI for SPS adoption (via first-tier banks operating with FINAGRO in rural areas).

11. The new PES carbon sequestration scheme (PES2-Carbon) was designed to partially offset/compensate for structural challenges impeding farmers' access to FINAGRO's RCI (ICR in Spanish) credit incentive, intended to support adoption of iSPS (pre-AF). PES2 combined up-front support (e.g., soil analysis, seeds/seedlings) with an ex-post, performance-based payment incentive to small- and medium-scale farmers to encourage adoption

of iSPS. The PAD defined the minimum/maximum area for average farm size across project regions based on the social assessment and existing legislation: small (4–70 ha), medium (71–200 ha), and large (200+ ha).

[12.] At appraisal, existing nurseries were believed to be adequate to provide needed planting and seed materials in the regions to be covered by the project. However, the practical implementation experience revealed important capacity gaps in these areas. The AF included financing for the implementation of a strategy for plant and seed production working closely with private nurseries and with farmers for in-situ production.

[13.] The Orinoquia region is specified in the CPF, as well as biodiversity conservation and reduced deforestation in the Amazonia Region.

[14.] CPF Objective Indicators show targets for: (a) area brought under environmentally-friendly cattle ranching production (silvo-pastoral livestock) systems; (b) areas of environmental significance brought under protection measures in target areas of the Amazon region; (c) reduced effluent discharge into the Rio Bogota.

[15.] Initially tested on 100 farms in Quindio Department.

[16.] PES were offered selectively to participants, while TA was transversal to all the project's direct participants.

[17.] *Proyecto Ganadería Colombiana Sostenible: Informe Tecnico Final*, 2010-2020. FEDEGAN/TNC/Fondo Acción/CIPAV, March 2020. (Recipient/Client's final Completion Report)

[18.] Impact Evaluation CMSCR: S. Pagiola, with core data analysis by A. Pfaff (Professor, Duke University) and J. Robalino (Professor, University of Costa Rica). Final report, 2020.

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[20.] Effects of Intensive Silvo-pastoral Systems on Physical and Biological Soil Erosion Reduction. Giraldo N. and Chará, J. 2017.

[21.] Impact Analysis of the Introduction of SPS on Milk Productivity and Animal Load in the Intervention Areas of the Colombia Mainstreaming Sustainable Cattle Ranching Project. Background Paper, Solano C and Serba, L.: 2020.

[22.] The project area covered a total of 159,811 ha, including roads and infrastructure.

[23.] *Páramos* are protected mountain ecosystems, typically occupying an extensive area above the tree line and below the snow line at 3,400–5,000 meters above sea level. These valuable scrublands are a vital element of mountain watersheds, storing large quantities of water, regulating water flow, and providing up to 80 percent of the water used by Colombia's towns and cities.

[24]. Two methodologies were used to monitor changes in land use: full geo-referencing (FULL), and the self-

reporting methodology (AUTO) applied at baseline, with land use verifications depending on the year in which the farm joined the project.

25. The PES2 scheme started in 2016 and subsequently needed adjustment to ensure that farmers received higher ex-ante support to cover the high up-front costs of establishing iSPS.

26. The original target of 12,000 ha converted into iSPS assumed, inter alia, that a mix of beneficiaries would include some 600 medium/large scale farms converting an average 20 ha each. In practice, the participation of larger farmers was far below expectations and under the AF, not encouraged.

27. Most conversion to iSPS occurred in the project's last three years. PES2 started full implementation in 2016. Participation gradually increased as the PSE2 scheme was validated/adopted by pioneer farmers. Some did not receive PES2 ex-post payments: those planting iSPS in the final year of the project, as verifications were done a year after iSPS establishment; those with <2 ha of iSPS (min. conversion area); those receiving payments for iSPS under PES1; and, those with iSPS established in areas affected by severe weather.

28. The project also conducted genetic analysis and built knowledge about the contribution of fodder trees such as leucaena (*Leucaena leucocephala*), Mexican sunflower (*Tithonia diversifolia*) and tilo (*Sambucus peruviana*) to farm productivity and the reduction of GHG emissions. Related technical publications were produced.

29. Measured using robust methodologies linked to the Colombian national monitoring system for climate financing (*Sistema de Monitoreo, Reporte y Verificación de Financiamiento Climático*).

30. While the project was designed prior to the ascendancy of the landscape approach, its design/implementation did consider landscape connectivity. Targeting for biodiversity benefits explicitly considered the spatial distribution of biodiversity in the landscape (and offered bonuses, for example, in areas of especially high biodiversity benefits). Establishment of live fences and trees on pastures had a strong element of landscape connectivity. The ICR acknowledges the relevance of aggregated efforts at the landscape level in Section V, Lessons Learned. The geographic dispersion of project efforts resulted mainly from the need to involve farmers interested in adopting innovative approaches over diverse eco-systems. These pioneer farmers proved the concept, provided learning, and induced replication. As knowledge and experience were gained, adjacent farmers engaged, increasing the potential for impacts at a landscape level.

31. Vegetation: number of species/plot, density of foliar strata, soil coverage, canopy coverage, stem density, diameter/height distribution.

32. Effects of Intensive Silvo-pastoral Systems on Physical and Biological Soil Erosion Reduction. Research covered 10 farms in two ecoregions. Erosion was quantified on degraded land and iSPS parcels (3000 m2), from August 2016 to November 2017. Giraldo N. V. and Chará, J. 2017.

33. The Bank commissioned a econometric analysis based on data of the quasi experimental exercise looking at thirteen variables. This follow-up analysis confirmed the initial results and provided details of the main

productivity and quality-related variables impacted through the adoption of SPS systems.

[34.] Commissioned by the World Bank to Technoserve; see http://documents.worldbank.org/curated/en/324381569396107123/Mainstreaming-Sustainable-Cattle-Ranching-Project-Business-Case.

[35.] The main factors are indicated throughout Section IIB, and more explicitly in Section III B, Factors Affecting Implementation: (a) high up-front costs of SPS introduction/adoption; (b) limited financing available for smaller-scale ranchers and their own reluctance to borrow; and, (c) small scale of landholdings of most farmers applying to participate. Appraisal estimates were based on significant participation of larger farmers and thus larger average farm size per beneficiary. Further, the UK donor's insistence that the AF focus on small-scale ranchers/poverty reduction and limit the participation of larger ranchers, formalized this trend. This reduced the amount of land available for conversion to environment-friendly SPS. Extreme climatic events in 2015 and 2016 further affected SPS progress.

[36.] For example, when the FINAGRO credit instrument proved ineffective, another (PES-2) was designed and piloted to provide financial incentives to farmers up-front. Restructurings also included adjustments to PES schemes to align them to operational realities. Other changes resulted from receiving an Additional Financing, and from efforts to use the remaining funds effectively in the final period.

[37.] *Plan Nacional de Desarrollo, 2018–2022: Pacto por Colombia, pacto por la Equidad* (http://bit.ly/PNDPactoporColombia).

[38.] For instance, the AF amended the Results Framework to collect gender-disaggregated data for the PDO-level indicator "Number of cattle ranching farms benefitting from Project instruments (TA, PES, or support for establishment of on-farm nurseries)."

[39.] *https://www.nature.org/es-us/sobre-tnc/donde-trabajamos/tnc-en-latinoamerica/colombia/historias-en-colombia/ganaderia-productiva-protege-naturaleza-paz/*

[40.] Under the AF, 2,269 technical staff, 367 teachers, and 3,868 students from outside the project participated.

[41.] The national roundtable (MSG-Col - *Mesa de Ganadería Sostenible Colombia)* - is a public-private forum with some 53 members. Both MADR and the Ministry of Environment and Sustainable Development (MASD) are leading players in MSG-Col, now an essential forum to disseminate technical knowledge and facilitate dialogue on programs and policies for sustainable CR.

[42.] As noted, the PAD envisioned that producers would obtain US$22M in FINAGRO credit lines to develop SPS.

[43.] The multi-dimensional poverty index, which is arguably a better measure of well-being, is not useful in this case because certain variables (such as education) change slowly and with a lag, so they would be unlikely to have changed yet due to project effects.

[44.] The PAD foreshadowed first-year outreach activities to include peer-to-peer sessions/visits with potential participants to farms successfully implementing SPS, to demonstrate SPS benefits, discuss implementation costs and technologies for different eco-systems, jointly identify potential funding sources, and discuss farmer

concerns.

[45.] Beneficiary selection procedures were optimized during implementation, as follows: application forms and required documentation were simplify; the list of requirements for participation were reduced; a strategic alliance was established with the Land Restitution Agency to verify land ownership and the entire selection process was done digitally. The Recipient Completion Report indicates that about 78 percent of beneficiaries were small-scale (averaging 19 ha), 17 percent were medium-sized (averaging 85 ha), and 5 percent were large (averaging 306 ha).

[46.] The target established in the NDP is: 1.4 million hectares under sustainable conservation systems, of which 301,900 hectares are to be under restauration processes, including 147,000 hectares under SPS systems.

[47.] Case Study on the Climate Resilience of Sustainable Livestock Production using Silvo-pastoral Systems. Commissioned by the World Bank. Ramirez, M. and Perez, K., 2019.

[48.]Target values for land area under improved land management/systems depended on about 30% of total beneficiaries (i.e., 600 of the targeted 2,000) being larger ranchers converting around 20 ha apiece (the source of the Intermediate Outcome Indicator of 12,000 ha of intensive SPS). To reach 50,500 ha (PDO Indicator 1), 2,000 ranchers would have had to convert an average 25 ha. (Small ranchers in earlier calls for interest averaged around 15-16 ha total land size, implying overly ambitious targets). In practice, this did not occur, and beneficiaries were, by end-of-project, 95% small- and medium scale, and 5% large. Under the AF (2014-2019), the UK donor – adopting a more overt poverty reduction focus - required that the project target only small- and medium-scale beneficiaries.

[49.] Some 588 ranchers attended project credit training sessions, of whom 229 (39%) confirmed their interest in obtaining credit. Only 14 credit applications had been presented to *Banco Agrario* by end-2014. Six were approved and the others rejected or not disbursed.

[50.] Supply-side factors included: traditional risk aversion of financial institutions to lending to small-scale ranchers lacking a credit history and with collateral compliance difficulties, thus entailing higher transaction costs; lack of awareness of SPS and its potential returns (this was a pilot incentive for SPS); and, scarcity of financial instruments adapted to SPS investments (particularly for cash flow). On the demand side: small ranchers' uneven credit histories and limited understanding of collateral requirements; their perception that mortgages were risky; and, their early stage of learning about project-promoted systems and benefits.

[51.] Reasons: (a) area converted to sustainable land use on each ranch was smaller than originally estimated, as was ranch size; and, (b) the type of changes implemented received lower payments, e.g., dispersed trees.

[52.] The Aide Memoire (November, 2015) observes that El Niño 2015 had devastated the livestock subsector, affecting more than 80,000 farms on 2M ha and killing 34,524 head of cattle.

[53.] These consisted of TA, TA + PES1, TA+ PES2, and TA + PES1 + PES2.

[54.] Studies sought to: evaluate the business case for private sector support for broad adoption of SPS, including its profitability; develop/validate methods for measuring the impact of alternative land uses on carbon capture and deforestation; understand how land-use changes promoted by the project influenced the carbon balance; assess productivity gains generated by changes in land use; and, delineate the links between SPS and climate resilience.

[55.] The NAMA details national targets for reducing GHG emissions in the bovine subsector and prioritizes the activities to achieve those targets. The CMSCR helped to prepare the livestock sector emissions baseline, and post-project, work has progressed under the Bank-managed Trust Fund.

[56.] The Rural Planning and Management Unit (*Unidad de Planificación Rural Agropecuaria*) is developing a Productive Management Plan for the livestock sector, which will define the vision for growth in the cattle ranching sector over the next 20 years.

[57.] Partnering with Cattle Ranchers for Forest Landscape Restoration. Alicia Calle Ambio, Royal Swedish Academy of Sciences, 2019. https://doi.org/10.1007/s13280-019-01224-8

[58.] An impact evaluation of the previous RSPS pilot project in Quindío showed that participants retained land use changes several years after the project had ended. Pagiola and Rios, 2013; Pagiola and others, 2014.

[59.] In 2019, FINAGRO released a subsidized interest rate credit line to support conversion to SPS systems, with FEDEGAN working closely with FINAGRO to ensure broader dissemination among farmers of this option. Furthermore, BANCOLOMBIA, a private sector bank, released in September 2020, its sustainability credit line for CR, supporting SPS-based on farm transformations. These green climate finance developments are largely attributed to the outcomes of the CMSCR project.