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Forest Conservation and Sustainable Development Goals in Colombia: Assessment of Projects in the AFOLU Sector

María Catalina Becerra
International Development Studies

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maribece@nmbu.no

Noragric
Department of International Environment and Development Studies
The Faculty of Landscape and Society
P.O. Box 5003
N-1432 Ås
Norway
Tel.: +47 67 23 00 00
Internet: https://www.nmbu.no/fakultet/landsam/institutt/noragric

Declaration

I, (name), declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature……..

Date……

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Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
AR	Afforestation and Reforestation
CDM	Clean Development Mechanism
CCB	Climate Communities and Biodiversity Standard
DANE	National Administrative Department of Statistics
GHG	Greenhouse gas
Ha	Hectare
ICONTEC	Colombian Institute of Technical Standards and Certification
IDEAM	Institute of Hydrology, Meteorology and Environmental Studies
LSC	Local stakeholder consultation
NGOs	Non-Governmental Organization
NDC	Nationally Determined Contributions
REDD+	Reducing Emissions from forest Degradation and Deforestation
SDGs	Sustainable Development Goals
UBN	Unsatisfied basic needs
UICN	International Union for Conservation of Nature
VCS	Verified Carbon Standard

Summary

The achievement of the Sustainable Development Goals (SDGs) at the national level is a priority for the Colombian government. However, none of the Agriculture, Forestry and Other Land Use (AFOLU) carbon projects validated and/or verified in Colombia against international standards before 2018, have considered the identification of regional and project-specific determinants of performance in relation to the achievement of SGDs, and consequently the impacts of such projects on the SGDs are unknown.

This is of particular importance given that these projects occupy more than 2 million hectares of the national territory and involve vulnerable areas of tropical and native forest along with the ecosystem and communities that depend on them. The findings of this research might be used by project developers interested in identifying the determinants that could potentially influence compliance with the SDGs.

In total, nine impact variables directly associated with the SDGs were identified as being the most common variables targeted by the 24 AFOLU projects assessed in this research. Sixteen regional and project-specific determinants were associated with each one of them through the statistical associations of quantitative and qualitative data. A case study was also analyzed in order to argument the findings of the quantitative analysis.

Six impact variables were impacted by regional determinants only: the type of working agreement offered to the workers was found associated with the occurrence of poverty and extreme poverty in the municipalities; the presence of indigenous peoples in the project area was impacted by the behavior of the deforestation rate by department; the proportion of women hired by the projects with the percentage of people with unsatisfied basic needs, and with access to basic infrastructure; the number of training sessions provided was associated with the school coverage in the municipalities; the destiny of the revenues from the carbon credits with the access to sewerage, and the improvement of the economic welfare with the school coverage as well.

One impact variable was associated with the occurrence of project determinants only: job creation was impacted by the scope, objective and type of land tenure of the project area. On the other hand, the number of black communities hired by the project and the investments in road infrastructure were associated with regional and project specific determinants, including: access to basic infrastructure, the occurrence of poverty and extreme poverty, the rate of people with unsatisfied basic needs, the behavior of the GINI coefficient, the household size, and the project size, the emissions reduced and the percentage of area already intervened.

Each impact variable was associated with the achievement of the SDGS number eight (promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all), ten (reduce inequality within and among countries), five (achieve gender equality and empower all women and girls), four (ensure inclusive and

equitable quality education and promote lifelong learning opportunities for all) and one (end poverty in all its forms everywhere).

Finally, the results of the case study show that the selected project can contribute to the achievement of the SDGs eight, ten, 15 (protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss) and 17 (strengthen the means of implementation and revitalize the global partnership for sustainable development). Unfortunately, the results also show that the revenues of the project from the sale of carbon credits were not as expected, and that the lack of knowledge of the project owners, and of transparency from the intermediaries, can result in unexpected low returns that prevent the project from achieving its targets.

1. Introduction

The expansion of carbon markets as a strategy to generate monetary benefits that support the design and execution of projects that conserve or increase greenhouse gas reservoirs, has attracted the attention of different governments and organizations, as all the activities and processes developed at a project scale might serve to demonstrate the national progress in the achievement of international commitments that bind countries to reduce emissions and offset the ones that cannot be completely avoided, e.g. The Paris Agreement (European Comission, 2015).

Colombia is one of the few countries that has advanced the most in terms of the design and implementation of carbon projects and on the definition of Intended Nationally Determined Contributions (NDC) for reducing greenhouse gas emissions (GHG) (Herrera, 2015). It is one of the few countries that already have a national carbon strategy in place and lately, Colombia launched the Colombian Carbon Tax. Such a tax is targeted towards all organizations that produce or use certain fossil fuels (gasoline, kerosene, jet fuel, among others) (Ministry of Finance and Public Credit, 2017). Colombia has also developed several projects able to compete in international voluntary carbon markets.

In Colombia, offsetting projects associated with the Agriculture, Forestry and other Land Uses (AFOLU) program, have been able to cope with different methodologies that assess the performance of projects in relation to the reduction of carbon emissions, the impacts of the project on the local communities, the financial health of the projects and in general, the successful validation and verification of the emissions reduced or sequestered by the plant covers.

However, all projects validated before 2018 on behalf of international standards, lack of a system that can assess the performance of the projects about the achievements of the Sustainable Development Goals (SDGs).

The inclusion of an SDG performance evaluation system has been one of the objectives of most international standards, as projects need to cope with international development agreements in order to effectively reduce the impacts of climate change while supporting the inclusive and sustainable development of local communities. For example, the Gold Standard has now transitioned into the Gold Standard for the Global Goals, that includes a set of parameters and requirements specifically associated with the project´s contribution on the SDGs that are needed to achieve a normal carbon certification. This, however, does not apply for projects validated before 2018, although older projects seeking their verification will have to transition into this new standard of rules (Gold Standard, 2019).

Likewise the Verified Carbon Standard (VCS) has recently launched its Sustainable Development Verified Standard (SD Vista), which consists of a framework for assessing and reporting on the sustainable development achievements of projects, through the application of rules for the design and implementation of initiatives interested in deliver benefits associated to the SDGs, while generating SD Vista assets that can also be traded in the voluntary market (VERRA STANDARD, 2018)

Consequently, and in spite of the need of older projects to identify their impacts on the SDGs to be able to transition into the latest version of the Standards, this research aims at

assessing the performance of Colombian AFOLU projects validated before 2018 under international standards (VCS, Gold Standard and Clean Development Mechanism (CDM), in relation to the achievement of specific SDGs, in order to generate a set of variables and procedures that can be used by project developers, to evaluate their projects and to claim monetary benefits, given their contribution to the SDGs. Such assessment includes the review of the project's public documents, the execution of phone interviews and the development of a case study.

2. Thematic background

Countries, organizations and citizens that are committed to reducing their GHG emissions locally or globally, have contributed to the development of different initiatives: from transitioning to clean energies and low impact farming to the enhancement of carbon sinks in plant covers. However, such actions do not eliminate the carbon footprint completely, and consequently, polluters have decided to offset their remaining emissions (Ecosystem Marketplace, 2018).

Offsetting projects

Offsetting projects include reforestation, afforestation, conservation or sustainable management of ecosystems, especially in developing countries. However, developed countries are also exploring offsetting their emissions locally. Most offsetting projects follow the rules and methodologies set out by voluntary standards. Standards make sure that the emissions reduced through these projects are real, measurable, verifiable (by an external audit) and additional, meaning that they would not occur in the absence of the offsetting activity (Ecosystem Marketplace, 2018).

There are 170 voluntary offsetting projects in 83 countries (see map) that belong to the AFOLU sector. These projects together have contributed to the reduction of 95.3 $MtCO2_e$ from 2005 to 2018. 11% of those projects are located in Latin America and the Caribbean (Ecosystem Marketplace, 2018).

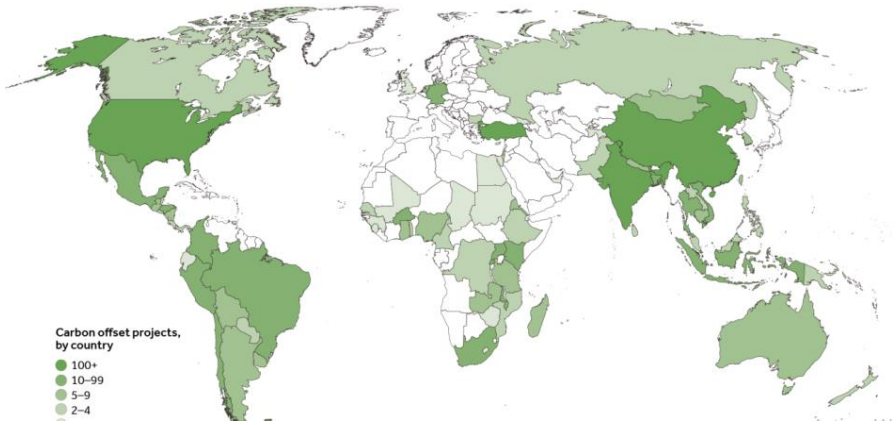


Figure 1 Location of voluntary carbon projects. Map produced by Ecosystem Market place and reported at the Forest Trends report on voluntary carbon markets 2018[1]

Offsetting projects in Colombia

In 2018, there were about 24 AFOLU projects validated on behalf of international voluntary standards in Colombia. Such projects occupy two million hectares approximately and involve the participation of indigenous peoples, black communities, farmers, private and public organizations and the national government. None of those projects has proven to

[1] https://bit.ly/2HXFX3H

demonstrate effectively their contributions to the sustainable development goals as no methodologies or rules were in place at the moment of their validation.

The sustainable development goals (SDGs) aim at ending poverty and protecting the planet for the well-being and survival of all species living on earth. Targets and indicators have been formulated towards the achievement of 17 SDGs, that in addition to the objectives targeted by the former Millennium Development Goals, included specific actions on areas such as climate change, peace, and justice, economic inequality, among others (UNDP, 2018).

Colombia, along with other 192 countries has agreed to achieve the accomplishment of the SDGs by 2030, and to do so, Colombia has created a strategy with specific financial and technical plans, framed in what is known as the “national strategy for the implementation of the SDGs”, that like many other national plans, depends on the implementation of the peace agreement (National Planning Department, 2017).

Such plans include subnational commitments to achieve zero deforestation by 2030 and to contribute with the reduction of poverty (SDG7), conserve the life on land (SDG15), reduce GHG emissions, (SDG13), reduce inequalities (SGD10), among others (National Planning Department, 2017).

Forest and the SDGs

The relationship of the SDGs with the conservation of forest has been defined in different studies and declarations, including the New York Declaration on Forest (Craig, 2019). Such declaration defines the importance of the achievement of the SDGs on the conservation and sustainable use of forest worldwide as summarized below:

The poorest people in the world depend on the forest for their survival. Most of those people generate income and food directly from the forest. Either by extracting Non-timber forest products or by harvesting wood.

Forest support crop production and food security as forest covers protect water sources, house pollinators, and seed dispersers, and act as natural controllers of pest and diseases in addition to host fauna that is part of the diet of many poor communities

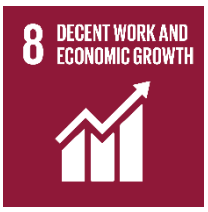
When deforestation occurs, different contagious diseases are spread into the environment especially due to the pollution and degradation of the water sources that depended on them. Forest also provide environments that are enjoyable by humans and that positively impact on the human health

When children have access to clean water and sanitation more school days can be generated in the world. The availability and quality of water is directly linked with the presence of healthy forest covers

Women usually depend more on natural resources for their survival as they are usually the primary users of the forest for the collection of food and medicine, charcoal for cooking, agroforestry systems and in general for the extraction of non-timber forest products

As mentioned before most freshwater available come from in or around forest areas

More than half of wood production is used for the generation of energy. Thus transitioning to more affordable and clean energy sources can reduce the pressure on the forest.



About 50 million people are employed in the forestry sector worldwide. Commercial plantings, sustainable forest management, and agroforestry systems are the activities that provide most jobs.

The main drivers of economic development especially in developing countries are the ones that contribute the most with the deforestation and forest degradation. Mining, large-scale agriculture, and oil production are among those drivers

Inequality in land distribution and access to land occurs especially in tropical developing countries where most forests are located. Reducing inequalities can facilitate indigenous and rural communities to access and manage land.

The urban forest can improve the quality of water and air. Their importance has also been associated with the sequestration of pollutants, the improvement of urban landscapes and the maintenance of urban flora and fauna.

The main driver of deforestation globally is the expansion of agriculture. Thus promoting the responsible consumption and production of food and other agricultural commodities can benefit the permanence of forest.

According to the source, forest offer about 30% of natural climate solutions needed to hold global warming below 2°C.

The reduction of the sedimentation that affects marine life is mostly possible because of the presence of forest. Likewise, mangroves can reduce the impact of storms and can protect coastal communities

Forest host 80% of the global biodiversity

Corruption and lack of governance allow the illegal logging and burning of the forest, especially in tropical countries. They also promote the existence of institutions that ignore the rights of communities over their forest.

Multi-stakeholder action is needed to reduce and eliminate deforestation and forest degradation. This includes the transparent participation of governments, NGOs and local communities, among others

The conservation of forest for the survival of humans and other forms of life has been promoted through different national and global partnerships and commitments, such as the ones established in 1992 by the Agenda 21, the UN forum on forest in 2000, the celebration of the international year of forest in 2011 and more recently the launching of the 2030 Agenda that dedicates special attention on forest through the SDG 15 (United Nations, 2019).

As can be noted, the contributions of forest on the achievement of the SDGs have been well documented as most stakeholders recognize the undeniable dependence that we have on the forest to survive. However, according to Seymour and Busch, (2017) from the World Resource Institute, the impacts of deforestation on the SDGs are less documented. Such impacts include increases in the vulnerability of communities and infrastructure to natural disasters, the reduction of agricultural productivity and the consequent rise of prices of most consumed commodities, the negative affectation of water sources, the reduction of the capacity of hydroelectric caused by continuous sedimentation, among others.

Thus, the development of reforestation, restoration and forest conservation projects can reduce such impacts, especially if projects are designed according to rigorous requirements

that prioritize the achievement of the SDGs as a mean to obtain economic benefits and support the development of local communities.

The achievement of the SDG 15, Life on earth, has been a priority for Colombia and consequently the country has invested in the establishment of a system for the monitoring of forest as a first step towards the reduction of deforestation and forest degradation. However, other actions on the AFOLU sector such as the creation of a carbon market, have also been considered to reduce greenhouse gas emissions GHG, while protecting and increasing the national forest cover and all its associated communities and ecosystems (Fundación Natura, 2018).

In this regard, the regulated and voluntary markets for the trade of carbon credits (that are equivalent to carbon dioxide sequestered by trees) generated by the AFOLU sector, and verified by national or international standards, are now playing a key role in Colombia, as more than 2 million hectares are currently involved in a carbon project, and hence the monitoring and report of their impacts might contribute to the achievement of the SDGs targeted by the Colombian government.

Different organizations have been trying to create synergies between the SDGs and carbon programs such as REDD (Reducing Emissions from Deforestation and forest Degradation) and validation standards like the VCS standard, the most used standard in Colombia by the AFOLU sector, that has lately developed the Sustainable Development Verified Impact Standard, a special methodology for the assessment of the impacts of carbon projects on the SDGs (VERRA STANDARD, 2018).

However, even when certification standards are now exploring ways to link the impacts of any carbon project to the SDGs, the methodologies used by all Colombian carbon projects before 2018, don't have a system for the assessment of such links, and consequently the impacts of the projects on the SDGs are unknown or poorly documented (Forest Trends, 2018).

The Project Cycle

For every AFOLU project to issue carbon credits, it is necessary to undertake certain steps before credits can be traded. The step one involves consultation with local communities in order to define the project activities and more importantly, to approve or reject a project as per the communities' desire. Once all stakeholders agree to continue with the process, then the project needs to be validated on behalf of a standard.

Such validation is conducted by an independent third party (auditor). Validation includes the review of the Project Document against the methodologies and program requirements and the acceptation of the preliminary carbon estimations. Once the project is validated, it needs to go through verification in order to issue credits.

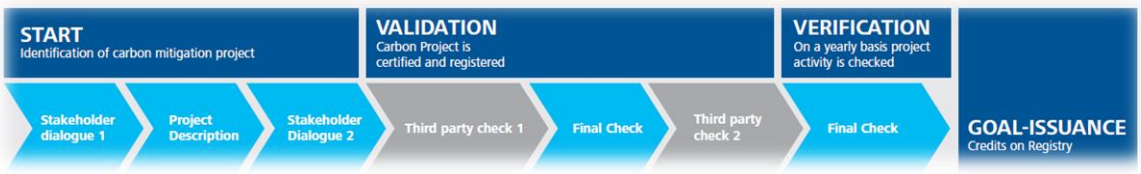


Figure 2 Project Cycle of AFOLU carbon projects[2]

Verification includes the calibration of the carbon estimations by installing permanent or temporal plots on the field to estimate the tree biomass that is then converted into equivalent carbon dioxide (a credit). Verification can occur simultaneously with validation if the trees are big enough to generate significant results in terms of biomass. Otherwise, verification can occur no later than five years after validation. Only when a project is verified, it can generate and trade carbon credits. (Gold Standard, 2019).

This research involves only projects validated before 2018. It is not known if those projects are currently attempting to be verified because such information is classified and inaccessible for the public.

[2] Image created by South Pole, 2018.

2.1. Objectives

Identify regional and project-specific determinants of performance of AFOLU projects validated against international standards before 2018 in terms of their contribution to the achievement of specific Sustainable Development Goals.

Specific objectives

1. Identify the association between regional and project specific determinants and impact variables for the totality of the voluntary AFOLU projects validated before 2018 on behalf of international standards
2. Identify the contributions and challenges of a case-study project in the achievement of the SDGs

Research questions

1. What are the regional and project specific determinants of performance to assess the achievement of SDGs in AFOLU carbon projects
2. Which SDGs are most commonly targeted by the projects?
3. What are the strengths and weakness of the projects that enforce/prevent them from complying with the SDGs?

3. Research design

This chapter includes a description of the study area, the methods of sampling, the tools used for data collection and the procedures applied to analyze de data for the quantitative assessment and the case study

3.1. Study area

The projects assessed are distributed in the continental territory of Colombia, and their areas are spread out in ten departments. The approximated area occupied by the projects is greater than 2 million hectares.

Figure 3 Location of some voluntary AFOLU projects validated before 2018. The project location was taken from the public VCS project database

The projects subject of this research were identified in the public registries of the most used voluntary carbon standards, including the VCS, the Gold Standard and the Clean Development Mechanism. The identified projects are summarized in the table below:

Table 1 Projects identified for the development of this research

Project ID	Project name	Geographic region	Size
A101	Restoration of degraded areas and reforestation in CÁCERES	Andean	1,230
A102	Restoration of degraded areas and reforestation CRAVO NORTE	Orinoquía	9,640
A103	Recovery of degraded areas with agroforestry systems in Colombia-NECOCLI	Andean	102
A104	Recovery of degraded areas with agroforestry systems in Colombia-EL RETIRO	Andean	116
A105	Vegachi restoration of degraded lands	Andean and Caribbean	176
A106	Super Cerdo Conservation and Reforestation in Barbosa	Andean	82
A107	Forestry Project for the Basin of the Chinchina River, an Environmental and Productive Alternative for the City and the Region	Andean	4,539
A108	Grouped Project for Commercial Forest Plantations Initiatives in the Department of Vichada	Orinoquía	12,172
A109	Colombia Corpochivor REDD+ Project	Andean	937
A110	Chocó Darien REDD+ Project	Pacific	13,465
A111	REDD+ Project Resguardo Indigena Unificado Selva de Mataven (RIU SM)	Orinoquia Amazonia	1,150,212
A112	Concosta REDD+ Project	Pacific	54,623
A113	Mutatá REDD+ Project	Andean Pacific	34,288
A114	Rio Pepe y ACABA REDD+ Project	Pacific	48,177
A115	Bajo Calima y Bahía Málaga (BCBM) REDD+ Project	Pacific	83,452
A116	Carmen del Darién (CDD) REDD+ Project	Pacific	118,318
A117	SUPP REDD+ Project	Pacific	47,667
A118	Cajambre REDD+ Project	Pacific	60,316
A119	Reforestation with Rubber on degraded lands of Colombia	Orinoquia	10,000
A120	Productive forestry systems on degraded grasslands in Colombia	Orinoquia	4,123
A121	Acapa -- Bajo Mira Y Frontera REDD+ Project	Pacific	58,212
A122	Forestry Project “More Forests for Medellin”	Andean	680
A123	Proyecto “Incorporación de la biodiversidad en el sector cafetero en Colombia”	Andean	357
A124	Bonos de Carbono “Cooperación Verde”	Andean	1,230

The identified projects are distributed in five regions as described below:

- Amazonia region: 280,033 people inhabit this region. The Amazonia region is the biggest Colombian region characterized by having a warm climate and high precipitations throughout the year that allow the existence of highly diverse tropical forest. The Amazonian region presents some of the most dramatic rates of deforestation in the country (Hernández, 2019).
- Andean region: this region is dominated by the Andes Cordillera and is the most populated region in Colombia. It includes different forest ecosystems that are constantly threatened by the expansion of settlements and crops (Hernández, 2019).
- Pacific region: This is one of the most diverse regions of the world. Its location and climatic conditions make it possible for the development of tropical forest of various types. The region gathers seven national parks, and the majority of the inhabitants are black communities (Hernández, 2019).
- Orinoquia region: The orinoquia region borders with Venezuela and includes different ecosystems such as natural savannahs, dry and tropical forest, gallery forest and swamps. It is surrounded by some of the most important and diverse rivers in Colombia (Hernández, 2019).
- Caribbean region: This is a region with a very warm climate located in northern Colombia. It gathers important coastal sanctuaries, swamps and the Sierra Nevada. Its diversity varies according to the height that goes from the sea level to the 5000 meters (Hernández, 2019).

3.2. Method of sampling

This thesis consisted in the execution of a quantitative assessment and a case study. The methods of sampling are described below:

3.2.1. Quantitative analysis

The quantitative analysis consisted in the identification and associations of regional, impact and project specific variables in order to identify the determinants of performance of each project in relation to the achievement of the SDGs. (Table 3)

The projects assessed were 24 Colombian projects that belong to the AFOLU sector, and that have been registered or validated under the following validation standards: Gold Standard, VCS standard and the Clean Development Mechanism (CDM). The project documents reviewed were openly published at the websites of each certification standard (Table 2):

Table 2 Websites of the certification standards and main Project developers

Projects pipeline and database from websites
Gold Standard: https://www.goldstandard.org/our-work/projects-and-registry
VCS Standard http://www.vcsprojectdatabase.org/#/home
Clean Development Mechanism https://cdm.unfccc.int/Registry/index.html

There are other AFOLU projects certified by ICONTEC, the only certifying body in Colombia. However, ICONTEC projects are not published openly, and despite several attempts to reach the project owners, no response was received from any of them. The methods used to contact those included phone calls and emails containing the presentation letter from NMBU (Annex I), and a power point presentation with the objectives of the research and the description of the necessity of accessing the project documentation. As a consequence only projects validated by international certification entities were assessed. The totality of those projects (24) was reviewed and contacted.

The method of sampling was the opportunistic sampling approach which aims at capitalizing on opportunities to collect data from certain individuals/projects, as only information from projects openly published was acquired. However, the entire population of Colombian projects validated by international standards was sampled.

Three different sets of determinants were assessed from those 24 projects: regional, project-specific, and those associated with the achievement of the SDGs (impact). For the first two sets, secondary information was reviewed. The information related to the project itself was obtained from the approved websites of the different certification standards, while for the regional determinants only official secondary sources were consulted (government and private sources).

For the impact variables, in addition to the review of project documentation, the project owners were contacted, and a phone interview was addressed to them. The phone

interviews consisted of 20 questions designed to last no more than ten minutes in total. The questions were addressed towards the identification of the project´s contribution to the achievement of nine SDGs (Table 3). Those SDGs were selected after comparing all project documents and assessing which were the project targets and achievements that could be associated with them. The result of such comparison was used to determine the number of SDGs that most projects can usually target, even unintentionally (United Nations, 2018). The full questionnaire can be found in Annex 2.

Table 3 Sustainable Development Goals, indicators, and questions associated with them

SDG	Indicator	Adjusted indicator	Question
1 End poverty in all its forms everywhere	The proportion of the population living in households with access to basic services	Projects that support the development of different types of basic infrastructure: roads, bridges, nurseries, improvement of housing, alternative energy, offices, schools, transportation means, and water-related infrastructure	14
2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture	The proportion of the agricultural area used for sustainable agriculture	Projects that contribute to the development of infrastructure for sustainable food production systems Projects that have implemented sustainable agrifood systems	14 17
4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Attendance rate by sex to formal or informal education during the last year. Proportion of schools with access to (a) electricity; (b) the Internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities; (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions)	Number of training sessions provided by the project Number of assistants to training sessions Contribution of the project to support and develop school-related programs in the project zone	12 13 19
5 Achieve gender equality and empower all women and girls	Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination based on sex The proportion of women in managerial positions	The proportion of women hired by the project The proportion of women hired by the project that occupy high-responsibility positions	10 11

8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Average hourly earnings of female and male employees, by occupation, age, and persons with disabilities The proportion of youth (aged 15–24 years) not in education, employment or training	Number of temporal and permanent jobs created by the project since the project start date Type of working agreement preferred for the workers of the project The average age of the people working for the project	3 4 5
10 Reduce inequality within and among countries	The proportion of people living below 50 percent of median income, by sex, age, and persons with disabilities	Number of indigenous hired by the project Number of black communities hired by the project	9 9
15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Progress towards sustainable forest management Red List Index	The proportion of project area already intervened Contribution of the project to the protection of endangered species	1 n/a[3]
16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable	Proportions of positions (by sex, age, persons with disabilities and population groups) in public institutions (national and local legislatures, public service, and judiciary) compared to national distributions	Number of ex-combatants and people displaced by the armed conflict hired by the project	8

[3] n/a apply to all SDGs that were assessed through secondary sources rather than phone interviews

and inclusive institutions at all levels			
17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	Foreign direct investment (FDI), official development assistance and South-South cooperation as a proportion of the total domestic budget	New investments attracted by the implementation of the project	18

3.2.2. Data collection

The desk review and the interviews resulted in the identification of 60 variables per project classified into the project and regional determinants and impact variables (Figure 1). However, due to the rate of response per variable and their relation to the project, only 49 were included in the quantitative analysis as described below.

Variables identified during the review of secondary and primary sources were organized in a matrix containing the following data:

- Project name as registered in the Project Document
- Project id as coded in this thesis

Impact variables are those variables that reflect the impacts of the project on the climate, communities, and biodiversity according to the regional context. These are directly linked with the achievement of the SDGs but depend on the regional and project explanatory variables. In addition to the review of the official project documents, these variables were also identified through phone interviews addressed to the project owners. The contact details of the owners were openly published at websites of the validation Standards. 16 Impact variables were identified:

- Temporal and permanent jobs created by the project: this variable relates to the number of temporal and permanent jobs created by the project since validation. The data for this variable was obtained from the review of the Project Document and then confirmed through the phone interview with the project owners. SDG associated number 8
- The preferred working agreement offered to project workers: This variable is associated with the quality of employment offered to the workers. Projects that prioritize indefinite (permanent) agreements are promoting a stable working environment in which workers have secured their access to social security services along with other benefits not available when working under temporal agreements. SDG associated number 8
- Presence of indigenous inside the project area: this variable indicates if the project involves indigenous people living inside the project area. SDG associated number 10
- The number of indigenous hired by the project: this variable attempts to show that the project has no discrimination regulations against indigenous peoples living inside or close to the project area. SDG associated number 10
- The number of black communities hired by the project: this variable attempts to show that the project has no discrimination regulations against black communities living inside or close to the project area. SDG associated number 10
- People from armed conflicts involved in the project: this variable attempts to show that the project has no discrimination regulations against black communities living inside or close to the project area. SDG associated number 16
- The proportion of women hired by the project: data obtained from the Project document and then confirmed through the phone interviews. SDG associated number 16 and 5

- The proportion of women occupying high-responsibility positions: such positions include the coordination and management of staff, budgets or technicalities of the project. Data for this variable was obtained from the phone interviews. SDG associated number 5
- The number of training sessions provided by the project: this variable is about the number of training sessions provided to the workers and local communities since the project was validated. SDG associated number eight and four
- Project's support on the development of road infrastructure: this variable tries to identify if the project has invested in the development of road infrastructure inside the project area
- Project's support on the development of housing infrastructure: housing infrastructure for workers installed inside the project area. SDG associated number one
- Project's investments from the sale of carbon credits: this variable tries to identify if the project has received any revenues from the credits since validation, and if so, the variable indicates what types of investments have been done with such money. SDG associated number one
- Project's support on the development of agrifood infrastructure: agrifood systems include orchards, sustainable agriculture, and fishing. SDG associated number 2
- Projects capacity to attract further investments: this variable attempts to show if the project has managed to attract further investments from external private or public sources. SDG associated number 17
- Project's support on the development of school programs: such programs are only related to the schools located close to the project area. SDG associated number 4
- Project's contribution to the improvement of the economic welfare of local communities. SDG associated number 1

Project-related variables are the determinants specific to every project that can be easily manipulated, also in the short term. They include the location, size, validation standard, objective, scope, etc. These were taken directly from the Project Document that is openly published at the websites of the validation Standards. These 12 variables are:

- Location, department
- Project scope (conservation-reforestation)
- Project size (hectares)
- Methodologies used for the validation of the emissions reduced by the projects. The projects used seven methodologies from the Verified Carbon Standard. Some projects were also validated before the Gold Standard methodologies. Methodologies present a set of parameters and conditions that projects should follow to issue carbon credits. Methodologies are selected according to the applicability conditions of every specific project and on the types of vegetation and activities planned for each initiative.
- Project start date
- Project objectives classified as Reforestation with native and introduced species, development of agroforestry systems, restoration of degraded forest, a mix between reforestation, agroforestry and human-assisted regeneration; and finally, conservation and sustainable forest management (REDD+)

- Standard used for the validation of the projects. The Standards included were the VCS, the CBB, the VCS+CCB, the Gold Standard and the CDM.
- Project duration
- Type of land tenure identified for the project area and classified either as public, communitary or a mix of both of them
- Percentage of the project area already intervened (since validation) as per the descriptions included in the Project Documents
- Annual reduction $tCO2_e$ (tones of equivalent carbon dioxide)
- Population living inside the project area as per the information reported in the Project Documents

Regional variables are associated with specific socio-economic indicators at the municipal or departmental scale that usually remain constant in the short to intermediate term. They are those obtained from the review of secondary local (vereda) and regional (municipality or department) data. These variables were used to identify how the regional and local characteristics of a project affect how a project can contribute to the achievement of the SDGs. The 21 selected variables were:

- Protection of endangered species: All Project Documents include a section in which the plant and animal species identified inside the project area are listed and classified according to the red list[4] of the International Union for Conservation of Nature (IUCN). A Project that included species classified as endangered, critically endangered and extinct in the wild was considered as projects that protect endangered species.
- The project location in relation to conflict zones as identified by the Defensoria del Pueblo, (2018). The source classifies the municipalities according to the risk they have of presenting one or more armed conflicts. All assessed projects located inside a municipality classified as having a high to extreme risk of armed conflict was considered as a project located in a conflict zone.
- Rural population per municipality as per the National General Census executed in 2005. Data included in this research was for the number of people registered as living in the rural areas of the municipalities only (DANE, 2005a).
- Percentage of rural population with unsatisfied basic needs (UBN) as reported by the National General Census in 2005. The indicators that made up the UBN in Colombia are inadequate housing, critically overcrowded households, inadequately serviced households, households with high economic dependency and households with school-age children not attending school. (DANE, 2005b)
- Percentage of people with access to electricity, sewerage, aqueduct, phone, and toilet connected to the sewerage as reported by DANE, (2015)
- School coverage measured as the percentage of children and youth officially coursing (registered) primary and secondary studies in public and private schools per department in 2017. (Ministerio TIC, 2017)
- Internally displaced people measured through the intensity index. The intensity of forced displacement index shows the number of individuals expelled by a

[4] UICN https://bit.ly/2ZOvTzT

municipality/department over the population of the municipality/department expelling per thousand inhabitants. (Unidad de Victimas del Conflicto, 2018)

- Health coverage: percentage of people per municipality in 2018 with access to health services provided either by the public social security services or by private entities. (Ministerio de Salud y Protección social, 2018)
- Percentage of non-fetal deaths in children registered in 2017 per municipalities. (DANE, 2018)
- The trend of deforestation classified either as positive (increased), negative (decreased) or neutral (constant). The data for this variable was published by the Institute of Hydrology, Meteorology and Environmental Studies of Colombia (IDEAM, 2017). Data correspond to the rate of deforestation for the period 2015-2016 per department.
- Number of ex-combatants reinserted per municipality during 2017 as reported by (Datos Abiertos de Colombia, 2018)
- Average people per household from in 2012 per department as reported by (DANE, 2017)
- Percentage of poverty incidence in 2012 per department (DANE, 2017)
- Extreme poverty incidence measured as a percentage of the total population in 2012 per department that is below the extreme poverty line which is the minimum per capita cost of a basket food that guarantees the basic caloric needs of the population (DANE, 2017).
- Unemployment rate (%)
- GINI coefficient (DANE, 2017)
- Poverty Line per department in 2012 measured in Colombian pesos as the minimum income that a Colombian should receive every month for not being considered poor

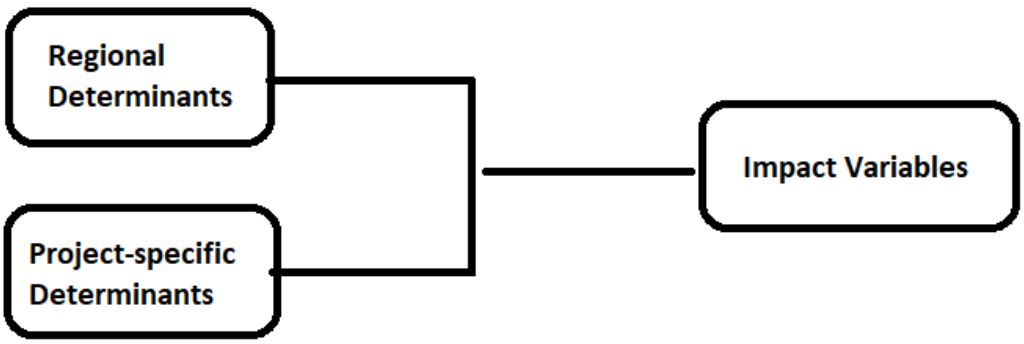


Figure 4 Regional and Project determinants and impact variables

The impact variables identified through phone calls were recorded in separate questionaries' designed for the 24 projects.

The review of secondary information consisted of the analysis of the following documents:

- Project Design documents or Project Documents: Contains the full description of the project

- Monitoring reports: includes information about impacts on climate, community, and biodiversity
- Validation and verification reports: these documents contain the recommendations done by auditors about the weakness and strengths of each project to, among others, monitoring, verify and report their impacts

These three documents are the core information used by the Standards and auditors to validate and verify the reduction of GHG emissions and for the proponents to claim carbon credits that are then traded in the market.

Regional determinants were identified by reviewing official secondary information, including information produced by the National Ministry of Environment, the Autonomous Environmental Authorities of each municipality, the National Planning Department and the entity in charge of collecting and validating national statistics, DANE.

3.2.3. Data analysis

After data collection, every regional and project specific variables were correlated against the impact variables by using the statistics program SPSS. The variables were coded in order to facilitate their analysis and then the codes were entered into the statistics program (Annex IV). Different types of test were applied depending on the type of the variable and considering that the impact variables (SDGs) were always the dependent variables:

Table 4 Type of test applied to each pair of variables

Impact variable	Expl variable	Type of test
Ranked	*Categorical*	*Kruskal-Wallis test*
Ranked	Ranked	Spearman test of association
Categorical	*Ranked*	*Kruskal-Wallis test*

The small sample necessitated certain choices with regard to data analysis. Multiple regression analysis was not feasible, so statistical tests focus on simple associations between one response variable and one explanatory variable.

Nonparametric tests most obviously have an application when ranked order dependent variables are involved; that is, variables measured according to an ordinal scale, such as Likert-scale data. However, the usefulness of these statistical tools goes beyond such applications. Standard statistical tools, such as analysis of variance and linear regression, rely on strict assumptions related to linearity and parameters of the distribution. Even deterministic and monotonic relationships may fail to yield significant results when these assumptions are violated (Sokal and Rohlf, 1981).

For data characterized by skewed distributions and nonlinear associations, logarithmic conversions – to normalize distributions and linearize associations – represent a standard tool. Logarithmic conversions may, however, be ineffective or impractical, for example when the data contain a large proportion of zero values. For such data, nonparametric tests – which are concerned only with the distribution of the variates and not with specific parameters – may possess greater power (Sokal and Rohlf, 1981).

Small samples often display these properties, and for such samples, it may, therefore, be desirable to convert numerical variables to ranked orders to facilitate the use of nonparametric tests (see examples in Sokal and Rohlf 1981, pp 430-432; 602-606).

Thus, although the data originally included numerical (continuous, cardinal-scale), ranked (ordinal-scale), and categorical variables, the numerical variables were converted into ranked orders. A Spearman test of association was employed when two ranked variables were involved, while a Kruskal-Wallis analysis of variance was employed when one ranked and one categorical variable was involved (implying sub-division of sample ranks into "treatments" defined by the categorical variable). The Kruskal-Wallis test tells when a categorical variable significantly influences the distribution of the ranked variables (McDonald, 2019).

The division thus assumed the direction of causality into outcome and explanatory variables; the data did not permit a test of casual direction in those cases where it might be ambiguous. Chi-square tests were also used when two categorical variables were involved, but the sample was too small for feasible chi-square analysis, and these were therefore omitted from the results.

3.3. Case-study

The qualitative analysis consisted of the design and execution of a case study. The type of sampling used for the case study was a generic purposive, and opportunistic sampling that uses a typical case of study, in the way that the case consisted in the reforestation with native and introduced species in Antioquia, and reforestation projects in Antioquia were the most common types of projects of the sample. Also, key informants were interviewed through open-ended conversations (Bryman, 2012). Key informants interviewed included representatives from the project management team, workers, and neighbors.

The case of study selected was the project A106, located in the municipality of Barbosa, Antioquia. The case was chosen because of the facility to access the project area from the city of Medellin and because of the ability of the project owner to authorize workers from the farm to give their free opinion about the project.

The case study consisted of the execution of semi-structured interviews with key informants, as such method allows flexibility in the way information is obtained depending on the context (Bryman, 2012). Although open conversations were held with the informants, an interview guide was designed to avoid leaving important topics out of the conversation.

The interview guide has been designed to investigate the process related to the implementation of the project and to relate the outcomes of the interview with some of the parameters assessed in the quantitative scheme. The questions included in the interview through open-ended conversations were:

- What kinds of problems have project managers experienced in terms of the implementation of the project?
- What kind of management approach have they applied to tackle this problem?
- How has collaboration between project management and the local community been? Have there been any controversies? If so, how have these been handled?
- Have there been “winners and losers” as a consequence of the project?
- Have there been any questions regarding rights over land or carbon credits?
- Do people know about the SDGs and how the project can contribute to achieving them?
- What do you like about the project and what you do not like?
- What type of contracts are mostly offered to the workers?
- How has the project contributed to job creation?
- How many institutions have approached the project?

Some other questions included in the interview were designed based on the results of the local stakeholder consultation[5] LSC that took place at the beginning of the project, and from other documents including the evaluation forms of the LSC (Table 5), the impact

[5] The local stakeholder consultation (LSC) is a public consultation required by all standards assessed in this thesis that consist on the free and prior consultation of the project with the stakeholders directly or indirectly impacted by the project. LSC should be conducted before the project is implemented as stakeholders need to be able to approve or reject the project and to propose or eliminate certain project activities(Gold Standard, 2019)

assessment, and the monitoring plan proposed in 2014 to assess the impacts of the project on the climate, communities and biodiversity.

The following comments were taken directly from the evaluation forms completed by the participants during the LSC. Participants included workers, neighbors, and representatives of regional and national environmental authorities. For the purpose of this research, the summaries were classified in categories that were then associated with specific SDGs.

Table 5 Summary of the evaluation forms obtained during the first local stakeholder consultation[6]

What do you like from the project	**SDG**	**What you do not like from the project**	**SDG**
Generates employment	8	The use of a few native species	15
Protects water bodies	6	Low participation of local communities in the project	8
Can contribute to the reduction of odors from the pig production factory	3	Lack of measures to protect the soil	15
Use and protects native species	15	The use of introduced species (Pinus and Eucalyptus)	15
Prohibits the exploitation of child labor	8	No replicas of the project in the neighboring areas	8
The project can improve the quality of water	6		
Forbids hunting	15		
Improves the landscape	15		
Promotes the participation and control from different organizations	17		
Promotes the protection of natural resources	15		
Can contribute to the increase of biodiversity	15		

Likewise, the contents of the following table (Table 6) include the results of the monitoring plan proposed in the sustainable Development Assessment (DA) performed during the first LSC. The parameters included were associated with specific SDGs just as the main topics highlighted in the evaluation forms.

[6] This table was constructed based on the results of the evaluation forms obtained during the first LSC. The SDGs were associated based on the review of secondary information

Table 6 Results of the sustainable development assessment

Parameter assessed during the DA	Method of monitoring	Results of parameter	SDG
Quality of employment	Surveys	Few permanent contracts	GOAL 8
Human and institutional capacity	Records of meetings with other organizations	Few institutions knew the project	GOAL 17
Quantitative employment and income generation	Records of people hired by the project	15 people hired by the project	GOAL 8

4. Results and discussions

This section shows the associations identified between regional and project specific determinants, and impact variables related to the achievement of the SDGs, for the totality (24) of the AFOLU projects validated before 2018 in Colombia, against the Verified Carbon Standard, the Climate Community and Biodiversity Standard, and the Clean Development Mechanism.

The impact variables identified are the most targeted SDGs that are associated with the occurrence of certain regional and project specific determinants. Such determinants are described in the following section.

On the other hand, the analysis of the case study served to identify the specific strengths and weaknesses of a project in the fulfillment of the SDGs. Likewise, the case-study allowed the comparison between the stakeholder's opinion on the project during validation and their opinion at the current time.

4.1. Quantitative analysis

The results and discussion of the quantitative analysis aim at responding to the objective one of this thesis. Every impact variable identified was tested against regional and project determinants and the results of this section are presented accordingly. To increase the coherence of the descriptive statistics, ranked and categorical variables were analyzed separately.

4.1.1. Descriptive statistics

The identified variables were classified in the following categories: ranked (numerical) and categorical:

Ranked variables:

Table 7 includes information about the number of respondents per variable, the maximum and minim values that each variable could take, the mean and the deviation standard. The names of the variables are presented according to how they were coded. For a better understanding of the results, please refer to the code book.

Thirty ranked variables were identified. Most of them were numerical variables converted into ranked in order to increase the possibility of models fitting such a small sample. Many of the ranked variables came from the review of secondary data. When no information was available for a variable, it was classified as not applicable (N/A). The descriptive statistics of the numerical variables that were then converted into ranked are shown in Table 6.

Projects A121, A122, A123, and A124 were the projects with the less rate of response as the project owners could not be reached by phone and consequently, they were not interviewed. Twenty-four variables had a rate of response of 100%. The variables with fewer responses were: the amount of population living inside the project area, the number of training sessions provided since validation, and the average number of people per household.

Five of the variables presented in the previous table were classified as impact variables because they had a direct relationship with the SDGs. The descriptive statistics of such variables are commented below:

The average number of jobs generated by the 24 projects analyzed is 152 (including both, temporal and permanent). On the other hand, about 15% of the workers hired by the project are women, and 40% of those women occupy high responsibility positions, meaning that they either manage staff and budgets or that they coordinate the technical development of the project.

Likewise, the average number of training sessions provided since the projects were validated is 29. Most of those training sessions were about safety and protective equipment, management of pest and diseases and handling of hazardous substances such as herbicides. The average number of ex-combatants hired by the projects was 37. Ex-combatants are those that used be part of the Revolutionary Armed Forces FARC (the former oldest guerilla in Colombia) or the paramilitary forces, and that are now re-inserted into the civil society.

Table 7 Descriptive statistics for the numerical variables

Variable/descriptive statistics	N								
	Valid	**Missing**	**Mean**	**Median**	**Mode**	**Std deviation**	**Minimum**	**Maximum**	**Sum**
Size	24	0	71470.5	9820	82.1	231976.8	82.1	1150212	1715293
Duration	24	0	36.2	30	30	27.1	0	100	870
% area intervened	24	0	86.6	100	100	27.1	0	100	2080
Tons CO2e reduced	23	1	289607	58000	58000	744983	593	3622352	6660971
Population inside project área	16	8	3773.6	1599.5	2	5204.7	2	18395	60379
Jobs created	21	3	152.1	50	400	176.8	1	470	3196
Women hired by the project	19	5	15.6	10	0	17.7	0	60	298.1
Women in high-responisbility positions	19	5	40.7	20	100	43	0	100	774.2
Number of training sessions provided	18	6	28.5	25	10	21.6	2	74	514
rural population per municipality	24	0	18129.5	10702	34633	17602.1	964	75605	435110
Unsatisfied basic needs per municipality	24	0	58.8	63.5	47.3	26.8	12.4	100	1411.2
% people with access to electricity	22	2	72.5	76.6	90	24.83	0.8	98.9	1595.9
% people with access to sewerage	22	2	39.4	42.9	61.1	30.8	0	96.5	868.6
% people with access to aqueduct	22	2	55	67.1	77	28.4	1	97.4	1210.5
% people with access to phone	22	2	27.1	19.2	29.6	27.2	0.5	91.1	596.7
% people with access to toilet	22	2	32.97	27	57.2	27.4	0.1	92.7	725.4
school coverage	24	0	88.5	81.3	70.6	27.1	49.3	172	2124.5
Internally displaced people	24	0	9.4	2.7	0	18.4	0	80.4	226.3
Health coverage	24	0	84	90.6	100	17.4	53.4	100	2016.4
Infant moratility rate	24	0	25.8	25.1	24	11.1	11.1	56.2	619.6
Ex-combatants reinserted in 2017 per municipality	24	0	36.3	20	64	29.6	5	116	873
Household size	18	6	3.6	3.4	3.4	0.3	3.3	4.1	65.3
Poverty incidence	20	4	40.9	28.2	26.8	18.2	26.8	68	819.7
Extreme poverty incidence	20	4	17.7	8.6	8.1	13.9	7.4	40	354.7
Unemployment rate	20	4	9.9	10.2	10.2	1.2	6.8	12.2	198.4
GINI	20	4	0.5	0.5	0.5	0	0.5	0.6	11
Poverty line per department	19	5	229553.3	240048	246012	20678.8	180067	250531	4361513

The following graphs show the distribution of frequencies of the variables that had a 100% response rate (N=24):

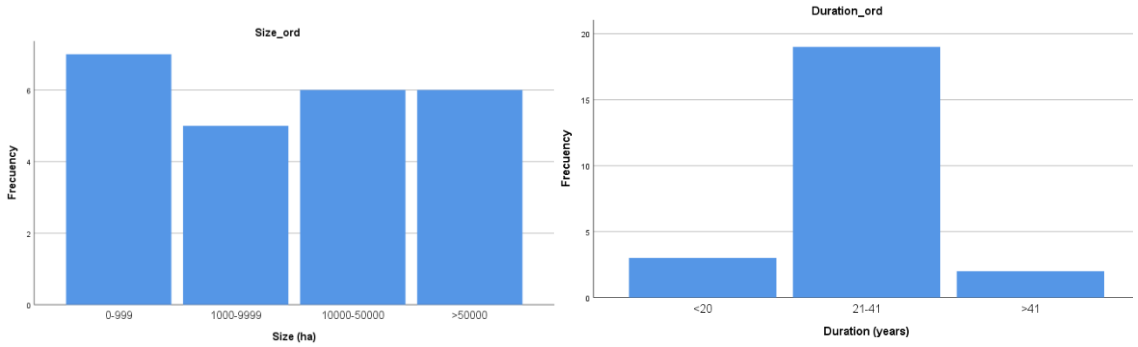


Figure 5 Size in hectares and t duration in years of the 24 AFOLU projects

As can be seen from the previous graphs, most AFOLU carbon projects in Colombia are designed to last 30 years, especially those that include afforestation and commercial reforestation, as 30 years cover at least two harvesting cycles. Projects that last more than 30 years are usually associated with conservation initiatives. Likewise, most projects had an effective area smaller than 1,000 hectares.

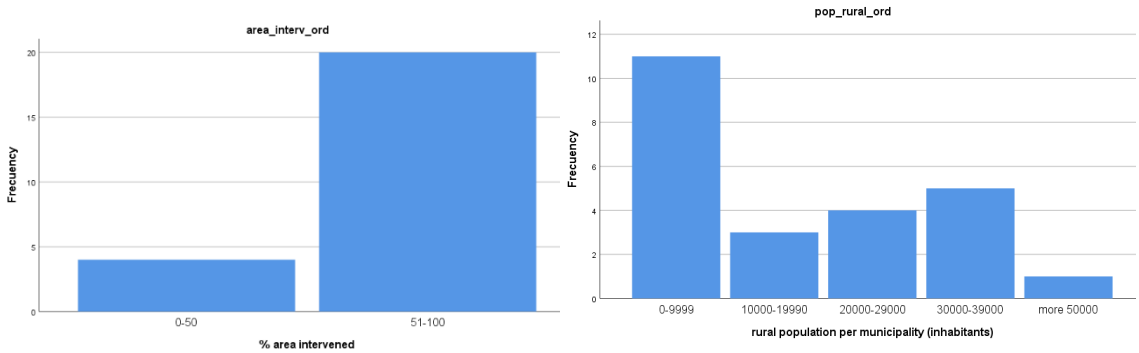


Figure 6 Percentage of the area already intervened by the Project since validation, and the total number of inhabitants per municipality

Graphs in Figure 6 show that most projects have already intervened more than 50% of the project area as per the activities planned and reported in the Project Documents since the projects were validated, even when about 80% of them have not received any revenues from the sale of carbon credits. Implementation activities on the field include the planting of trees, the execution of training sessions, the installation of nurseries, the delimitation of protected forest and the improvement of roads. On the other hand, the graph also shows that the majority of the projects are located in municipalities with small populations (less than 10,000 inhabitants). The reason for this, might be that projects are usually located in very isolated areas and far from urban centers.

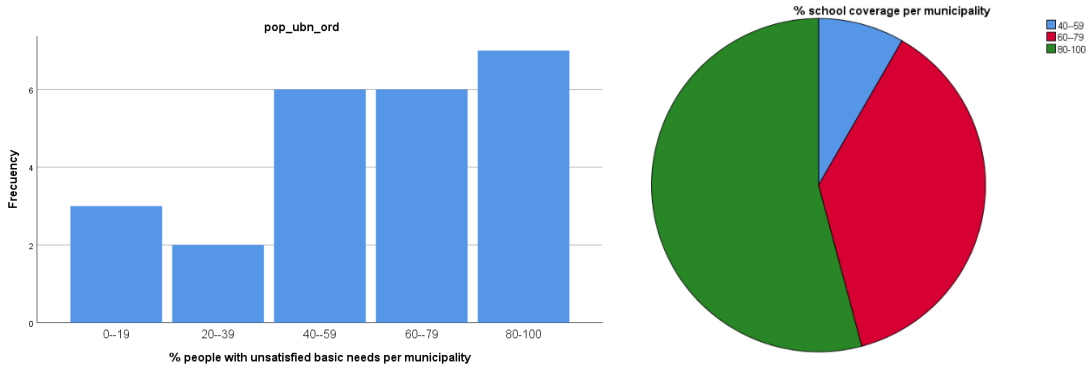


Figure 7 Percentage of people with unsatisfied basic needs per municipality and the percentage of children and youth with access to school per municipality

The variables represented in Figure 7, show that the majority of inhabitants of the municipalities where the projects are located live with many unsatisfied basic needs. Such a situation is not unusual as commonly people that rely on forest inhabits in very poor regions (Ministry of Environment and Sustainable Development, 2019). However, school coverage in the same municipalities is over 60%. Nevertheless, school coverage is not an indicator of school attendance which for some municipalities is lower than 60% especially for youth between 12 to 17 years (Gutiérrez, 2017).

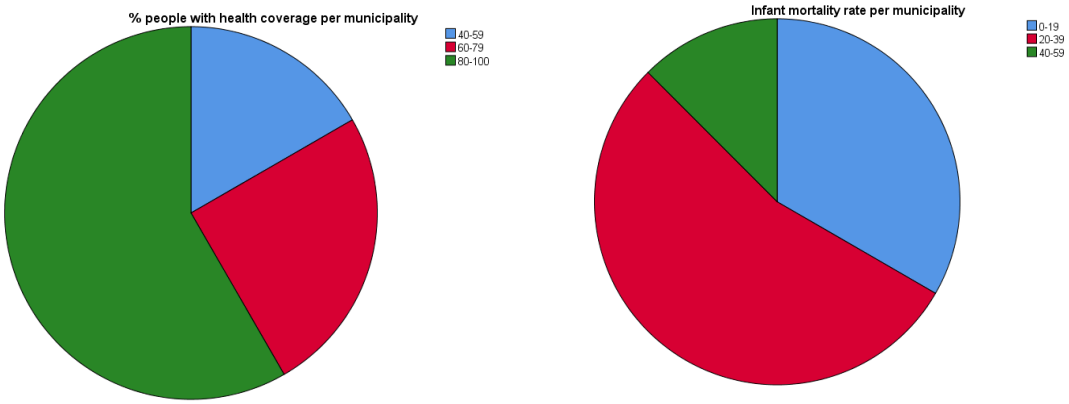


Figure 8 Percentage of people with access to health coverage per municipality and infant mortality rate

Figure 8 shows that despite most people that inhabit in the municipalities where the projects are being implemented have access to health services provided by either public or private entities, the infant mortality rate in the same regions is quite high. However, health access does not inform about the quality of the health services provided to the rural population, which most times is not adequate since many times health stations do not have the basic infrastructure necessary to provide a good service (Delgado-Gallego, Vázquez-Navarrete and Lygia De Moraes-Vanderlei, 2010).

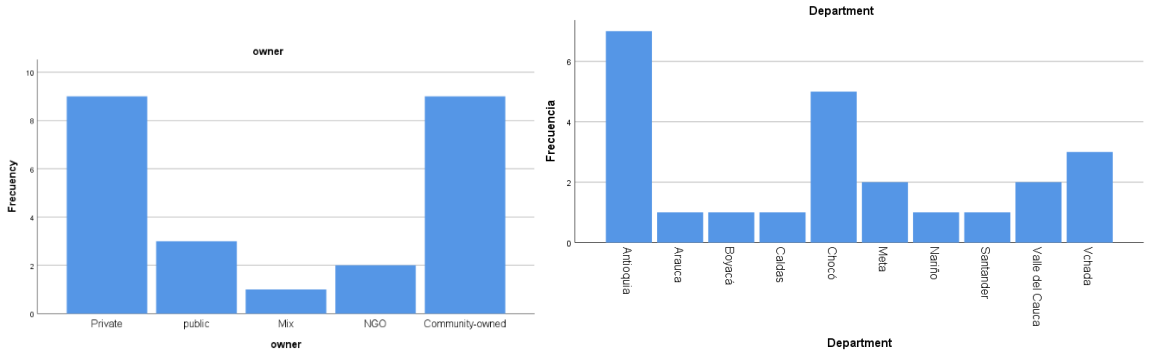
Categorical variables:

Twenty-seven categorical variables were identified in the quantitative analysis. The results of the following table are for the variables already coded. For a better understanding of the table, please review the code book.

Table 8 Descriptive statistics for categorical variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Owner	24	1.0	5.0	2.958	1.8292
Department	24	1.0	10.0	4.833	3.2793
Scope	24	.0	1.0	.542	.5090
Method	24	1.0	8.0	5.000	2.7187
Objective	24	1.0	5.0	3.333	1.8337
Standard	24	1.0	5.0	3.125	1.0759
Tenure	24	1.0	3.0	1.500	.5898
work_indefinite	21	.0	6.0	.762	1.3749
indigenous_insi	20	.0	1.0	.350	.4894
indigenous_hired	20	.0	1.0	.300	.4702
Black_hired	22	.0	1.0	.455	.5096
armed_conflit	23	.0	1.0	.783	.4217
Infra_road	18	.0	1.0	.389	.5016
infra_housing	18	.0	1.0	.111	.3234
infra_energy	18	.0	1.0	.056	.2357
infra_water	18	.0	1.0	.111	.3234
infra_office	18	.0	1.0	.167	.3835
infra_transport	18	.0	1.0	.056	.2357
infra_school	18	.0	1.0	.167	.3835
infra_food	18	.0	1.0	.111	.3234
investments	21	1.0	4.0	1.381	.9207
Agryfood	21	.0	1.0	.810	.4024
new_investments	18	1.0	5.0	2.333	1.2834
school_prog	17	.0	1.0	.588	.5073
endangered	23	.0	1.0	.870	.3444
armed_zone	22	.0	1.0	.773	.4289
Valid N (listwise)	16				

The following charts show the frequency distribution of the variables that had a 100% response rate (N=24). As can be seen from the graphs, most projects are either owned by private companies or by different local communities that possess ownership rights over a proportion of land. Such communities include indigenous and black people. The charts also show that most projects are located in the department of Antioquia, perhaps because most project developers work in Medellin, the capital of that department. Likewise, the majority of the projects include activities of reforestation and restoration rather than pure conservation (REDD+). However, conservation projects occupy bigger extensions of land compared to AR activities.



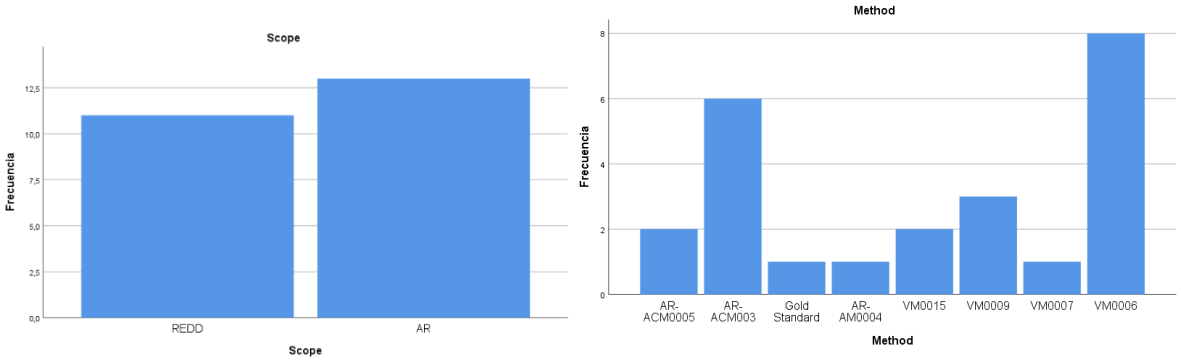


Figure 9 Scope, department, type of owner and methodology used to validate the AFOLU projects

Graphs in Figure 9 show that the majority of the projects involve the execution of afforestation and reforestation activities. However the most used methodology was the VM0006[7] for carbon accounting for mosaic and Landscape-scale REDD projects. This contradiction might be related to the fact that some REDD projects include AR activities as part of their project objectives.

Figure 10 shows that most projects prefer to combine the VCS and CCB standard, in order to quantify impacts beyond carbon sequestration. Projects that choose to do this can also claim higher prices over the carbon credits. The figure also shows that most project objectives are related to the execution of activities associated with the conservation of forest.

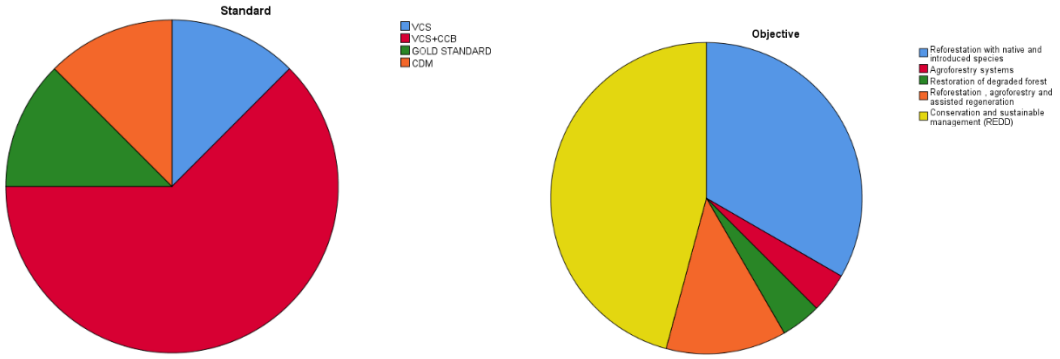


Figure 10 Standard used for the validation of the Projects and objectives of the different initiatives assessed

[7] VM0006

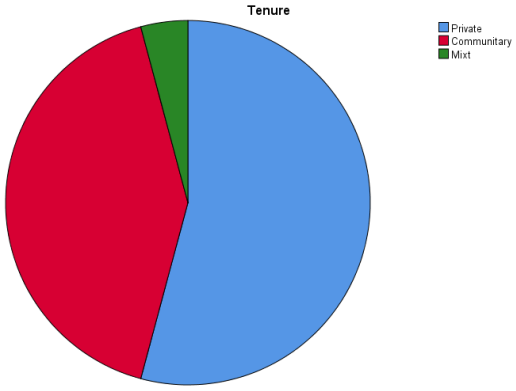


Figure 11 Type of land tenure

Even though the majority of projects are not REDD+, most of the 24 AFOLU projects included practices associated with sustainable forest management. Such practices promote the conservation of plant covers but do not exclude the possibility of harvesting for the management of the forest and the economic wellbeing of the local communities (Secretariat of the Convention on Biological Diversity, 2009).

4.1.2. Associations between determinants and impacts

The 16 impact variables were analyzed against every regional and project specific determinants to identify the determinants of performance of the 24 AFOLU projects. The models mentioned in Table 4 were run in SPSS in order to identify any significant associations. The variables that presented significant associations are presented in the following tables, while the complete results of all the analysis are presented in Annex III.

The occurrence of no associations between most variables might be caused by the small size of the sample, the difference in the responses per variable, the existence of great variations between projects or a combination of the three of them.

Nine impacts (outcome) variables were identified as having a significant association with different regional and project specific determinants. Those impact variables are associated with the achievement of the SDGs 1, 4, 5, 8, and 10. The results for each impact variable are described below:

Job creation

The impact variable “jobs” defined as job creation, has a direct relation with the reduction of poverty (SDG 8). In China, for example, it has been estimated that the development of forest carbon projects could generate about 56.18 million short-term jobs and 361,000 long-term jobs by 2050 (Shuifa et al., 2010).

According to the same source, global warming and its impacts on the financial stability of a country, has brought even more attention from different stakeholders into the creation of jobs through the development of afforestation and other types of forestry projects, especially because in China, the forest management activities might require in average 103.5 man-days per hectare.

Table 9 Job creation

Outcome variables	Explanatory	Type of test	associations - r-	significance level
Jobs (ordinal)	the owner (categorical)	Kruskal-Wallis	8.897	0.064
	department (categorical)	Kruskal-Wallis	10.789	0.214
	scope (categorical)	Kruskal-Wallis	7.055	0.008
	size (ordinal)	Spearman	-0.272	0.232
	methodology (categorical)	Kruskal-Wallis	9.306	0.231
	Objective (categorical)	Kruskal-Wallis	7.995	0.092
	validation standard (categorical)	Kruskal-Wallis	6.956	0.114
	duration (ordinal)	Spearman	-0.288	0.205
	tenure (categorical)	Kruskal-Wallis	4.933	0.026
	% intervened (ordinal)	Spearman	-0.182	0.431
	CO2e (ordinal)	Spearman	-0.372	0.106
	Population project area (ordinal)	Spearman	-0.411	0.128
	project start date (ordinal)	Spearman	-0.272	0.233
	endangered (categorical)	Kruskal-Wallis	1.038	0.308
	conflict zone (categorical)	Kruskal-Wallis	0.75	0.386
	rural population (ordinal)	Spearman	0.027	0.909
	UBN (ordinal)	Spearman	-0.062	0.789
	electricity (ordinal)	Spearman	0.003	0.991
	sewerage (ordinal)	Spearman	0.026	0.912
	Aqueduct (ordinal)	Spearman	0.202	0.392
	Phone (ordinal)	Spearman	0.109	0.648
	Toilet (ordinal)	Spearman	0.051	0.831
	school coverage (ordinal)	Spearman	0.234	0.308
	IDP (ordinal)	Spearman	0.009	0.968
	Infant mortality (ordinal)	Spearman	-0.271	0.235
	Trend of deforestation (ordinal)	Spearman	-0.035	0.879
	excombatants reinserted (ordinal)	Spearman	0.051	0.827
	household size (ordinal)	Spearman	-0.377	0.149
	poverty incidence (ordinal)	Spearman	-0.119	0.649
	extreme poverty incidence (ordinal)	Spearman	-0.199	0.443
	unemployment rate (ordinal)	Spearman	-0.183	0.483
	GINI (ordinal)	Spearman	-0.308	0.23

Likewise, in Brazil, reforestation projects have also proven to have increased job creation in the project areas, compared to a non-project scenario, while REDD+ projects implemented in Bolivia and also in Brazil have had a minor impact on employment creation and even sometimes have resulted in job loss (May *et al.*, 2005).

This research supports the findings of the previously mentioned authors, as the results of the Kruskal-Wallis associations show that more jobs are generated when the scope of the project is associated with the development of Afforestation and Reforestation (AR) activities rather than pure conservation projects. The reason might be that despite REDD+ projects are bigger, they usually involve indigenous or black communities that work collectively for the project but without a contractual relation related to a working agreement. AR projects also tend to include the planting of introduced species for the trade of wood and hence require more seasonal workers (Shuifa *et al.*, 2010).

Caplow, Jagger, and others had also supported this difference in job creation depending on the scope of the project, when they were assessing the socioeconomic impacts of REDD+ projects in countries like Brazil, Bolivia, Belize, and Mozambique. They found that in some cases job creation was reduced as a consequence of the project because in most cases some activities were prohibited such as logging, hunting, mining and others that are not acceptable by the REDD+ schemes (Caplow *et al.*, 2011). They also mentioned that the quality of those jobs was not good enough, as jobs were mostly informal and no contract agreements were established with the local communities (Asquith, Vargas and Simth, 2002).

However, the associations between jobs and the type of objective of the project show that more jobs are generated when the project involves different land management types, including agroforestry, assisted regeneration and sustainable management of forest, rather than reforestation or conservation only. This statement has been supported by forestry projects executed in Argentina, and in other regions where project developers realized that the sustainable forest management could generate more employment than reforestation or conservation activities only, because they involve activities that require seasonal and temporal workers.

Such activities include plant production, planting, maintenance, harvesting, training sessions, management of fauna and flora, the establishment of agroforestry systems, commercialization of non-timber forest products, among others (Martinez, 2002).

Finally, the associations between jobs and the type of project owner show that when the owners are either the result of a partnership between private and public institutions or when the owners are NGOs or communities, then the project has more capacity to generate employment.

An example of this has been justified by Harvey *et al.*, (2010), who analyzed private and community-owned projects in Colombia, Ecuador, Brazil, the Philippines, China, Peru, Guatemala, Madagascar, and Mexico. The results show that more jobs can be created when the projects are privately owned, or when there is a mix between private and public owners, than when the project is completely communitary.

Working agreements

The preferred type of working agreement offered to the employees of forest carbon initiatives can have a direct relation with the achievement of the SDG number 8, as in Colombia the quality of the employment is directly linked with the type of working agreement. There are three different types of working agreements in Colombia according to Ceballos, (2013) from the Colombian company El Empleo:

The fixed-term type of contract offers the employee job stability for a limited period but excludes the possibility of getting an economic compensation in case of dismissal, and also promotes the lack of motivation and sense of belonging to the project as the person can be replaced at any time.

Table 10 Type of working agreement

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Work_indefinite (categorical)	size (ordinal)	Kruskal-Wallis	2.463	0.482
	duration (ordinal)	Kruskal-Wallis	0.258	0.259
	% intervened (ordinal)	Kruskal-Wallis	0.259	0.611
	CO2e (ordinal)	Kruskal-Wallis	4.034	0.401
	Population project area (ordinal)	Kruskal-Wallis	3.161	0.531
	project start date (ordinal)	Kruskal-Wallis	-0.176	0.444
	rural population (ordinal)	Kruskal-Wallis	3.731	0.444
	UBN (ordinal)	Kruskal-Wallis	3.026	0.553
	electricity (ordinal)	Kruskal-Wallis	5.461	0.243
	sewerage (ordinal)	Kruskal-Wallis	2.223	0.695
	Aqueduct (ordinal)	Kruskal-Wallis	6.066	0.281
	Phone (ordinal)	Kruskal-Wallis	1.098	0.778
	Toilet (ordinal)	Kruskal-Wallis	1.991	0.738
	school coverage (ordinal)	Kruskal-Wallis	0.549	0.76
	IDP (ordinal)	Kruskal-Wallis	5.189	0.158
	Infant mortality (ordinal)	Kruskal-Wallis	3.069	0.216
	Trend of deforestation (ordinal)	Kruskal-Wallis	0.639	0.727
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	4.344	0.227
	household size (ordinal)	Kruskal-Wallis	4.532	0.104
	poverty incidence (ordinal)	Kruskal-Wallis	7.961	0.047
	extreme poverty incidence (ordinal)	Kruskal-Wallis	6.195	0.045
	unemployment rate (ordinal)	Kruskal-Wallis	4.541	0.338
	GINI (ordinal)	Kruskal-Wallis	3.481	0.062

The service provision-type of contract creates short-term jobs that prevent the worker from growing inside the company, planning for the future or accessing basic social security services as they are not covered by the project or the company.

Finally, the indefinite-term type of contract, which is the most appreciated one, offers all the benefits that an employee can enjoy inside an organization, while it provides major stability and in general workers under this type of agreement is more capable of impacting positively on the project´s productivity.

29% of the assessed projects preferred the use of indefinite working agreements for their employees. Likewise, the impact variable “working agreement” was found as having a significant association with the poverty and extreme poverty incidence reported per municipality (**¡Error! No se encuentra el origen de la referencia.**0). According to the results of this thesis, projects tend to offer more indefinite (permanent) working agreements

when the poverty and extreme poverty incidence per department are bigger. This means that when projects are located in very poor departments, they attempt to offer high-quality employment to the workers to help them get out of poverty.

No other studies that support this finding in Colombia have been found in most academic databases. For this reason, such associations can only be verified if the population size is increased or through the execution of a similar study.

The indigenous inside project area

The presence of indigenous peoples inside the project areas shows that the project owners and developers have decided to make no exclusion regarding the origin, ethnicity or traditions of the project's stakeholders. This indicates that projects aim at contributing to the reduction of inequalities as described in SDG number 10 (United Nations, 2018). The only significant associations found for the categorical variable "indigenous_inside the project area" was with the ordinal variable "trend of deforestation."

The results of the Kruskal-Wallis associations (Table 111) for these two variables show that there are more indigenous peoples inside the project area when the trend of deforestation in the department where the projects are located is positive (when deforestation increases). Seven out of 24 projects reported to have indigenous peoples living inside the project areas. Such projects are located in the departments of Antioquia, Arauca, Valle del Cauca, and Vichada. However, the trend of deforestation has only increased in the departments of Antioquia and Arauca. The rate of deforestation in the other two departments has remained constant.

The scope of the projects located in the departments where the trend of deforestation is positive is about afforestation and reforestation, contrary to what was expected as most projects that involve indigenous are REDD+. In theory, REDD+ projects, that are the ones that include most indigenous, are usually located in areas where the deforestation is high in order to demonstrate additionality and to generate carbon credits as per the methodology requirements (Gold Standard, 2019).

This means that REDD+ projects located in regions where the deforestation rate has decreased over the last ten years are not eligible to generate carbon credits or their carbon potential is low, as projects need to demonstrate that their activities are reducing emissions from planned or unplanned deforestation or degradation, and if no deforestation is occurring, then the main project objective could not be achieved. However, the REDD+ projects analyzed in this thesis are located in areas where the deforestation has remained constant.

The reason for this might be that developing a REDD+ project in highly threatened forest in Colombia presents challenges associated to security instability due to the presence of armed forces and to the fact that controlling the deforestation can be too difficult as these armed groups along with other social actors might not be interested in allowing the developing of conservation projects (Revista Semana, 2018). Similar situations have occurred in Indonesia, as REDD+ projects in that country are located in areas where the treats to deforestation are not that important (Murray *et al.*, 2015).

Table 11 Indigenous living inside the project area

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Indigenous_inside (categorical)	size (ordinal)	Kruskal-Wallis	4.385	0.223
	duration (ordinal)	Kruskal-Wallis	0.538	0.463
	% intervened (ordinal)	Kruskal-Wallis	0.259	0.611
	CO2e (ordinal)	Kruskal-Wallis	7.168	0.127
	Population project area (ordinal)	Kruskal-Wallis	3.161	0.531
	rural population (ordinal)	Kruskal-Wallis	3.41	0.492
	UBN (ordinal)	Kruskal-Wallis	4.126	0.389
	electricity (ordinal)	Kruskal-Wallis	7.591	0.108
	sewerage (ordinal)	Kruskal-Wallis	0.905	0.824
	Aqueduct (ordinal)	Kruskal-Wallis	4.211	0.378
	Phone (ordinal)	Kruskal-Wallis	2.803	0.423
	Toilet (ordinal)	Kruskal-Wallis	0.209	0.976
	school coverage (ordinal)	Kruskal-Wallis	0.313	0.855
	IDP (ordinal)	Kruskal-Wallis	2.558	0.465
	Infant mortality (ordinal)	Kruskal-Wallis	0.696	0.706
	Trend of deforestation (ordinal)	Kruskal-Wallis	6.023	0.049
	excombatants reinserted (ordinal)	Kruskal-Wallis	0.715	0.87
	household size (ordinal)	Kruskal-Wallis	4.532	0.104
	poverty incidence (ordinal)	Kruskal-Wallis	2.692	0.442
	extreme poverty incidence (ordinal)	Kruskal-Wallis	2.077	0.354
	unemployment rate (ordinal)	Kruskal-Wallis	0.828	0.843
	GINI (ordinal)	Kruskal-Wallis	1.573	0.21

Black communities hired by the project:

The involvement of black communities in forestry carbon projects is also highly associated with the achievement of the SDG number 10 as explained before. 42% of the projects assessed through phone interviews affirmed that their staff included afro-Colombians. Those projects are distributed in five departments: Antioquia, Chocó, Nariño, Santander, and Vichada. About 11% of the Colombian population is considered black (Valencia, 2016).

According to the results of the Kruskal-Wallis associations (Table 122), projects that hire black communities are usually located in areas where the rate of people with unsatisfied basic needs is bigger compared to areas with better economic conditions, and in regions were access to sewerage and toilet is limited. This result fit the current socioeconomic conditions of the country as black communities in Colombia usually live in poor areas where the access to basic infrastructure, education and employment is limited or absent (DANE, 2005a).

53.7% of the black communities in Colombia have their basic needs unsatisfied, and 50% of the black population of Choco and Nariño is considered poor and such situation continues to deteriorate despite the poverty in other departments has been reduced. Likewise, about

half of the black populations inhabit in regions were the sewerage, and toilet infrastructure is absent (Ministerio de Cultura, 2011).

Table 12 Black communities hired by the project

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Black communities hired (categorical)	size (ordinal)	Kruskal-Wallis	6.984	0.072
	duration (ordinal)	Kruskal-Wallis	1.75	0.417
	% intervened (ordinal)	Kruskal-Wallis	2.763	0.096
	CO2e (ordinal)	Kruskal-Wallis	10.671	0.031
	Population project area (ordinal)	Kruskal-Wallis	6.5	0.092
	rural population (ordinal)	Kruskal-Wallis	3.974	0.409
	UBN (ordinal)	Kruskal-Wallis	12.567	0.014
	electricity (ordinal)	Kruskal-Wallis	6.662	0.155
	sewerage (ordinal)	Kruskal-Wallis	7.911	0.048
	Aqueduct (ordinal)	Kruskal-Wallis	8.079	0.089
	Phone (ordinal)	Kruskal-Wallis	5.822	0.213
	Toilet (ordinal)	Kruskal-Wallis	7.911	0.048
	school coverage (ordinal)	Kruskal-Wallis	3.033	0.219
	IDP (ordinal)	Kruskal-Wallis	1.964	0.58
	Infant mortality (ordinal)	Kruskal-Wallis	3.904	0.142
	Trend of deforestation (ordinal)	Kruskal-Wallis	1.054	0.59
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	5.333	0.149
	household size (ordinal)	Kruskal-Wallis	4.125	0.127
	poverty incidence (ordinal)	Kruskal-Wallis	8.758	0.003
	extreme poverty incidence (ordinal)	Kruskal-Wallis	8.5	0.037
	unemployment rate (ordinal)	Kruskal-Wallis	3.463	0.484
	GINI (ordinal)	Kruskal-Wallis	4.857	0.028

As per the relation of this variable with project determinants, it was evident that more black individuals are involved in projects that have a bigger capacity to reduce carbon emissions. Projects with black people are located on the Pacific coast where the deforestation rates are high. Consequently, the implementation of the project activities can positively contribute to the reduction of carbon emissions.

Four out of ten projects that involve black communities are located in the department of Choco, one of the most diverse regions in the world where the carbon sequestration capacity is higher than in other types of forest as the climatic conditions promote the rapid growth of forest species (WWF, 2014). Consequently, the results of this associationss are as expected.

The proportion of women hired by the project

The involvement of women in forest carbon projects is directly linked with the achievement of SDG number 5 about gender equality. 58% of the projects assessed included women in

their staff. However, the proportion of women hired by the projects in relation to men was in most cases less than 30%. Nevertheless, about 80% of those women occupy high-responsibility positions inside every project.

Table 13 Women working for the project

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Women hired by the project (ordinal)	the owner (categorical)	Kruskal-Wallis	1.813	0.77
	department (categorical)	Kruskal-Wallis	8.092	0.325
	scope (Categorical)	Kruskal-Wallis	-0.35	0.142
	size (ordinal)	Spearman	0.004	0.987
	methodology (categorical)	Kruskal-Wallis	4.521	0.718
	Objective (categorical)	Kruskal-Wallis	3.273	0.513
	validation standard (categorical)	Kruskal-Wallis	4.284	0.232
	duration (ordinal)	Spearman	0	1
	tenure (categorical)	Kruskal-Wallis	0.618	0.432
	% intervened (ordinal)	Spearman	0.254	0.295
	CO2e (ordinal)	Spearman	0.174	0.477
	Population project area (ordinal)	Spearman	0.323	0.26
	project start date (categorical)	Kruskal-Wallis	0.21	0.388
	endangered (categorical)	Kruskal-Wallis	2.221	0.136
	conflict zone (categorical)	Kruskal-Wallis	0.561	0.454
	rural population (ordinal)	Spearman	-0.03	0.904
	UBN (ordinal)	Spearman	0.55	0.015
	electricity (ordinal)	Spearman	-0.385	0.104
	sewerage (ordinal)	Spearman	-0.524	0.021
	Aqueduct (ordinal)	Spearman	-0.56	0.013
	Phone (ordinal)	Spearman	-0.298	0.215
	Toilet (ordinal)	Spearman	-0.458	0.049
	school coverage (ordinal)	Spearman	0.067	0.786
	IDP (ordinal)	Spearman	-0.235	0.333
	Infant mortality (ordinal)	Spearman	0.315	0.188
	Trend of deforestation (ordinal)	Spearman	0.178	0.465
	excombatants reinserted (ordinal)	Spearman	-0.222	0.36
	household size (ordinal)	Spearman	0.347	0.188
	poverty incidence (ordinal)	Spearman	0.289	0.277
	extreme poverty incidence (ordinal)	Spearman	0.237	0.378
	unemployment rate (ordinal)	Spearman	-0.409	0.116
	GINI (ordinal)	Spearman	0.237	0.378

The results of the associations (Table 133) show that the AFOLU projects hire more women in areas where the rate of people living with unsatisfied needs is high and in areas with

difficult access to a toilet, aqueduct, and sewerage. This means that when projects are located in poor areas, they promote the inclusion of skilled women into the project. However, the results do not tell if the women hired by the project are from the department where the project is located or if they come from other regions.

Therefore, in order to identify if the regional determinants impact the projects capacity to involve more women, it is necessary to investigate the origin of those women as their precedence might reduce the significance of the associations. Yet, it is important to highlight that women play a key role in the forestry sector as they are usually the ones in charge of managing the nurseries, collecting firewood and non-timber forest products and in some cases, because women have more access to education than men (El Tiempo, 2018), they can coordinate the entire development of the project.

Training sessions offered to the workers and local communities:

The transference of technology through formal or informal education has been linked to the achievement of the SDG 8 about decent work and economic growth, and the SDG number 4 about inclusive and equitable quality education, as when projects provide training sessions, they enforce the worker's capacities to perform their jobs and they promote education as a way to access better job positions as workers can specialize in specific techniques that are required for the good development of AFOLU projects**.**

The results of the spearman model show (Table 14) that there is a positive association between the number of training sessions offered to the workers and local communities and the school coverage. Results show that projects located in municipalities with greater school coverage provide more training sessions about the project's technologies. This might be related to the fact that municipalities that promote education, even in rural areas, usually have more public schools and training institutions. The cooperation between those institutions and the projects might be in the way of institutions providing instructors that train workers in the project area or, projects offering training sessions to students from those educational centers.

This is, however, only true for projects located in areas with good education coverage, as in departments like Chocó and Nariño, the education coverage is very limited, and most people is only able to course primary studies (Cardona, 2014). In these cases, projects might require to provide even more training sessions as the local staff is usually illiterate. However, sometimes projects prefer to hire people from other regions to reduce the costs associated with the execution of training sessions.

When projects occur in areas where people have access to education, they can provide more specialized training sessions as workers and local communities can read, write and even to manage and analyses simple mathematical problems. Hence it is more costly-effective to implement projects in areas where education is a priority and in regions that present partnerships with universities, schools, and educational centers.

Table 14 Training sessions offered by the project to the workers and local communities

Outcome variables	Explanatory	Type of test	associations - r-	significance level
Training sessions (ordinal)	owner (categorical)	Kruskal-Wallis	3.358	0.5
	department (categorical)	Kruskal-Wallis	5.192	0.519
	scope (categorical)	Kruskal-Wallis	1.941	0.164
	size (ordinal)	Spearman	0.27	0.294
	methodology (categorical)	Kruskal-Wallis	8.476	0.292
	Objective (categorical)	Kruskal-Wallis	2.62	0.623
	validation standard (categorical)	Kruskal-Wallis	1.519	0.678
	duration (ordinal)	Spearman	-0.163	0.532
	tenure (categorical)	Kruskal-Wallis	1.805	0.179
	% intervened (ordinal)	Spearman	0.195	0.452
	CO2e (ordinal)	Spearman	0.144	0.581
	Population project area (ordinal)	Spearman	0.222	0.467
	project start date (categorical)	Kruskal-Wallis	0.205	0.43
	endangered (categorical)	Kruskal-Wallis	1.521	0.217
	conflict zone (categorical)	Kruskal-Wallis	0.672	0.412
	rural population (ordinal)	Spearman	0.261	0.312
	UBN (ordinal)	Spearman	0.207	0.425
	electricity (ordinal)	Spearman	-0.066	0.8
	sewerage (ordinal)	Spearman	-0.178	0.493
	Aqueduct (ordinal)	Spearman	-0.042	0.874
	Phone (ordinal)	Spearman	-0.121	0.643
	Toilet (ordinal)	Spearman	-0.192	0.461
	school coverage (ordinal)	Spearman	0.527	0.03
	IDP (ordinal)	Spearman	-0.243	0.347
	Infant mortality (ordinal)	Spearman	0.135	0.604
	Trend of deforestation (ordinal)	Spearman	-0.17	0.515
	excombatants reinserted (ordinal)	Spearman	-0.251	0.331
	household size (ordinal)	Spearman	0.093	0.753
	poverty incidence (ordinal)	Spearman	0.262	0.366
	extreme poverty incidence (ordinal)	Spearman	0.229	0.43
	unemployment rate (ordinal)	Spearman	0.092	0.755
	GINI (ordinal)	Spearman	0.229	0.43

Development or improvement of road infrastructure

Different authors have linked the development and/or improvement of road infrastructure with the reduction of poverty (SDG 8) as roads allow the exchange of products between

communities, facilitate the access to important infrastructure that most times is not available in isolated areas, reduce the risk of children dropping out of school as they allow the access to schools, as usually, children from rural areas in Colombia are not able to go to their schools because the roads are poorly developed, and they improve the economic conditions of municipalities as well designed roads allow tourism and attract investors, among other reasons (Pérez, 2005).

Table 15 Road infrastructure developed or improved by the project

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Road infrastructure (categorical)	size (ordinal)	Kruskal-Wallis	9.052	0.029
	duration (ordinal)	Kruskal-Wallis	2.097	0.35
	% intervened (ordinal)	Kruskal-Wallis	5.343	0.021
	CO2e (ordinal)	Kruskal-Wallis	9.582	0.048
	Population project area (ordinal)	Kruskal-Wallis	5.2	0.267
	rural population (ordinal)	Kruskal-Wallis	1.766	0.622
	UBN (ordinal)	Kruskal-Wallis	8.39	0.078
	electricity (ordinal)	Kruskal-Wallis	1.577	0.813
	sewerage (ordinal)	Kruskal-Wallis	3.573	0.467
	Aqueduct (ordinal)	Kruskal-Wallis	6.899	0.141
	Phone (ordinal)	Kruskal-Wallis	1.634	0.652
	Toilet (ordinal)	Kruskal-Wallis	6.024	0.197
	school coverage (ordinal)	Kruskal-Wallis	1.104	0.675
	IDP (ordinal)	Kruskal-Wallis	3.753	0.289
	Infant mortality (ordinal)	Kruskal-Wallis	2.694	0.26
	Trend of deforestation (ordinal)	Kruskal-Wallis	3.422	0.181
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	3.356	0.187
	household size (ordinal)	Kruskal-Wallis	4.667	0.031
	poverty incidence (ordinal)	Kruskal-Wallis	3.5	0.174
	extreme poverty incidence (ordinal)	Kruskal-Wallis	3.5	0.061
	unemployment rate (ordinal)	Kruskal-Wallis	3.309	0.346
	GINI (ordinal)	Kruskal-Wallis	3.5	0.061

Projects that invest in road infrastructure were found more related to different project determinants, including the project size, the percentage of the area already intervened and the potential for the reduction of carbon emissions (Table 15). The bigger the project area, the more investments are needed to improve road infrastructure in order to access the forest and extract wood and other agricultural commodities produced sustainably. Likewise, the bigger the area intervened the more roads it has. This is because project activities usually involve the improvement of roads as poorly developed roads prevent communities from trading their products and accessing the local and regional markets. Finally, when the projects are big, they have more potential to reduce carbon emissions as more plant covers can be protected and established.

This variable has also been correlated with the regional determinant about the number of people per household. The associations indicate that the bigger the household, the more road infrastructure is developed. This might be because the most populated areas required good road infrastructure to communicate with other regions and especially to trade products from the agricultural and forestry sector. However, no similar studies in Colombia were found to justify the latest associations

Investments with carbon revenues

Table 16 Destiny of the revenues received from the sale of carbon credits

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Investment carbon revenues (categorical)	size (ordinal)	Kruskal-Wallis	4.506	0.212
	duration (ordinal)	Kruskal-Wallis	5.386	0.068
	% intervened (ordinal)	Kruskal-Wallis	0.652	0.419
	CO2e (ordinal)	Kruskal-Wallis	6.322	0.176
	Population project area (ordinal)	Kruskal-Wallis	1.939	0.747
	rural population (ordinal)	Kruskal-Wallis	2.474	0.649
	UBN (ordinal)	Kruskal-Wallis	7.599	0.107
	electricity (ordinal)	Kruskal-Wallis	1.454	0.835
	sewerage (ordinal)	Kruskal-Wallis	10.338	0.035
	Aqueduct (ordinal)	Kruskal-Wallis	2.731	0.604
	Phone (ordinal)	Kruskal-Wallis	0.843	0.839
	Toilet (ordinal)	Kruskal-Wallis	8.061	0.089
	school coverage (ordinal)	Kruskal-Wallis	0.603	0.74
	IDP (ordinal)	Kruskal-Wallis	5.705	0.127
	Infant mortality (ordinal)	Kruskal-Wallis	1.454	0.483
	The trend of deforestation (ordinal)	Kruskal-Wallis	5.37	0.068
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	1.454	0.693
	household size (ordinal)	Kruskal-Wallis	0.825	0.662
	poverty incidence (ordinal)	Kruskal-Wallis	1.457	0.692
	extreme poverty incidence (ordinal)	Kruskal-Wallis	0.504	0.777
	unemployment rate (ordinal)	Kruskal-Wallis	5.463	0.243
	GINI (ordinal)	Kruskal-Wallis	0.126	0.723

The results of the Kruskal-Wallis model shows (Table 16) that there are positive and significant associations between the investments done with the carbon revenues and the access to sewerage per department. The analysis shows that when projects invest their revenues in paying debts and in the implementation of the project activities, people in the department have more access to sewerage. That could probably mean that the carbon revenues can contribute to the improvement of basic infrastructure in the departments where the projects are located. However such result has not yet been proven by another similar study in Colombia

That associations do not represent the majority of the population as 18 out of 24 projects have not received any revenues from the sale of carbon credits at the moment of validation. Consequently, the analysis will have to be repeated once all projects are verified and ready to issue and trade credits in the voluntary markets.

Improvement of economic welfare

The improvement of the socioeconomic conditions of any community through the execution of a forestry carbon project is linked to the achievement of different SDGs, but especially to the SDG 1 about the reduction and elimination of poverty. 80% of the projects included in this research agreed that the project has contributed to the economic welfare of the local communities. However, most of the projects have not yet received revenues from the carbon credits, and hence no monetary benefits have been evident.

Table 17 Economic welfare

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Economic welfare (ordinal)	size (ordinal)	Spearman	4	0.261
	duration (ordinal)	Spearman	0.592	0.744
	% intervened (ordinal)	Spearman	0.045	0.831
	CO2e (ordinal)	Spearman	8.233	0.083
	Population project area (ordinal)	Spearman	3.236	0.519
	UBN (ordinal)	Spearman	6.01	0.198
	electricity (ordinal)	Spearman	6.781	0.148
	sewerage (ordinal)	Spearman	2.553	0.635
	Aqueduct (ordinal)	Spearman	0.036	0.874
	Phone (ordinal)	Spearman	6.01	0.198
	Toilet (ordinal)	Spearman	3.984	0.408
	school coverage (ordinal)	Spearman	8.363	0.015
	IDP (ordinal)	Spearman	0.957	0.812
	Infant mortality (ordinal)	Spearman	0.962	0.618
	Trend of deforestation (ordinal)	Spearman	3.374	0.185
	Ex-combatants reinserted (ordinal)	Spearman	2.471	0.481
	household size (ordinal)	Spearman	2.396	0.302
	poverty incidence (ordinal)	Spearman	6.585	0.086
	extreme poverty incidence (ordinal)	Spearman	2.507	0.474
	unemployment rate (ordinal)	Spearman	6.394	0.172
	GINI (ordinal)	Spearman	0.643	0.422

Nevertheless, other benefits associated to the improvement of local biodiversity, the inclusion of vulnerable communities and the transfer of technology were considered by the proponents surveyed as being important factors to define the economic welfare of the stakeholders directly or indirectly impacted by the projects.

The results of the last associations (Table 17) show that stakeholders that think that the projects have improved the economic welfare of the local communities are located in areas where the school coverage is high. This might be related to the fact that educated communities usually have more context of the impacts that such types of projects can generate, and hence can compare similar initiatives and tell that the project is contributing to their socioeconomic development.

However, in order to extrapolate the results of such associations to other projects, it is necessary to identify if the stakeholders involved in the project come from the municipalities and departments where the project is located. Otherwise, the associations might not be significant under the current conditions.

4.2. Case Study

The analysis of a case study was done to identify the challenges and contributions of a specific project in the achievement of the SDGs. Despite the informants interviewed did not show evident knowledge about the SDGs and their implication on the project, their association with the project was established by reviewing the project documentation and by asking guiding questions (Annex II) to the informants through the execution of an informal interview. The results of the case study are described below:

Case: ID: A106

Description of the project:

The project A106 as coded in the quantitative section of this thesis consists in the reforestation of 82.14 hectares with native and introduced tree species in the municipality of Barbosa, Antioquia. Additionally, the project enforces the assisted regeneration of plant species to protect water bodies and to increase biodiversity. The project area includes a pig production factory whose water needs are satisfied by the water bodies present in the farm, reason why the project owner is interested in the reforestation and conservation of plant covers as they participate in the regulation of the water cycle. The project area was initially reforested by the project owner 15 years ago when the owner established a pig production factory, however, due to eligibility conditions[8], only the area mentioned above was considered for the carbon project.

According to the project design document, the farm where the project is located, was initially dedicated to extensive grazing as it was (and in some areas continues to be (Alcaldia de Barbosa, 2019)) a common practice among the farmers of this region. Most natural covers were removed for the establishment of grasslands for meat and milk production. As a result of such activities, soils were compacted and eroded, and the water streams flowing inside the farm were almost extinct.

When the project owner acquired the farm (approximately 20 years ago), the owner decided to start with a restoration process to recover especially the natural covers surrounding the water sources, in order to increase the water production needed for the pig factory established few years after the acquisition, as the required water could not be obtained inside the farm because rivers were basically dry. The owner's interest in growing a forest increased over the years, and in 2011 the owner decided to establish a commercial and

[8] The Gold Standard methodology establish that all areas that 10 years before the project start date were covered by forest (as per the national forest definition), are not eligible for a carbon project

protective plantation with native and introduced species to obtain revenues from the sale of wood and carbon credits while conserving water sources and increasing natural covers.

Figure 12 Location of the Project area: Colombia, department of Antioquia, Municipality of Barbosa. (Google Maps, 2019)

The project start date was October 3rd of 2011 and the crediting period will be 40 years that is the maximum number of years included in the harvesting cycle of the planted species. The methodology applied to this project was the Gold Standard Methodology Version 2.2. Some of the key features of the project about the achievement of one or more sustainable development goals (SDGs) are summarized in the following table (Table 18) (South Pole and Super Cerdo Paisa, 2015):

Table 18 Summary of key findings of the documents review process

Guiding question/statement	Results
Permanent and temporal jobs created by the project at the moment of validation (2015)	470
Main contract type offered to the worker	Service provision and outsourced
Presence of Indigenous inside the project area	No
People from armed conflicts involved in the project	No
Women hired by the project since the project start date	10
Women in high responsibility positions since the project start date	2
Number of training sessions provided since the project start date	15
Number of assistants to training sessions offered since the project start date	50
Types of infrastructure developed/improved by the project since the project start date	Road infrastructure Housing for workers Biodigester Water infrastructure
Has the project attracted the attention of donors or investors?	No
Has the project received money from the trade of carbon credits?	No
Agrifood systems developed/supported by the project?	Orchards Pig production
Has the project invested in school programs?	Yes

Does the project protect endangered species?	No
What is the percentage of area intervened by the project so far?	100
Annual tonnes of CO_2e reduced by the project	1415

The site visit took place on Thursday, March 7th, 2019. The date and time of the site visit were agreed with the project owner by phone a few days before the meeting. The project owner was told that the purpose of the visit was to get to know the opinions of the project participants about the main challenges and opportunities that the project has generated since its inception in 2011.

Once in the project area, the project owner addressed a few words about the main challenges of the project, most of them especially related to the lack of economic resources needed for the implementation of the activities (planting, harvesting, monitoring) and then due to the owner having other responsibilities, left in charge a person (informant 1) whose role was to oversee the activities related to the planted area.

Key informants interviewed:

- Informant 1: in charge of the planted area
- Informant 2: in charge of managing the nursery owned by a subsidiary of the company acting as the project owner. Informant 2 was also a neighbour of the project who lived a few kilometres away from the farm
- Informant 3: in charge of overseeing the security of the project and of coordinating the tours inside the project area. Informant 3 is a peasant that lives on a small farm next to the project area. Informant 3 has been part of the project since its inception.
- Informant 4: Neighbour of the project that owns a farm located five km away from the project area, but who lives in Barbosa, the capital of the township. The neighbour participated in the first local stakeholder consultation and hence knew about some details of the project. He has been in touch with workers of the farm

All conversations were established when the key informants were executing their daily activities, the reason why the conversations lasted for a maximum of 20 minutes. The results of the conservations were classified by themes as described below:

Potential for the generation of carbon credits

The informants interviewed argued that when the project was designed, they were told that the carbon potential was much higher compared to the current situation. Based on that potential they invested large amounts of money in the acquisition of plant material with excellent genetic quality, in addition to the installation of a big nursery, the construction of houses for the workers and the development of water infrastructure for the prevention of fires.

While all of those investments will contribute to extract high-quality wood once the harvesting season begins, they argued that the investments costs would not be covered, not even partially with the revenues obtained from the sale of carbon credits. They also argued that the certification costs were too high and that in order to verify their remaining reductions and trade credits, they will have to invest in the monitoring of the planting area. Otherwise, the certification could be lost.

Likewise, due to the few revenues of the project obtained from the credits, the informants stated that there might be difficulties for transporting the wood from the highest parts of the farm to the collecting point, as the extracting method initially designed consisted in the use of aerial lines. However, due to the lack of revenues, the extracting method will have to be redesigned. To manage such issue, the project owner, according to the informant, decided to expand the planted area in order to cover the extra costs caused by the carbon certification with the commercialization of wood in the local markets.

However, there were informants that commented that despite the budget of the project has been readjusted, there have not been major issues regarding the implementation of the project as the plantings have occurred as scheduled, no impacts of diseases or pest have been evident, the natural covers surrounding the waters have been restored and the biodiversity has increased.

Notwithstanding, most informants contradicted the previous statement by saying that due to lack of resources from the carbon credits, the maintenance of the planting has been postponed and hence there are some areas in poor conditions, especially those located at the top of the mountain where the access is limited.

In conclusion, most key informants interviewed claimed that their prospects were much greater than the sale of carbon credits that have occurred since the project began. The informants assured that there were probably inconsistencies when signing the contracts for the certification, since several intermediaries participated and it seems that the expected profits were exaggerated by some of the parties involved in the negotiation.

This supposed reduction in expected profits has prevented, according to the informants, the execution of maintenance and monitoring activities, which in turn has diminished the project's capacity to generate jobs. This is a particular project as it was one of the first carbon projects from the forestry sector validated in Colombia. As it was one of the first projects, it was validated with methodologies[9] that no longer exist and that allowed the sale of credits ex-ante, meaning that the credits could be sold without reducing the emissions at that time. It was a commitment between the project and the Standard that allowed such transaction (Arnoldus and Bymolt, 2015).

However, the project owner did not know or was not communicated that the ex-ante credits had a lower value in the market as buyers preferred to buy credits ex-post (credit produced and issued) (Arnoldus and Bymolt, 2015). That could probably be the reason why the profits received did not meet the owner’s expectations.

Another interpretation of the issue could be that the project owner misunderstood or was not informed about the real potential of the carbon credits, as they are considered incentives rather than substantial sources of financing. Carbon credits are usually used to cover part of the costs of the project activities, but they alone cannot fully cover the implementation of the project (The World Bank, 2010).

It is also important to highlight that some authors state that one of the reasons why project owners don’t receive the revenues expected, is because the intermediaries get part of the resources that were meant to be for the projects, because, among others, the cost of

[9] The Gold Standard Afforestation/Reforestation (A/R) Requirements version 0.9 (August 2013)

certification is too high, and the bureaucracy delays the processes and promotes the participation of third parties (NGOs, private companies, government) before the money can get into de project (Bohn, 2013).

In any case, it seems that the lack of information and perhaps transparency could seriously impact the management and development of forestry carbon projects and their associated objectives. To avoid this from happening, project owners should be well informed and advised before getting involved in a carbon scheme as the profitability, and the carbon potential should be clear from the beginning that is when the project activities are designed.

Job creation and quality of employment

Despite the discontent related to the carbon certification, some informants argued that the forestry project had brought positive impacts on the local communities and the environment, as the water bodies are now protected, the local biodiversity has increased, the quality of soils has been improved and the project will have the capacity to generate about 50 temporal and permanent jobs once the harvesting season begins (in about two years).

However, informants also stated that the project has not generated as many jobs as were planned as currently only three people are working for the carbon project and all occupy high-responsibility positions. Hence, according to them, the job creation potential will only be evident once harvesting commences.

Another opinion from one informant was that the project had not had an impact on employment generation because it has not been socialized with the communities, as according to them no other meetings have taken place after the LSC and consequently the community is not aware of any job opportunities and the current situation of the project. The same informant stated that the project only accepts highly qualified staff as the informant was aware of job applications being refused because of the lack of experience of the local communities in the management of planted areas. Nevertheless, another opinion on the topic is that there has not been much collaboration between the communities and the project because, in the first place, the project only requires three temporal jobs and because the available labor is already occupied by the pig factory that works inside the farm.

On the other hand, the quality of employment is referred in this thesis as the ability of the project to generate permanent jobs that are backed with a formal contract that ensures that workers have access to social security services, vacations, a constant payment and insurance in case of dismissal, among others, (GERENCIE.COM, 2017).

In this regard, some informants stated that all working agreements currently offered to the workers (only three) are indefinite (permanent with no-ending term set). The roles occupying such positions are the forestry engineer, the coordinator of the nursery and the farm manager. The informant's opinion on this topic was that once harvesting begins, most agreements will be of service provision or by daily term (both temporal), as most activities will last short periods of time and will be seasonal (thinning, harvesting, transporting the wood, etc.), and consequently, the project will not be able to provide high-quality employment in the nearly future.

In conclusion, according to the informants interviewed the main type of contract that will most likely be offered to the workers once harvesting activities begin will be temporal or by daily term. Some arguments in favour of such type of contract state that commercial planting

requires the execution of temporal and seasonal activities, e.g., planting usually occurs at the beginning of the raining season, and replanting is required only when necessary; harvesting can last in some cases only six months, depending on the type and size of the planting area (Navarro Cárcamo *et al.*, 2010).

Such temporality promotes that people who work on silviculture are temporal, seasonal or migrant. The type of contract offered to them can have a significative impact on their health, security and the environment (FAO-OIT-UITA, 2007). In Colombia, the contracts can be of different forms, including fixed-term (limited duration) or indefinite term. Both types are required by law to contribute to the social security system, however, when working under an indefinite -term contract, the contracting party cannot dismiss the employee at any time, while the fixed-term offers the contractor the option to renovate or terminate the contract at any time (GERENCIE.COM, 2017).

Other types of contracts include service provider through which a person is exceptionally (temporally) hired, to supply activities or to develop specialized activities that cannot be assumed by the permanent personnel. The relationship established under this type of contract does not admit the element of subordination on the part of the contractor, who acts as an autonomous and independent party subject to the terms of the contract and contract law. Nevertheless, most times workers are obliged to comply with a working schedule. Under this agreement, the contractor has no benefits such as vacations, remunerated extra time, and parental leave and is obliged to pay for its security system in order to get paid by the contracting entity (Corte Constitucional, 1997).

Daily-term contracts are those where workers are paid daily or per hour. Such are temporal and despite the law requires that the contractor covers its social security system, wages can be so low that they do not pay and hence most workers under this agreement are not protected against any eventuality and can be dismissed at any time (Economia Simple, 2016). Temporal and daily term contracts usually do not offer the possibility of saving and planning for future expenses and consequently can promote economic instability of the people. As a consequence, if the project fails to provide contracts that can offer stability to the workers, its performance on the creation of jobs will be unsatisfactory.

No evident knowledge about the SDGs

Most informants showed not much knowledge about the SDGs and their importance for the project. Informants were able to only note the importance of the carbon sequestration on the regulation of climate and the enhancement of tree covers for the protection of biodiversity, but they could not relate such importance to the achievement of any SDG.

Such lack of knowledge can be justified with the fact that this project was validated under an older version of the Gold Standard, where no special requirements were specifically set for the achievement of the SDGs. However, the methodology used for validation included the “no do harm assessment” that was a document in which the project must be explained in terms of its impacts on indigenous peoples and local communities, working conditions, no discrimination, anti-corruption, occupational health and safety, tree species, Genetically Modified Organisms, biodiversity, erosion, fertilizers, chemical pesticides, biological control agents, water resources and waste.

None of the topics previously mentioned was explained as having a relationship with the SDGs during the stakeholder consultation although they are closely related. For this reason,

none of the interviewed had any idea about the SDGs and their relationship with the project. Nevertheless, after reviewing the project documentation as part of this thesis, such a relationship was established as detailed in Table 2

However, due to the Gold Standard regulations, the project will have to be transitioned into the latest version of the Standard, denominated the Gold Standard for the Global Goals[10], which includes a new methodology specially designed to assess the achievement of SDGs through the implementation of the project activities. Such transition will happen in the upcoming months, and the results will only be visible once the project owner monitors the trees and all other factors included in the monitoring plan

Participation of local communities

Regarding the local communities and their participation in the project, an informant mentioned that there had been no concerns or problems caused by the project, nor has been any negative issue raised by the communities. The input and grievances mechanism[11] put in place in the farm, has, according to the informant, constantly been reviewed in order to check if there are any controversies or discontent from the local communities related to the implementation of the project activities, and fortunately for them, there have been none.

Another informant stated that there had not been any controversies with the local communities, especially because most of the surrounding towns provide the labour used by the project and by the pig factory, both located in the same farm. In this regard, another informant mentioned that the collaboration between the communities and the project owners had been reduced to the working relationship kept with the workers that are also the neighbours, but because the farm is private, the access to the public is not allowed unless agreed with the owner and arranged with the farm manager, and hence further collaboration is not possible. Yet, ecotourism and academic visits are allowed upon confirmation from the owners.

The informant also mentioned that despite the inputs and grievances mechanism is not frequently used as it was meant to be for the workers of the carbon project, but most workers currently work for the pig factory, no major concerns from the communities have been identified.

Informants also stated that one way of collaboration between the local communities and the project has been through the execution of training sessions on topics like occupational safety, and the constant support from the project to the local school of the vereda to which the project has provided free teaching material.

In conclusion, some of the interviewed mentioned that after the LSC no other meetings had taken place to communicate the progress or the impacts of the project since the project initiated. However, although no formal meetings have taken place, the workers claimed that

[10] https://www.goldstandard.org/project-developers/standard-documents

[11] The input and grievance mechanism is a requirement of the Standard used to make sure that the projects have in place a mechanism for the communication between the project owners and/or developers and the local communities. The mechanism consists in a secured mailbox where anyone interested in leaving a comment, complain or suggestion, can do it so privately by filling up a form that is then periodically reviewed by the managers of the project. (The Gold Standard, 2018)

most of the people that work inside the farm come from Barbosa and are neighbours of the farm and hence are aware of the project.

The new Gold Standard requires in addition to the LSC, the execution of a performance verification at least every two years, however, the methodology used to validate the project demanded that verifications could take place at least every five years. Such verifications offer an opportunity for the communities to participate in meetings and discussions about the project. The verification has not occurred yet but will most likely happen this year.

Communications with the local communities must be kept as per the monitoring plan. One of the communications methods that must be constantly monitored is the "input and grievance mechanism." However, I could not have access to the results of such a mechanism.

Landscape and biodiversity

In terms of the impact of the project on the landscape and the local biodiversity, some informants highlighted the positive change in the landscape of the farm as 15 years ago the landscape was dominated by empty terrains used for extensive grazing. However, today, according to them, the farm looks like covered by a dense forest, and the landscape has been transformed into a much better one.

Nevertheless, the same informant stated that there are some concerns about the use of introduced species as some claim that the project should include native species only. However, the project owner and managers have explained that the introduced species are all well adapted to the local conditions and that they are needed for the financial stability of the project and for the execution of the project activities, that include the restoration of degraded areas, conservation of water sources and generation of employment.

Another informant claimed that because of the project, new bird and mammal species have been identified inside the farm, and that even during the dry seasons the water streams running from the top of the hill inside the farm towards the municipality of Barbosa, are capable ok keeping stable flow rates, which has benefited the communities downstream. Such a statement was supported by another informant that recognized the increases in the water flows on the properties located downstream the water sources that are born in the project area.

Despite the bad reputation of forest plantings with introduced species, it has been proven that the long-term impacts of such introduced covers are positive as they can contribute to the restoration of degraded landscapes if the right species are chosen. Meaning that not all species can adapt to every condition and hence, detailed studies need to take place before establishing exotic species. (CIFOR, 2017). Likewise, the use of well-adapted introduced species has been positively accepted by different reforestation companies because they have special technological packages that avoid companies from experimenting with species as all details have already been studied and proved in different locations. (Proexport, 2012).

Also, the growth rates of Pinus and other species is sufficiently high to generate revenues in the short-term (6 to 10 years), and consequently, project owners prefer to combine introduced and native species to protect the financial health of the project and investors and to finance conservation and restoration activities in their territories. (Proexport, 2012). The project document of the project A106 includes a detailed forest management plan that

clearly states that the selection of the species was carefully reviewed and approved by experts based on the reasons previously exposed.

On the other hand, Parrota, (2006), states that forest plantings with mixed species promote the plant diversity in the Underwood and are capable of attracting local fauna as highlighted by most of the informants interviewed.

Participation from third parties

An informant mentioned that the project had attracted the attention of some universities that constantly sent over students that want to learn about reforestation with native and introduced species. Some partnerships have also been established with training institutions that have provided training about safety in work, the use of proper equipment and machinery when harvesting wood, and the monitoring of water quality downstream (mainly due to the impacts of the pig factory on water sources).

Another informant claimed that the project has brought visitors and investors even from other countries and that all of them were driven by their interest of visiting a forest that is well conserved and located not far from the capital of the department (Medellín). However, it is clear that planting itself has not attracted such attention alone but is the carbon project that has been published and communicated in different media, including the website of the standards, the local newspapers, and the trading platform where buyers and traders constantly review the project characteristics, and value the credits that are commercialized in the international voluntary market.

In this order of ideas, project owners should be aware of the growing popularity of carbon projects (Hartmann *et al.*, 2011) if they decide to execute such initiatives, because all details associated to the projects will be openly published and anyone interested can approach the owner and even raise comments and complains if something is not clear or not complying with the selected methodologies. However, in most cases, including this one, the attention usually focusses on the positive impacts that a project can bring as investors want to buy credits that are real and backed up by sustainable management of forest and active participation of local communities.

Comparison between the former evaluation forms and the results of the interviews:

To compare the results of the previous LSC with the opinions of the key informants interviewed, informants were all indirectly asked about what they like and what they did not like about the project. The comments presented below are a summary of the different conversations:

Table 19 Summary of conversations with the key informants

What do you like from the project	What you do not like from the project
Brings visitors and investors, even from other countries	Odors from the pic factory still present
Protects water bodies	Due to lack of maintenance, some planted areas are in poor conditions
Increases biodiversity	The project includes introduced species
Promotes the generation of employment	Carbon credits not able to cover certification costs
Improves the landscape	Generation of few jobs

Creation of partnerships with training institutions	

What people like from the project today and at the moment of validation is that the project generates employment for the local communities, promotes the participation of private and public institutions, protects water bodies and improves their quality, and contributes to the increase of local biodiversity. Likewise, what people in the past and today do not like about the project is that it uses introduced species.

What is different today, according to the informant's opinion is that the project has not generated as many credits as planned, and consequently some maintenance activities have had to be postponed. This was not overseen by the participants of the LSC who only claimed (in addition to the comments mentioned before), that what they did not like that the project had not been replicated in the neighboring areas. Such opinion will likely change if a new LSC is put in place, but there is no way to justify such a statement without the assessment of the local communities.

As a summary, the findings of the key study served to identify that the project has contributed to the achievement of five specific SDGs: reduction of carbon emissions (SDG 13) despite the reductions and associated economic benefits were not as expected; creation of few high-quality permanent jobs (SDG 8), improvement of landscape and increase of biodiversity (SDG 15), the strengthen of local and global partnerships with private and public actors (SDG 17), and finally, the involvement of different stakeholders in the project (SDG 10).

5. Conclusions

Association between impact variables and regional and project-related determinants was only evident for nine impact variables. The most commonly targeted SDGs were the number eight (promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all), ten (reduce inequality within and among countries), five (achieve gender equality and empower all women and girls) , four (ensure inclusive and equitable quality education and promote lifelong learning opportunities for all) and one (end poverty in all its forms everywhere) are associated with those nine impact variables.

Impact variables associated with regional determinants only were: the type of working agreement offered to the workers, the presence of indigenous peoples in the project, the proportion of women hired by the projects, the number of training sessions provided, the destiny of the revenues from the carbon credits and the improvement of the economic welfare.

On the other hand, only one impact variable was associated with the occurrence of project determinants only: job creation. Finally, the number of black communities hired by the project and the investments in road infrastructure were associated with both, regional and project specific determinants.

The results of the quantitative analysis show that AFOLU projects can create more jobs when the projects are privately owned, or when there is a mix between private and public owners, than when projects are completely owned by communities. Communities, on their own, lack the experience and technical training needed to comply with the requirements of the methodologies and procedures set by the certification standards.

Another conclusion is that more jobs are generated when the projects involve different land management types, rather than reforestation or conservation only. Likewise, the results of this thesis indicate that the quality of jobs can increase when projects are located in very poor areas, as apparently, projects tend to offer more permanent contracts to the poorest people in order to contribute with the local economic development. However, it is important to highlight that most jobs in the AFOLU sector are seasonal.

Also, this thesis served to identify that the presence of vulnerable communities inside the project, such as indigenous or afro-descendants, is higher in poor regions where the access to basic infrastructure is limited and in areas where forest have the highest potential to reduce carbon (Choco and Antioquia). These areas are located in the poorest departments of the country where forest are constantly threatened by illegal harvesting.

Another conclusion is that projects that decide to invest more on the development or improvement of road infrastructure, usually occupy large expanses of land with high carbon sequestration capacity, and where more than 50% of the land has already been intervened with the project activities

Finally, some questionable results in terms of their applicability to the total sample are the association between the rate of women hired by the project, and the occurrence of poverty in the areas where the projects are located, as the origin of the women is unknown. On the contrary, the association between the destiny of the investments done with the revenues from the carbon credits and the access to sewerage per department could not be justified or corroborated with other similar studies.

These results indicate that the achievement of specific SDGs can depend on project determinates that are easily identified for all AFOLU carbon projects in Colombia, including the scope, objective, and size; and on certain socioeconomic conditions of the territory where the project is located. However, in order to identify more associations, it is necessary to increase the population and sample size by including the projects certified under ICONTEC, the national certification standard.

As per the case study, the main challenge identified was that the expectations related to the carbon revenues were not as planned due to the lack of information and planning when designing the project activities. The reduction in the revenues impacted the implementation of the project activities. For this reason, all project owners need to carefully review the carbon potential of their projects and also, they need to understand that carbon revenues alone cannot be used for the implementation of the totality of the project activities, as they work as marginal incentives rather than a complete source of financing.

On the other hand, the case study served to identify that the project is positively contributing and in an indirect way to the achievement of the SDG 8, 10, 15 (protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss) and 17 (strengthen the means of implementation and revitalize the global partnership for sustainable development) , despite project stakeholders being largely unaware of the significance or importance of the SDGs.

Results also show that projects that promote forest conservation have a great capacity to contribute to the achievement of specific SDGs (as the ones mentioned above), especially if they are related to regional and project specific determinants.

Regional determinants represent context; one cannot expect these variables to change in the short to intermediate term, but their significance can be taken into account when determining the geographical distribution of projects and investments. Project-specific determinants concern project design, so the variables can be easily manipulated, also in the short term. These associations should be of assistance in (a) designing projects with a greater likelihood of success, and (b) revising the standards and regulations for assessing these projects.

An effective assessment and monitoring of the SDGs for the AFOLU projects will only take place once projects initiate the verification process, and only if the verification demands compliance with the new SDG-related requirements of most certification standards.

However, if the projects are not required to comply with the new regulations, their impact on the SDG will have to be assessed through the use of similar methodological approaches, including the review of secondary sources, the execution of surveys and interviews, and if possible, the assessment of more case studies.

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Annex I

Consent letter

Norges miljø- og biovitenskapelige universitet

NMBU
Ås, Norway
May, 2018

To whom it may concern

María Catalina Becerra Leal is a masters student in International Development Studies at the Norwegian University of Life Sciences (NMBU).

The objective of her thesis research is to assess the performance of AFOLU projects in terms of their contribution to the achievement of specific Sustainable Development Goals (SDGs). The research aims to identify regional and project-specific determinants of performance. In order to achieve her objective, Maria will compile a database of socioeconomic and geographical indicators. Access to public and private information associated with these projects, and the natural and social environments in which they are located, is crucial to the success of her research.

The results of the research will serve to inform the implementing and sponsoring bodies about the strengths and challenges of the projects in terms of their impact on specific SGDs. The research will also critically consider the applicability of the SDGs as an opportunity for claiming economic benefits via carbon credits or by accessing funds for international cooperation.

The information that Maria would like to access includes reports and other documents published at the different certification standards' web pages (including VERRA, CCB Standard, ICONTEC and Gold Standard). The documents to be consulted are Project Documents (PD), Monitoring reports, validation and verification reports.

I hereby confirm that the information to be collected will be used for academic purposes only. Her thesis will enter the university's records, but will not be published online (as per the request of the student).

Sincerely yours,

Espen Olav Sjaastad
Professor and thesis supervisor

Annex II

Questionary:

1. What is the project size in hectares?
2. What type of activity is implemented by the project?
   a. REDD+
   b. Commercial reforestation
   c. Conservation and sustainable management of forest
   d. Agroforestry system
   e. Others
3. How many direct and indirect jobs have the project generated since the project start date?
4. What type of contract(s) is offered to the employees?
   a. Fixed term
   b. Indefinite term
   c. Service provision
   d. Daily Fee
   e. Other
5. What is the average age of the people working for the project?
6. Are there indigenous communities living inside the project area?
7. Are there black communities or other minorities living inside the project area?
8. Have you hired people reinserted or displaced from the armed conflict?
9. Have you hired indigenous or black communities?
10. How many women have been hired by the project?
11. How many of the women hired by the project occupy high responsibility positions?
12. How many training sessions have been provided as part of the project?
13. Approximately how many people have participated in the training sessions?
14. What type of infrastructure (roads, aqueduct, schools, houses, alternative, energy, etc) of common use has been supported or developed by the project?
15. Have you received money from the sale of carbon credits?
16. Have you used the money from the carbon credits for the implementation of the project activities?
    a. Yes
    b. No, I have used it to cover other expenses
    c. I have not received money
17. Do you feel that the project has attracted investments from the public or the private sector?
18. Has the project invested or developed any school-related program for the children living in the project area?
19. How would you respond to the following statement: The implementation of the project has contributed to the economic welfare of the local communities that live inside or close to the project area?
    a. Strongly agree
    b. Agree
    c. Disagree
    d. Strongly disagree

Annex III

Table 20 Indigenous hired by the project

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Indigenous_hired (categorical)	size (ordinal)	Kruskal-Wallis	3.167	0.367
	duration (ordinal)	Kruskal-Wallis	0.429	0.513
	% intervened (ordinal)	Kruskal-Wallis	0.402	0.526
	CO2e (ordinal)	Kruskal-Wallis	6.183	0.186
	Population project area (ordinal)	Kruskal-Wallis	2.429	0.657
	rural population (ordinal)	Kruskal-Wallis	3.468	0.483
	UBN (ordinal)	Kruskal-Wallis	4.459	0.347
	electricity (ordinal)	Kruskal-Wallis	6.937	0.139
	sewerage (ordinal)	Kruskal-Wallis	4.423	0.219
	Aqueduct (ordinal)	Kruskal-Wallis	4.486	0.344
	Phone (ordinal)	Kruskal-Wallis	3.715	0.294
	Toilet (ordinal)	Kruskal-Wallis	2.915	0.405
	school coverage (ordinal)	Kruskal-Wallis	1.923	0.382
	IDP (ordinal)	Kruskal-Wallis	5.429	0.143
	Infant mortality (ordinal)	Kruskal-Wallis	0.302	0.86
	Trend of deforestation (ordinal)	Kruskal-Wallis	3.132	0.209
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	1.453	0.693
	household size (ordinal)	Kruskal-Wallis	1.325	0.516
	poverty incidence (ordinal)	Kruskal-Wallis	0.504	0.918
	extreme poverty incidence (ordinal)	Kruskal-Wallis	0.231	0.891
	unemployment rate (ordinal)	Kruskal-Wallis	1.573	0.665
	GINI (ordinal)	Kruskal-Wallis	0.007	0.933

Table 21 People from armed conflicts hired by the project

Outcome variables	Explanatory	Type of test	associations -r-	significance level
People from armed conflict (categorical)	size (ordinal)	Kruskal-Wallis	0.381	0.944
	duration (ordinal)	Kruskal-Wallis	0.76	0.684
	% intervened (ordinal)	Kruskal-Wallis	1.287	0.257
	CO2e (ordinal)	Kruskal-Wallis	2.208	0.698
	Population project area (ordinal)	Kruskal-Wallis	3.132	0.536
	rural population (ordinal)	Kruskal-Wallis	8.583	0.072
	UBN (ordinal)	Kruskal-Wallis	4.41	0.353
	electricity (ordinal)	Kruskal-Wallis	1.213	0.876
	sewerage (ordinal)	Kruskal-Wallis	0.819	0.936
	Aqueduct (ordinal)	Kruskal-Wallis	1.728	0.786
	Phone (ordinal)	Kruskal-Wallis	0.834	0.934
	Toilet (ordinal)	Kruskal-Wallis	2.157	0.707
	school coverage (ordinal)	Kruskal-Wallis	0.604	0.739
	IDP (ordinal)	Kruskal-Wallis	4.246	0.236
	Infant mortality (ordinal)	Kruskal-Wallis	0.448	0.799
	Trend of deforestation (ordinal)	Kruskal-Wallis	1.72	0.423
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	1.612	0.447
	household size (ordinal)	Kruskal-Wallis	0.656	0.72
	poverty incidence (ordinal)	Kruskal-Wallis	3.831	0.28
	extreme poverty incidence (ordinal)	Kruskal-Wallis	3.994	0.262
	unemployment rate (ordinal)	Kruskal-Wallis	4.282	0.369
	GINI (ordinal)	Kruskal-Wallis	0.621	0.431

Table 22 Women occupying high-responsibility positions

Outcome variables	Explanatory	Type of test	association s -r-	significance level
Females high position (ordinal)	owner (categorical)	Kruskal-Wallis	1.087	0.896
	department (categorical)	Kruskal-Wallis	7.823	0.348
	scope (Categorical)	Kruskal-Wallis	0.829	0.363
	size (ordinal)	Spearman	-0.082	0.739
	methodology (categorical)	Kruskal-Wallis	2.777	0.905
	Objective (categorical)	Kruskal-Wallis	4.532	0.339
	validation standard (categorical)	Kruskal-Wallis	2.001	0.572
	duration (ordinal)	Spearman	0	1
	tenure (categorical)	Kruskal-Wallis	0.188	0.665
	% intervened (ordinal)	Spearman	-0.042	0.865
	CO2e (ordinal)	Spearman	0.059	0.81
	Population project area (ordinal)	Spearman	0.044	0.882
	project start date (categorical)	Kruskal-Wallis	-0.197	0.419
	endangered (categorical)	Kruskal-Wallis	1.258	0.262
	conflict zone (categorical)	Kruskal-Wallis	0.722	0.396
	rural population (ordinal)	Spearman	-0.175	0.474
	UBN (ordinal)	Spearman	-0.137	0.577
	electricity (ordinal)	Spearman	0.03	0.904
	sewerage (ordinal)	Spearman	-0.012	0.962
	Aqueduct (ordinal)	Spearman	-0.004	0.987
	Phone (ordinal)	Spearman	0.27	0.263
	Toilet (ordinal)	Spearman	0.035	0.887
	school coverage (ordinal)	Spearman	0.066	0.787
	IDP (ordinal)	Spearman	-0.09	0.714
	Infant mortality (ordinal)	Spearman	0.068	0.781
	Trend of deforestation (ordinal)	Spearman	-0.027	0.914
	excombatants reinserted (ordinal)	Spearman	0.229	0.345
	household size (ordinal)	Spearman	0.075	0.782
	poverty incidence (ordinal)	Spearman	-0.07	0.796
	extreme poverty incidence (ordinal)	Spearman	-0.079	0.772
	unemployment rate (ordinal)	Spearman	-0.102	0.706
	GINI (ordinal)	Spearman	-0.079	0.772

Table 23 Housing infrastructure for workers developed or improved by the project

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Housing for workers (categorical)	size (ordinal)	Kruskal-Wallis	5.525	0.137
	duration (ordinal)	Kruskal-Wallis	0.266	0.876
	% intervened (ordinal)	Kruskal-Wallis	0.425	0.514
	CO2e (ordinal)	Kruskal-Wallis	5.525	0.238
	Population project area (ordinal)	Kruskal-Wallis	2.167	0.705
	rural population (ordinal)	Kruskal-Wallis	2.019	0.569
	UBN (ordinal)	Kruskal-Wallis	4.25	0.373
	electricity (ordinal)	Kruskal-Wallis	2.429	0.657
	sewerage (ordinal)	Kruskal-Wallis	1.154	0.886
	Aqueduct (ordinal)	Kruskal-Wallis	5.844	0.211
	Phone (ordinal)	Kruskal-Wallis	2.125	0.547
	Toilet (ordinal)	Kruskal-Wallis	0.835	0.934
	school coverage (ordinal)	Kruskal-Wallis	0.133	0.936
	IDP (ordinal)	Kruskal-Wallis	0.425	0.935
	Infant mortality (ordinal)	Kruskal-Wallis	0.744	0.689
	Trend of deforestation (ordinal)	Kruskal-Wallis	1.063	0.588
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	4.25	0.119
	household size (ordinal)	Kruskal-Wallis	1.436	0.231
	poverty incidence (ordinal)	Kruskal-Wallis	1.885	0.39
	extreme poverty incidence (ordinal)	Kruskal-Wallis	1.077	0.299
	unemployment rate (ordinal)	Kruskal-Wallis	0.783	0.853
	GINI (ordinal)	Kruskal-Wallis	1.077	0.299

Table 24 Development or improvement of agrifood systems

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Agryfood systems (categorical)	size (ordinal)	Kruskal-Wallis	4.353	0.226
	duration (ordinal)	Kruskal-Wallis	4.74	0.93
	% intervened (ordinal)	Kruskal-Wallis	0.441	0.507
	CO2e (ordinal)	Kruskal-Wallis	4.156	0.385
	Population project area (ordinal)	Kruskal-Wallis	2.75	0.6
	UBN (ordinal)	Kruskal-Wallis	3.735	0.443
	electricity (ordinal)	Kruskal-Wallis	1.714	0.788
	sewerage (ordinal)	Kruskal-Wallis	7.313	0.12
	Aqueduct (ordinal)	Kruskal-Wallis	6.6	0.159
	Phone (ordinal)	Kruskal-Wallis	2.23	0.526
	Toilet (ordinal)	Kruskal-Wallis	2.563	0.633
	school coverage (ordinal)	Kruskal-Wallis	1.034	0.596
	IDP (ordinal)	Kruskal-Wallis	1.107	0.775
	Infant mortality (ordinal)	Kruskal-Wallis	1.471	0.479
	Trend of deforestation (ordinal)	Kruskal-Wallis	1.114	0.573
	excombatants reinserted (ordinal)	Kruskal-Wallis	0.956	0.62
	household size (ordinal)	Kruskal-Wallis	0.299	0.861
	poverty incidence (ordinal)	Kruskal-Wallis	1.889	0.596
	extreme poverty incidence (ordinal)	Kruskal-Wallis	0.433	0.933
	unemployment rate (ordinal)	Kruskal-Wallis	1	0.317
	GINI (ordinal)	Kruskal-Wallis	0.052	0.819

Table 25 Additional investments from private and public institutions

Outcome variables	Explanatory	Type of test	associations -r-	significance level
Attract further investment (categorical)	size (ordinal)	Kruskal-Wallis	0.849	0.838
	duration (ordinal)	Kruskal-Wallis	1.459	0.482
	% intervened (ordinal)	Kruskal-Wallis	1.135	0.713
	CO2e (ordinal)	Kruskal-Wallis	3.277	0.513
	Population project area (ordinal)	Kruskal-Wallis	1.093	0.895
	rural population (ordinal)	Kruskal-Wallis	1.071	0.784
	UBN (ordinal)	Kruskal-Wallis	3.578	0.466
	electricity (ordinal)	Kruskal-Wallis	0.617	0.961
	sewerage (ordinal)	Kruskal-Wallis	3.399	0.493
	Aqueduct (ordinal)	Kruskal-Wallis	5.187	0.269
	Phone (ordinal)	Kruskal-Wallis	2.767	0.429
	Toilet (ordinal)	Kruskal-Wallis	4.895	0.298
	school coverage (ordinal)	Kruskal-Wallis	2.639	0.267
	IDP (ordinal)	Kruskal-Wallis	1.035	0.793
	Infant mortality (ordinal)	Kruskal-Wallis	1.261	0.532
	Trend of deforestation (ordinal)	Kruskal-Wallis	0.897	0.639
	ex-combatants reinserted (ordinal)	Kruskal-Wallis	1.044	0.593
	household size (ordinal)	Kruskal-Wallis	0.015	0.903
	poverty incidence (ordinal)	Kruskal-Wallis	0.737	0.692
	extreme poverty incidence (ordinal)	Kruskal-Wallis	0.576	0.448
	unemployment rate (ordinal)	Kruskal-Wallis	0.032	0.999
	GINI (ordinal)	Kruskal-Wallis	0.576	0.448

Table 26 Support for the development of school programs

Outcome variables	Explanatory	Type of test	associations -r-	significance level
School program (categorical	size (ordinal)	Kruskal-Wallis	3.566	0.312
	duration (ordinal)	Kruskal-Wallis	1.429	0.232
	% intervened (ordinal)	Kruskal-Wallis	3.048	0.081
	CO2e (ordinal)	Kruskal-Wallis	3.196	0.526
	Population project area (ordinal)	Kruskal-Wallis	2.925	0.57
	rural population (ordinal)	Kruskal-Wallis	0.241	0.971
	UBN (ordinal)	Kruskal-Wallis	4.343	0.362
	electricity (ordinal)	Kruskal-Wallis	1.752	0.781
	sewerage (ordinal)	Kruskal-Wallis	2.872	0.412
	Aqueduct (ordinal)	Kruskal-Wallis	3.533	0.473
	Phone (ordinal)	Kruskal-Wallis	1.623	0.654
	Toilet (ordinal)	Kruskal-Wallis	3.325	0.344
	school coverage (ordinal)	Kruskal-Wallis	1.567	0.457
	IDP (ordinal)	Kruskal-Wallis	4.898	0.179
	Infant mortality (ordinal)	Kruskal-Wallis	2.4	0.301
	Trend of deforestation (ordinal)	Kruskal-Wallis	0.781	0.677
	excombatants reinserted (ordinal)	Kruskal-Wallis	0.241	0.886
	household size (ordinal)	Kruskal-Wallis	1.541	0.215
	poverty incidence (ordinal)	Kruskal-Wallis	2.181	0.336
	extreme poverty incidence (ordinal)	Kruskal-Wallis	0.777	0.378
	unemployment rate (ordinal)	Kruskal-Wallis	2.154	0.341
	GINI (ordinal)	Kruskal-Wallis	0.777	0.378

Annex IV

CODE BOOK

A project owner (Nominal)	code
Private	1
Public	2
Mix	3
NGO and OSC	4
Community-owned	5

Main scope (categorical)	code
REDD	0
AR	1

Project size (continuos)	
0--999	1
1000-9999	2
10000-50000	3
> 50000	4

Project start date (categorical)	code
Before 2010	1
After 2010	2

Department (Nominal)	code
Antioquia	1
Arauca	2
Boyacá	3
Caldas	4
Choco	5
Meta	6
Nariño	7
Santander	8
Valle del Cauca	9
Vichada	10

Metodology (nominal)	
AR-ACM0005	1
AR-ACM003	2
Gold Standard	3
AR-AM0004	4
VM0015	5
VM0009	6
VM0007	7
VM0006	8

Objective (nominal)	code
Reforestation with native and introduced species	1
Agroforestry systems	2
Restoration of degraded forest	3
Reforestation , agroforestry and assisted regeneration	4

Conservation and sustainable management (REDD)	5

Validation Standard (nominal)	
VCS	1
CCB	2
VCS+CCB	3
GOLD STANDARD	4
CDM	5

Project Duration (ordinal)	
0-20	1
21-41	2
more 41	3

Land Tenure (nominal)	
Private	1
Communitary	2
Mixt	3

% Project area already intervened (categorical)	
0--50	1
51--100	2

Annual reduction TCO2e (ordinal)	
500--9999	1
10000--49999	2
50000-99999	3
100000--500000	4
more 500000	5

Trend of deforestation in the region since the project start date (ordinal)	
Neutral	1
Negative (decreased)	2
Positive (increased)	3

Pupulation living inside the project area (ordinal)	
0--99	1
100--1999	2
2000--4999	3
5000-9999	4
more 10000	5

Jobs created by the project (ordinal)	
0-49	1
50-99	2
> 100	3

Working agreement indefinite	
no	0
yes	1

Indigenous inside the project area	
no	0
yes	1

Indigenous hired by the project	
no	0
yes	1

Black communities hired by the project	
no	0
yes	1

People from armed conflicts involved in the project	
no	0
yes	1

The proportion of women hired by the project (ordinal %)	
0--9	1
10--19	2
20--39	3
40--49	4
more 50	5

Number of training sessions provided by the project (ordinal)	
0--9	1
10--19	2
20--39	3
40--49	4
more 50	5

Proportion of women hired in high-responsibility positions (ordinal %)	
0--19	1
20--39	2
40-59	3
more 60	4

Number of assistants to training sessions (ordinal)	
0--49	1
50--99	2
100-999	3
more 1000	4

Has the project supported the development of road infrastructure (categorical)	
no	0
yes	1

Destiny Investments with carbon revenues (nominal)	
No revenues yet	1
Paying debts	2
Project development	3
Paying debts and project development	4

Has the project supported the implementation of agryfood systems inside project area (categorical)	
no	0
yes	1

Have you invested in any school related program?	
no	0
yes	1

Thanks to the recognition of the project, have you attracted further investments or support from other sources? (nominal)	
yes, Private sector	1
yes, The Government	2
yes. The Academia	3
yes, International ORG	4
No	5

Does the project promote the protection of endangered species?	
no	0
yes	1

Is the project inside or close to an armed conflict zone	
no	0
yes	1

Ex-combatants reinserted in 2017 per department	
0--20	1
21--41	2
42--62	3
63--83	4
84--104	5

Rural population per municipality (ORDINAL)	
0--9999	1
10000-19990	2
20000-29000	3
30000-39000	4
40000-49999	5

more 50000	6

Access to electric energy per municipality (%)	
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

Access to sewerage per municipality (%)	
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

Access to aqueduct per municipality (%)	
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

Access to local phone per municipality (%)	
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

Access to toilet per municipality (%)	
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

School coverage by municipality (%)	

Infant mortality rate per municipality (%)	

0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

Health Coverage (%) per municipality	
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

Poverty incidence per department 2012 - DANE (IDP) (%)	
20--29	1
30--39	2
40--49	3
50--59	4
60--69	5

Extreme Poverty incidence per department (%)	
8--14	1
15--21	2
22--28	3
29--35	4
36--42	5

Household size	
3--3.4	1
3.5--3.9	2
4--4.4	3

GINI	
0.51--0.59	1
0.6--0.69	2

Unemployment rate (%) (department 2017)	
6.8--7.4	1
7.5--8.1	2
8.2--8.8	3
8.9--9.5	4
9.6--10.2	5
more	6

rural population with unsatisfied basic needs per municipality	
0--19	1
20--39	2
40--59	3
60--79	4
80-100	5

Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitskapelege universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway