



XiCO_{2e}: MEXICAN REFORESTATION PROJECT



Document Prepared by FORLIANCE GmbH



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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project XiCO_{2e}: Mexican Reforestation Project is a grouped project for the afforestation, reforestation and/or revegetation (hereafter referred to as “ARR”) of lands in the states of Tabasco and Tamaulipas in Mexico. The main goals of this grouped project are:

- To restore degraded areas through the plantation of *Gmelina arborea*. The project activity will prevent further deterioration of already degraded areas, as well as soil erosion by providing protection through vegetative cover.
- To mitigate climate change by the removal of GHG through biomass growth.

The first project activity instance of the XiCO_{2e} project: includes 1,014.82 hectares planted in the state of Tabasco and 204.18 hectares planted in the state of Tamaulipas southeast and northeast Mexico respectively for a total of 1,219.01 ha during the monitoring period 2017-2022,

The project will achieve greenhouse gas (GHG) emissions reductions through the carbon sequestration by pools mentioned in section 6.5 through the reforestation with *Gmelina arborea*. The estimated annual average is 3,512 tCO_{2e} and the estimated total GHG emissions reduction and removals is 95,701 tCO_{2e}. Monitoring activities started on 11th January 2017 and ended on 30th July 2022.

The scenario existing prior to the implementation of the project were degraded lands. The previous land uses were grassland and agricultural lands, usually degraded. The Comisión Nacional Forestal (National Forestry Commission), CONAFOR in their reports classified these types of lands as suitable for forest uses ¹.

As a rotational plantation forestry project, the project ensures the regeneration of the carbon stock which the VCU are issued against by implementing a coppice forestry regeneration approach after the final harvest of each rotation. In this approach, the regeneration of tree biomass is not achieved through planting but instead by promoting regrowth, or “resprouting”, from the stumps of the harvested trees of the previous rotation. This method minimizes soil disturbance and other carbon losses that might otherwise occur during harvesting and replanting. A detailed description of the applied regeneration practices is given in Section 1.11.

¹ CONAFOR, 2010. Estudio de factibilidad de la Cuenca Forestal Industrial del Golfo de México, Informe Final Parte1(fase 1y 2), Cuencas Forestales Industriales. <http://www.conafor.gob.mx:8080/documentos/ver.aspx?articulo=1381&grupo=22>

| <u>Audit Type</u> | <u>Period</u> | <u>Program</u> | <u>VVB Name</u> | <u>Number of years</u> |
|-----------------------------------|------------------------|----------------|-----------------------------------|------------------------|
| Validation and first Verification | 11-01-2017 -30-07-2022 | VCS | AENOR International S.A.U (AENOR) | 5.55 |
| <u>Total</u> | 11-01-2017 -30-07-2022 | | | 5.55 |

1.2 Sectoral Scope and Project Type

The sectoral scope of the project is 14, Agriculture, Forestry and Other Land Uses (AFOLU). Within this category, the project is an Afforestation, Reforestation, Revegetation (ARR) type.

The XiCO_{2e}: Mexican Reforestation project has been designed and will be implemented as a grouped project.

The project has been implemented following the VCS Standard version 4.4 document.

1.3 Project Eligibility

The project activity is in the eligible category of Afforestation, Reforestation and Revegetation (ARR) of the AFOLU sector according to “Appendix 1: Eligible AFOLU Project Categories”, thus complying with the following eligibility requirements:

The project meets all the requirements of the VCS Program, including the six principles set out in section 2.2 of the VCS Standard v4.4 documents. The activities carried out in the project are aligned with Mexican law (see section 1.4). The Project proponents constantly review the legislative system, in order to keep up to date with the country’s law. The methodology used in this document for the validation of the project and the verification of the first instance is approved by the VCS Program.

The company plans to continue with the forestry activity for a minimum period of 30 years, thus ensuring constant carbon storage after harvest. In addition, the carbon loss that occurred during the harvest is accounted for and included in the project’s emissions, according to the guidelines of the document “AFOLU Guidance: Example for Calculating the Long-Term Average Carbon Stock for ARR Projects with Harvesting”.

The project does not affect native ecosystems, nor does it include activities that degrade hydrological functions. The project area was not drained or converted to create GHG credits. Compliance with this item is described below: Mexico defines its forests as an area having equal to or greater than one (1)

hectare, with tree crown cover equal to or greater than 30% and an average height of trees (in-situ) equal to or greater than four (4) meters². Based on this definition, an eligibility analysis was conducted to determine the eligible area (ha) that can be included as part of the project. The start year of the activities is 2017 and the forest cover was evaluated over the previous 10 years (2007-2017). The areas that present non-forest coverage were selected as eligible for ARR activities, while the remaining areas were defined as ineligible.

The results showed a total of 1,219.01 ha that meet the eligibility criteria for the first instance of the project, which corresponds to PROXYLO *Gmelina arborea* plantations. Table 1 summarizes the eligible areas in the States of Tabasco and Tamaulipas, while the following figures (Figures 1 and 2) show the corresponding geographical distribution.

Finally, the project ensures the regeneration of the carbon stock, against which VCUs are issued, by utilizing a coppice forestry regeneration technique after the final harvest of each rotation. This technique encourages the regrowth or “resprouting” from the stumps of the trees harvested in the previous rotation, instead of planting new trees. This approach minimizes soil disturbance and potential carbon losses during the harvesting and replanting processes. Detailed information on the regeneration practices implemented can be found in Section 1.11 and is supported by a submitted forest management plan signed by an authorized forester.

Table 1. Eligible areas that conform the first project activity instance of the XiCO2e: Mexican Reforestation Project.

| State | Total Area (ha) | First instance Area (ha) | Total Properties |
|-------------------|-----------------|--------------------------|------------------|
| Tabasco | 1,014.82 | 1,014.82 | 46 |
| Tamaulipas | 204.18 | 204.18 | 27 |
| Total | 1,219.01 | 1,219.01 | 73 |

² Available in: <https://cdm.unfccc.int/DNA/index.html>

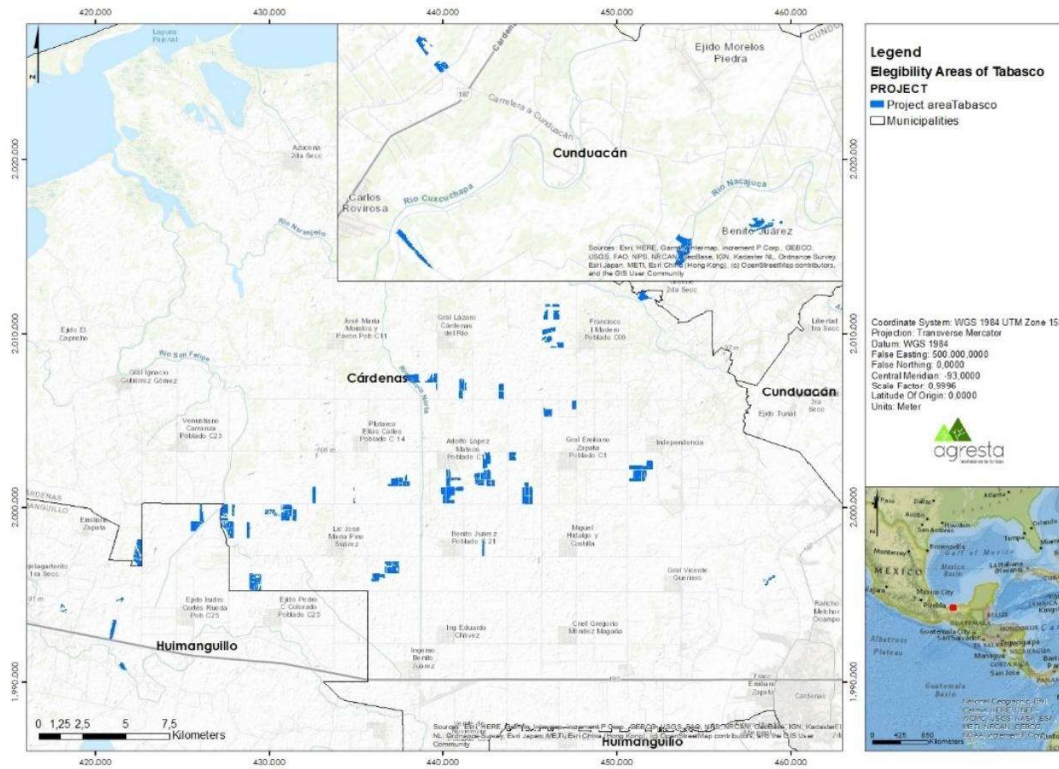


Figure 1. First project activity instance in the state of Tabasco.

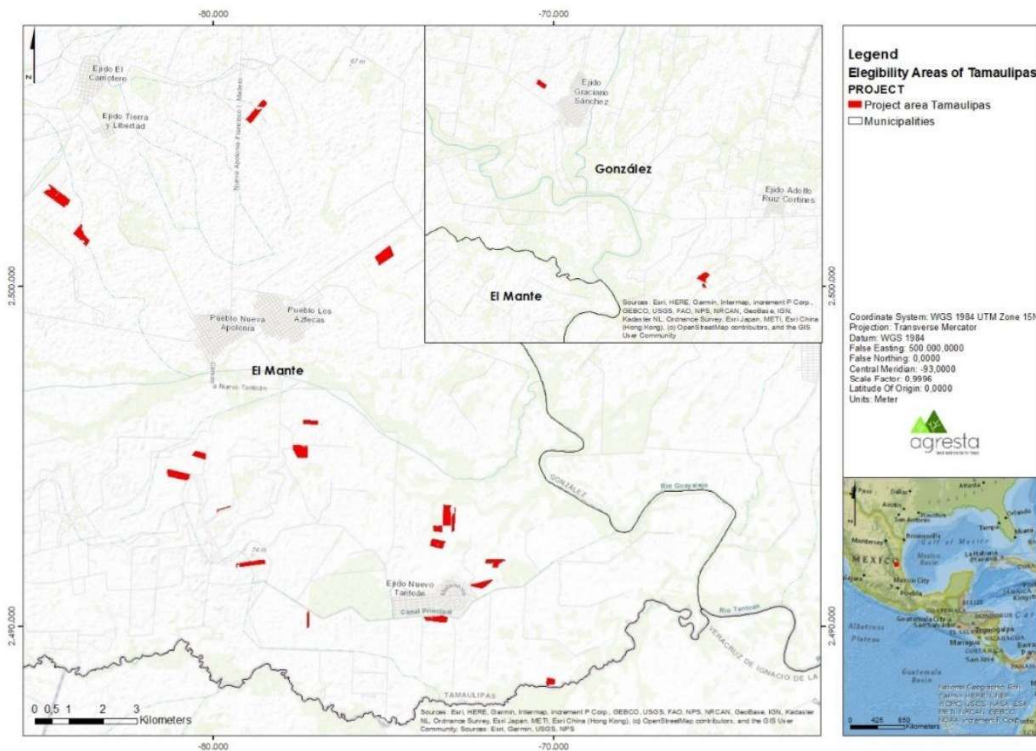


Figure 2. First project activity instance in the state of Tamaulipas.

1.4 Project Design

The XiCO2e: Mexican Reforestation project has been designed and will be implemented as a grouped project.

1.4.1 Eligibility Criteria

The first instance includes 1,219.01 hectares. For the new instances, the activities, technologies, and measures will be adopted following the same eligibility criteria as the first one.

As this project is a grouped project, any instance further implemented must comply with section 3.5.15 of the VCS Standard version 4.4. Therefore, any instance shall meet the following eligibility criteria:

1. Meet the applicability conditions set out in the methodology AR-ACM0003: Afforestation and reforestation of lands except for wetlands – Version 02.0
2. Use technologies or measures similar to the specified in this project description for the first instance and apply them in the same manner. New instances will consist of land restoration through planting using *Gmelina* species.
3. Apply the technologies or measures in the same manner as specified in the project description.

4. Following the baseline scenario determined in section 3.4 of this project description for the specified project activity and geographic area.
5. Have characteristics with respect to additionality that are consistent with that of the first instance, as described in “Section 3.5 Additionality”, facing similar barriers (Investment barriers, other than economic/financial barriers; Technological barriers; Barriers due to social conditions and/or Barriers due to prevailing practice);

In addition, as indicated in Section 3.6.7 of the VCS Standard version 4.4, “Inclusion of new project activity instances”, new project activity instances shall:

1. Occur within one of the designated geographic areas specified in the project description.
2. Comply with at least one complete set of eligibility criteria for the inclusion of new project activity instances.
3. Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.
4. Be validated at the time of verification against the applicable set of eligibility criteria.
5. Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance.
6. Have a start date that is the same as or later than the grouped project start date.
7. Be eligible for crediting from the start date of the instance through to the end of the project crediting period (only).
8. Only eligible for crediting from the start of the verification period in which they were added to the grouped project.
9. Not leave one VCS project and subsequently enrol in another VCS project.
10. Adhere to the clustering and capacity limit requirements for multiple project activity instances set out in Sections 3.6.8 - 3.6.9 of the VCS Standard version 4.4.

1.5 Project Proponent

Two entities have the overall control and responsibility for the project, acting as Project Proponents:

ALA BOOL Trust is a Mexican company that brings together small and medium-sized landowners to connect best forestry practices with direct access to customers and markets.

FORLIANCE is a German based company that plans, manages, and develops land use carbon projects, which align with the climate action strategies designed for corporates, their products, and services.

ALA BOOL Trust and FORLIANCE have signed a partnership contract for the development of the Project. ALA BOOL leads the forestry activities while FORLIANCE guides the certification process and supports the commercialization of carbon credits.

| | |
|--------------------------|--|
| Organization name | ALA BOOL TRUST SA DE CV |
| Contact person | Germánico Galicia García; Consuelo Marisel Figueroa Navarro |
| Title | Project Director; Deputy director of document management and information |
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| | |
|--------------------------|--|
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1.6 Other Entities Involved in the Project

FORLIANCE and ALA BOOL as the project proponents, have signed a legal agreement with PROXYLO, a private company that is dedicated to the establishment, management, and use of *Gmelina arborea* plantations in Mexico.

| | |
|----------------------------|--|
| Organization name | PROXYLO S.A.P.I DE C.V. |
| Role in the project | Forestry Expert |
| Contact person | Rafael Eduardo Riaño Masó |
| Title | General director |
| Address | Calle Grevilleas s/n, lote 4, fraccionamiento Pozo Azul, Xalapa, Veracruz, CP 91097. |
| Telephone | +52 228 1024580 |
| Email | PROXYLO S.A.P.I DE C.V. |

FORLIANCE GmbH, ALA BOOL Trust, S.A. de C.V. and PROXYLO S.A.P.I. de C.V. have a Project Development and Commercialization of VCU contract. Such contract refers to the commercialization of Verified Carbon Units (VCUs) under VERRA, with VCS generated by the Project during the accreditation period. The contract is available as part of the Supporting Documentation.

Agresta S. Coop has provided partial consultancy services to the Project Proponent for activities related to the developing of the document, calculations and QC /QA procedures.

| | |
|----------------------------|--|
| Organization name | Agresta S. Coop. |
| Role in the project | Advice on the joint PD development of the ARR project according to the VCS rules and requirement |
| Contact person | Jose Antonio Navarro |
| Title | Senior expert in Climate Change Unit |

The organizational chart of the project is presented in the following Figure.

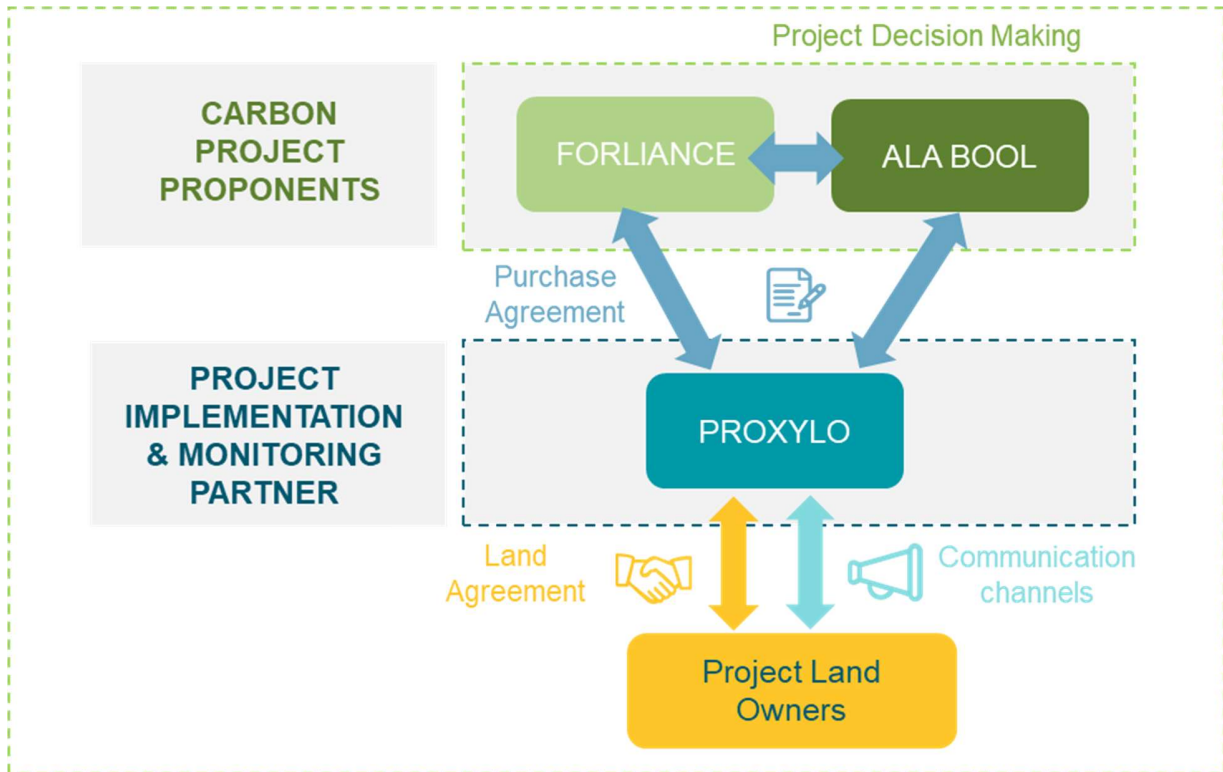


Figure 3. Xico2e Project organizational chart.

1.7 Ownership

Lands involved in the first instance of the XiCO2e: Mexican Reforestation Project include 73 properties leased by PROXYLO S.A.P.I DE C.V. to private landowners in the states of Tabasco and Tamaulipas.

Notarial certificates stating the right of use of the land units by the project developer within project boundaries are provided. These leases, available in Supporting Documentation, provide PROXYLO S.A.P.I DE C.V. the right to establish, manage and dispose freely of the outcomes and products of the forest commercial plantations³.

The landowners have signed an addendum to the leasing contract with Proxylo to specify the clause on the assignment of carbon credit rights. The owners of the leased forest land will assign the right to use any and all Verified Carbon Units (VCUs) generated by the removal of greenhouse gas (GHG) emissions

³ Legal property and agreements between Proxylo and Landowners are available in Supporting Documentation

from the reforestation activities to PROXYLO. Evidence of this addendum already signed has been provided as supporting documentation.

The lessor grants the usufruct to the lessee so that the latter may freely use, enjoy and enjoy the leased real estate, as well as the disposition of all its fruits and products arising from the plantation.

The XiCO_{2e}: Mexican Reforestation Project consists of a grouped project that has a management expansion plan of 9,000 hectares until the year 2030, as explained in section 1.12. Therefore, in the case of the future plantation, Proxylo will establish new contracts with the landowners.

As mentioned above, FORLIANCE GmbH and ALA BOOL Trust, S.A. de C.V. have a legal agreement with PROXYLO S.A.P.I DE C.V., of which designates them as the entities that own and commercialize the carbon credits associated with the reforestation activities on the properties involved in this project.

Proxylo has the legal right to operate 100% of the first instance of the project area.

1.8 Project Start Date

According to VCS Standard v4.4, the project start date is the date on which activities that lead to the generation of GHG emission reductions or removals are implemented. For this project, the start date is January 11, 2017, when the plantation campaign started.

1.9 Project Crediting Period

The crediting period of the project is 30 years. The period starts on January 11, 2017, and ends on January 10, 2047.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

| Project Scale | |
|---------------|---|
| Project | X |
| Large project | |

| Year | Estimated annual GHG emission reductions or removals (tCO _{2e}) |
|-----------------------|---|
| 11/01/2017-10/01/2018 | 2,770 |
| 11/01/2018-10/01/2019 | 10,802 |
| 11/01/2019-10/01/220 | 17,164 |
| 11/01/2020-10/01/2021 | 22,980 |
| 11/01/2021-10/01/2022 | 28,120 |
| 11/01/2022-10/01/2023 | 33,138 |
| 11/01/2023-10/01/2024 | -19,797 |
| 11/01/2024-10/01/2025 | -15,313 |
| 11/01/2025-10/01/2026 | -2,906 |
| 11/01/2026-10/01/2027 | 24,999 |
| 11/01/2027-10/01/2028 | -35,555 |
| 11/01/2028-10/01/2029 | 29,442 |
| 11/01/2029-10/01/2030 | 34,812 |
| 11/01/2030-10/01/2031 | -19,797 |
| 11/01/2031-10/01/2032 | -15,313 |
| 11/01/2032-10/01/2033 | -2,906 |
| 11/01/2033-10/01/2034 | 24,999 |
| 11/01/2034-10/01/2035 | -35,555 |
| 11/01/2035-10/01/2036 | 29,442 |
| 11/01/2036-10/01/2037 | 34,812 |
| 11/01/2037-10/01/2038 | -20,536 |

| Year | Estimated annual GHG emission reductions or removals (tCO ₂ e) |
|---------------------------------|---|
| 11/01/2038-10/01/2039 | -16,486 |
| 11/01/2039-10/01/2040 | -4,499 |
| 11/01/2040-10/01/2041 | 23,298 |
| 11/01/2041-10/01/2042 | -37,795 |
| 11/01/2042-10/01/2043 | 27,202 |
| 11/01/2043-10/01/2044 | 32,572 |
| 11/01/2044-10/01/2045 | -22,037 |
| 11/01/2045-10/01/2046 | -17,554 |
| 11/01/2046-10/01/2047 | -5,146 |
| Total estimated ERs | 95,701 |
| Total number of crediting years | 30 |
| Average annual ERs | 3,190 |

1.11 Description of the Project Activity

The project will achieve greenhouse gas (GHG) emissions reductions through the reforestation of *Gmelina arborea* plantations in degraded areas. These areas are not expected to revert to a non-degraded state without the intervention of anthropogenic influences and financial support. In the eligibility analysis available as supporting documentation, it was demonstrated that the areas selected for reforestation were degraded and have been for at least the last 10 years before the project start date. In that sense, they will most likely continue to be degraded areas in the future, in the without-project scenario.

The reforested areas contribute to minimising soil erosion by providing cover, thereby protecting, and restoring the degraded areas. GHG removals will be achieved through carbon sequestration by the reforestation with *Gmelina arborea*. These actions directly contribute to the mitigation of climate change.

The establishment of introduced and native species within commercial forestry plantations is governed by the General Forestry Development Law and its accompanying regulations enforced by the Mexican Ministry of Environment and Natural Resources (SEMARNAT) and the National Forestry Commission

(CONAFOR). The specific plantation areas in this project fall under the designation of LXXIII of the General Forestry Development Law, which pertains to temporarily forested land⁴. In these agriculture areas, the use of native species is not possible because these lands are not suitable for the ecological requirements of these. The native species included in the list or approved by SEMARNAT are the red cedar (*Cedrela odorata*), mahogany (*Swietenia macrophylla*), and kapok tree (*Ceiba pentandra*). As for non-native species, CONAFOR issues an annual list of species approved for commercial forestry plantations, including *Eucalyptus sp.* (eucalyptus), *Tectona grandis* (teak), *Gmelina arborea* (Gmelina), and *Hevea brasiliensis* (rubber) under the support concept of Commercial Forest Plantation (PFCA).

Gmelina species do not negatively impact native species. Gmelina is highly light demanding and is unlikely to establish itself in native forests. The fruit is also quite large and not wind-dispersed, so the risk of spreading is low. In Mexico, Gmelina has been a staple in plantation forestry since the 1990s (Ruiz-Blandon et al., 2022). Despite its widespread cultivation and the significant scientific attention, it has garnered, there have been no documented instances of Gmelina exhibiting invasive tendencies or causing detrimental effects on native ecosystems. Additionally, Gmelina does not feature on any invasive species lists or other lists identifying species of concern. This absence of negative reports, coupled with its extensive use and lengthy history in plantation forestry, suggests that Gmelina poses minimal risk to natural ecosystems when cultivated beyond its native range. Accordingly, it is also prudent to consider it as a low risk to the natural environment in Mexico⁵.

It's important to mention that the overseeing authority ensures proper plantation management, with a focus on mitigating potential adverse environmental impacts. Authorization from the authorities requires measures to prevent the uncontrolled spread of exotic species in forests in case this threat exists. As it can be observed in PROXYLO Forest Management Plan provided as supporting documentation, the potential impact of the Gmelina species is not included within the potential risks of the plantations⁶. Besides this, there are no other forest commercial plantations or native forests around the project area. The project area is included in the areas categorised as potentially suitable for Commercial Forest

⁴ Agricultural areas that are temporarily dedicated to forestry cultivation through commercial forest plantations, as well as those in which reforestation activities have been carried out, which may return to their condition of agricultural land when this activity disappears.

⁵ Ruiz-Blandon, B.A., Salcedo-Pérez, E., Rodríguez-Macías, R. et al. Growth, biomass, carbon and nutrient pools in *Gmelina arborea* established in pure and mixed forest stand production systems in Mexico. *New Forests* 53, 735–757 (2022). <https://doi.org/10.1007/s11056-021-09878-7>

Dvorak, W. World view of *Gmelina arborea*: opportunities and challenges. *New Forests* 28, 111–126 (2004). <https://doi.org/10.1023/B:NEFO.0000040940.32574.22>

World Agroforestry Center. 2009. Agroforestry Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Kenya. <https://www.worldagroforestry.org/output/agroforestry-database> accessed on 23-04-2024.

⁶ In the supporting documentation includes compliance with the National Call For The Application And Allocation Of Support Under The Rules Of The Sustainable Forestry Development For Well-Being Program, securing all necessary authorizations from Proxylo company

Plantation according to the Establishment and management protocol of the Ministry of Environment and Natural Resources (SEMARNAT), where there is non-native forest (see supporting documentation).

TECHNOLOGICAL PACKAGE USED BY PROXYLO IN THE FIELD

Site preparation

To improve soil structure and favour water infiltration, site preparation begins with a heavy 32-disc harrow, followed by a light harrow to break up the clods and fine-tuning increasing aeration and water absorption.

Subsoiling: this activity is done at a depth of 70 cm, to break the first layers of soil in lines where the plants are placed, which develops more efficiently their root system.

Edging: consists of building a 60 cm high by 1.5 m wide spine, following the line of the subsoiling.

A pre-emergent is applied to guarantee 90 days post planting without competition from grasses

If necessary, before establishing the plantation, irrigation is carried out to moisten the soil.

Establishment of the Plantation

The ARR activity begins with the design and layout of the plantation, which will be carried out at a distance of 2 meters between each sapling on the banks and 4 meters between each line, using a 2 x 4-meter line, obtaining a density of 1,250 plants per hectare.

The planting is done manually using a hoe or punch to open the stock on the edge where the plant is established and tamped around to avoid air pockets inside the stock and damage the root of the plant.

Fertilization

The fertilization process helps the rapid establishment of the plantation, better development of the trees and the production of good quality wood. Fertilization is done at the establishment of the plantation by applying 50 grams per plant of Yaramila Star, after 30 days, 75 grams per plant and 30 days later an additional 75 grams per plant. After three months of the 3rd application with Yaramila Complex 200 complementary grams are added.

Pruning

Since the main objective of the plantation is the production of quality wood, it is necessary to carry out pruning. The first pruning is done at 3 months of age of the plantation and consists of the elimination of unwanted axes and branches in the shaft of the plant, with the objective of concentrating the apical growth in a single axis without branches initially. Sixty days later, the second pruning is carried out, eliminating all branches on the stem. The third pruning occurs 60 days later where branches are eliminated from the stem at 50% of the height of the plant. The fourth pruning occurs 60 days later where

branches are eliminated at 50% of the height of the plant and the final pruning is performed 60 days later at a maximum of 60% of the total height of the plant.

The purpose of pruning is to guarantee straight, long, and unbranched shafts; this work is reflected in the final quality of the wood. The activity is carried out when the trees are in dormancy, preferably in winter or early spring. According to several authors, since the cambium is not active at this time of the year, it is more difficult for the bark to suffer wounds, blows or detachment⁷.

Weed Control

There are experimental reasons to affirm that the species to be planted are susceptible to be damaged by the competition of the underlying vegetation, mainly grasses and commercial forest plantations have as one of their main objectives to capture the maximum productive potential of the site and produce with the best quality and in the shortest possible time the forest raw materials.

Therefore, some mechanical and manual weed control tasks will be carried out. The roads in the middle of the borders are mowed with a tractor and mower twice a year during the first two years, clearing the line of trees manually with a machete. Subsequently, the trees are cut around the trees. Agrochemicals are applied twice a year during the first two years.

The elimination of weeds is carried out until the tree crowns reduce the penetration of the sun's rays and the shade produced is the best instrument of competition to achieve natural weed control.

Intermediate cutting or thinning

An intermediate cut of 50% of the trees is made after the plantation reaches one year of age. According to the initial density of 1,250 plants per hectare, about 625 poorly shaped and suppressed trees are eliminated in order to leave a final density of about 625 trees per hectare.

In this intermediate cutting or thinning, the dominated, poorly shaped, with less growth or damaged trees are selected and if necessary, even the well-shaped. This intends to give the trees that remain standing a growth area of about 20 to 30 square meters, thus leaving the best individuals until the end of the maturation period.

Given the age of the trees removed, it is expected to obtain a non-commercial volume of 1.45 m³ per hectare, so they will be chopped for incorporation into the soil. This activity is carried out in order to: reduce the number of trees per unit area so that the growth potential is distributed in the trees that are left and thus reach the desired commercial dimensions in less time; maintain the plantation in good

⁷ Meza Montoya, A. (2017). *Manual para productores de melina (Gmelina arborea) en Costa Rica*. https://www.researchgate.net/profile/Alejandro-Meza-Montoya/publication/318573023_Manual_para_productores_de_Melina/links/59710f294585153016391f66/Manual-para-productores-de-Melina.pdf

sanitary conditions and eliminate poorly shaped trees, favour the growth of trees with the desired phenotypic characteristics and space.

Pest and disease control measures

Preventive measures include the selection of *Gmelina* clones, vigorous plants from the nursery, site preparation, planting and thinning practices, and measures that favour sustainable control by natural enemies. In addition, visual inspections are made every 2 months to monitor the presence of pests or diseases. For suppression, if necessary, the pest or disease is identified and the decision is made to use mechanical or biological control (biological pesticides) or, if necessary, the use of synthetic pesticides.

Gmelina is a species that has been introduced more than 60 years ago and apparently does not yet have natural enemies in Mexico. Only attacks by the army ant *Atta formica* and *Atta* sp. have been reported, which, if found, is fought directly at the nest by applying specific products against the ant.

Harvesting

Once the requirements currently established by the corresponding legislation for the harvesting of products resulting from a commercial forest plantation are met, the procedure for the extraction of forest raw material consists of the following:

Felling is carried out with a Tigercat Feller 720G with a rotating disc head that allows the trees to be felled easily, using the tree-killing method.

Hauling and loading. After felling, the wood is manually cut and stacked. Logs are cut to the established measurements. The wood is stacked by diameter categories and finally loaded onto the transports.

Regeneration

This project follows a coppice forestry regeneration approach. In coppice forestry, in contrast to conventional plantation forestry, the regeneration of tree biomass is not achieved through planting but instead by promoting regrowth, or “resprouting”, from the stumps of the harvested trees from the previous rotation. By promoting regrowth from the stumps instead of planting, the coppice forestry regeneration approach minimizes soil disturbance and other carbon losses that might otherwise occur during harvesting and replanting. Further, the coppice forestry regeneration approach minimizes regeneration costs.

Most often it can be expected that multiple sprouts grow from each stump. Without proper management, these sprouts would compete with each other and would not allow for the production of high quality timber. Therefore, it is essential that an appropriate sprout management technique and sprout selection is implemented. To do so, first, so-called adventitious regrowth and proventitious regrowth must be identified. Adventitious regrowth comprises sprouts that form in healing calluses, often at the top of the stump. The vascular system of adventitious regrowth is not directly connected to the vascular system of the stump and has no direct connection to the remaining root system. Accordingly, adventitious regrowth is not suitable as a foundation for a high-quality and highly productive plantation. Proventitious regrowth emerges from pre-existing but previously dormant buds. These sprouts have a direct connection to the

stumps vascular system, and are able make use of the existing root system, as well as nutrient and energy deposits. Accordingly, proventitious regrowth grows much more vigorously than adventitious regrowth and is suitable for the regrowth of a highly productive and high quality plantation.

Once adventitious regrowth and proventitious regrowth has been differentiated, adventitious regrowth is eliminated from the stump and all proventitious sprouts except for 2-5 sprouts are removed.

Once the remaining sprouts reach a height of approximately 1 meter, the most rigorous and healthy looking sprout is selected and all other sprouts are eliminated. The remaining sprout now represents the target tree for the new rotation.

In the rest of the rotation, plantation management follows the prescribed management activities.

FOREST RESIDUE MANAGEMENT

Site preparation

On land shrub and grass vegetation, is shredded and incorporated into the soil by using a heavy harrow.



Image 1. Site Preparation



Image 2. Prepared soil

Pruning

Pruning residues (leaves, branches), when left between the borders, are shredded by the mower and incorporated into the soil.



Image 3. Pruning

Thinning

In this activity, 50% of the trees are removed, selecting those that are poorly shaped and overgrown. The branches of the removed trees are chopped, and the trunks are cut, placing the residues on the edge of the perimeter or on the curbs to prevent them from obstructing the passage of traffic on the streets.

Harvesting

Harvesting begins with cutting the trees and dragging them to the sizing, stacking, and loading area. In the sizing area, the trees are limbed, and the trunks are sized. The logs are stacked and loaded onto the vehicles that will transport the raw forest material to its destination. The residues from this activity are stacked and left for incorporation into the soil.



Image 4. Tree Felling



Image 5. Sizing, stacking and loading

1.12 Project Location

The project municipalities shown in the figure below constitutes the Project zone. All the future instances will be placed in the municipalities of Cardenas, Huimanguillo, and Cunduacan in Tabasco and in the municipalities of Gonzalez and El Mante in Tamaulipas. The proposed restoration grouped project intends

to generate GHG emission removals by restoring the ecosystems through the target of 9,000 hectares of Gmelina.

The plantations of the first instance of the project are located in the States of Tabasco (municipalities of Cárdenas, Huimanguillo, and Cunduacán) and Tamaulipas (municipalities of Gonzalez and El Mante). The distribution of the plantations is shown in the following figure. The coordinates of the plantation's properties are submitted separately as a KML file.

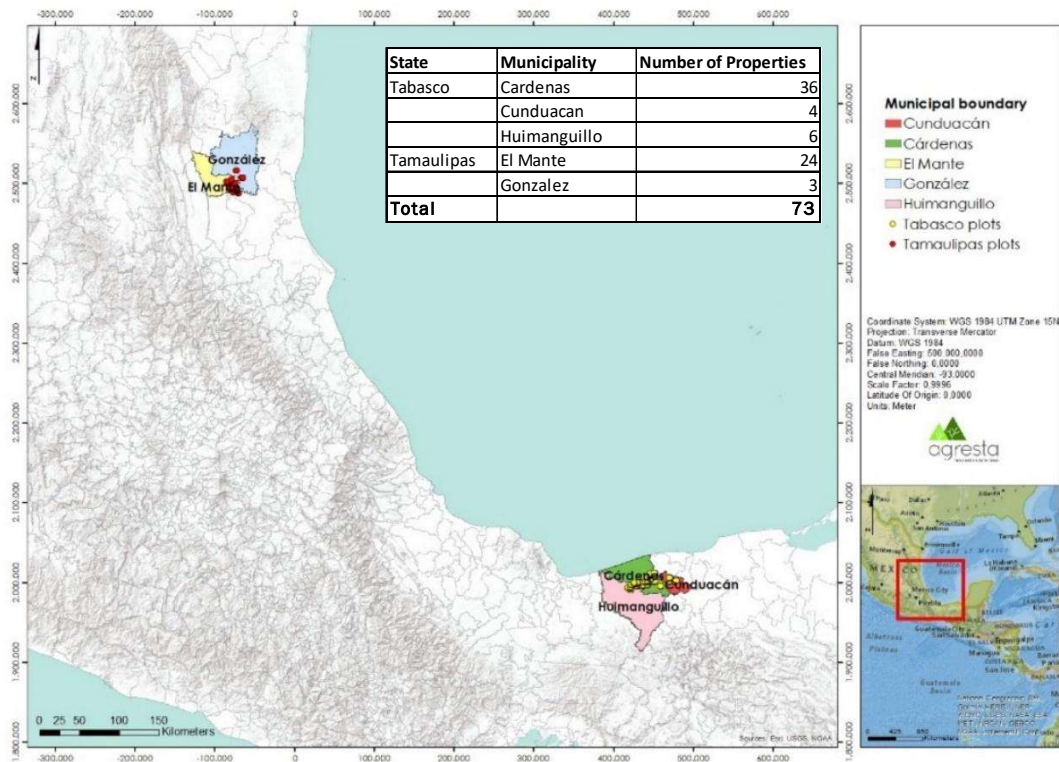


Figure 4. Project area location in Tabasco and Tamaulipas, Mexico.

In the following table it is presented the annual surface distribution by municipalities and states. As it can be observed over the 83% of the total area has been planted in Tabasco and Cardenas represents over the 73% of the Tabasco actual total area.

Future instances will be placed in the same municipalities. It is expected that the total area will be 9,000 ha by the inclusion of new activity instances,

| Planting year | Tabasco | | | Tabasco Total | Tamaulipas | | Tamaulipas Total | Grand Total |
|---------------|----------|-----------|--------------|---------------|------------|----------|------------------|-------------|
| | Cardenas | Cunduacán | Huimanguillo | | El Mante | Gonzalez | | |
| 2017 | 314.42 | 0.00 | 0.00 | 314.42 | 0.00 | 0.00 | 0.00 | 314.42 |

| Planting year | Tabasco | | | Tabasco Total | Tamaulipas | | Tamaulipas Total | Grand Total |
|---------------|----------|-----------|--------------|---------------|------------|----------|------------------|-------------|
| | Cardenas | Cunduacan | Huimanguillo | | El Mante | Gonzalez | | |
| 2018 | 244.97 | 0.00 | 19.46 | 264.42 | 0.00 | 0.00 | 0.00 | 264.42 |
| 2019 | 134.43 | 42.18 | 20.22 | 196.83 | 0.00 | 0.00 | 0.00 | 196.83 |
| 2020 | 0.00 | 0.00 | 41.36 | 41.36 | 0.00 | 0.00 | 0.00 | 41.36 |
| 2021 | 197.79 | 0.00 | 0.00 | 197.79 | 177.22 | 26.96 | 204.18 | 401.97 |
| Grand Total | 891.61 | 42.18 | 81.04 | 1,014.82 | 177.22 | 26.96 | 204.18 | 1,219.01 |
| Percentages | 73.14% | 3.46% | 6.65% | 83.25% | 14.54% | 2.21% | 16.75% | 100.00% |

1.13 Conditions Prior to Project Initiation

The project area, prior to the implementation of the proposed activity, consists of degraded agricultural lands.

The croplands present in the project area before the project activity consisted primarily of rice and sugar cane. Conversely, grasslands were predominantly utilized for extensive grazing, either through cultivated pastures or by relying on the natural vegetation cover..

In the project area there are some trees and shrub vegetation, with occasional pastures where grazing activities were present. The grazing in the project area was not intensive and was mainly related to the management of the old plantations as a work tool. Lands are leased by PROXYLO without the presence of cattle. This means that since January 2017, the month the Project started, to date there is no cattle in the farms involved in this first instance of the project.

On the other hand, in recent years, the National Forestry Commission's (CONAFOR) public policy to promote the development of commercial forest plantations has focused on reducing the dispersion of commercial forest plantations (CFPs) and concentrating them in specific regions for the supply of raw materials for the forestry industry, in order to respond to the deficit in the apparent consumption of timber forest products⁸.

The properties that make up the project area are classified in the catalogue "Areas of importance for conservation, restoration and production in Mexico" prepared by CONAFOR as Category II. Production areas (land suitable for forestation)⁹.

The main factors that lead to justify the degradation of the Project Area are the following:

- The effect of the Plan Chontalpa in the state of Tabasco. The plan Chontalpa began in 1955 with the clearing of 44,000 hectares of jungle, the construction of peasant housing, schools, health

⁸ Cuenca Forestal SSE - México.

⁹ Zonificación Forestal 2011. Categoría II. Zonas de producción — idefor.cnf.gob.mx

centres, dams, drains and the Nezahualcoyotl dam. According to Rzedowski (1978), the original vegetation in the area was medium and tall rainforest, but because the clearing was done with heavy machinery and deep ploughs, this prevented the regeneration of the rainforest (Salas-Urbe, 2022) and caused soil degradation.

- In the state of Tabasco, sugar cane production is dominant and characterized by a land-intensive management including tillage, drainage and the use of fertilizers (Herrera, Trejo-Téllez & Gómez-Merino, 2017; Armida-Alcudia et al., 2011). According to the study of Lopez et al. (2021), this area has an additional medium to high productive potential for rice cultivation.
- In Tamaulipas the degradation of soils is linked to the erosion and desertification. (“Principales procesos de degradación de suelos en México, 2002. Díaz, Asunción. 2012/01/01)

TABASCO STATE

Most of the Project area is located in the state of Tabasco which is located in the southeast of the country. The state is divided into productive regions or also called subregions, which group municipalities with similar geographic and productive characteristics. The project is taking place in the sub-region called Chontalpa. Tabasco is the region of Mexico with a complex hydrological network and with the highest rainfall recorded of the country, due to its proximity to the sea and its flat and low altitude terrain. Most of the state is influenced by warm and semi-warm climates which, together with the precipitation rates, represents one of the main characteristics for the development of intensive agricultural. Irrigated agriculture is represented by the production of cocoa, sugar cane and bananas. In Tabasco the first project activity instance involves the municipalities of Cárdenas, Huimanguillo, Centro, and Cunduacán.

Climate

Tabasco holds a humid tropical climate. Most of the year it is marked by significant rainfall, with little impact of the short dry season. This climate is considered Am (tropical monsoon) according to the Köppen-Geiger climate classification. The average temperature is 25.9 °C and the average rainfall is 1,702 mm per year.

Topography

The average altitude of the project area in the state of Tabasco is 8 meters above sea level (masl), while the plots located in the state of Tamaulipas have a slightly higher altitude, with an average altitude of 26 meters above sea level. The slopes of the Project area are flat areas with slopes of less than 1% in both states.

Hydrology

The state of Tabasco is the region of the country with the most complex hydrological network, as well as the one with the highest rainfall. Here, unlike other entities of the Republic, it is the surplus and not the lack of water that causes problems since there is a lack of adequate infrastructure to drain it. The

abundance of surface runoff with an apparently disorderly distribution has given rise to the formation of water bodies of varied dimensions, as well as marshes and flood plains populated by hydrophilic vegetation, such as mangrove, popal and tule. One of the aspects that characterizes the rivers of the Tabasco territory -considered a coastal upland plain- is the formation of meanders (sinuous courses), due to the flat terrain and the abundant transport of materials. This particularity is intimately linked to the floods caused by the continuity of rainfall for more than eight months. By virtue of the above, a considerable extension of the state gives the appearance of being composed of a series of lakes with islands. Despite the large volume of surface water, a certain degree of contamination and the high cost of the necessary works for its use do not allow satisfying the demands of the different uses. Due to this, groundwater is important since its permanence and greater spatial distribution offers certain advantages for industrial and domestic use.

Protected Natural Areas

Tabasco is home to an average of 23% of the nation's vertebrate biodiversity and 53% of the nation's freshwater wetlands. There are thirteen natural protected areas in the state that, due to their characteristics, are under different types of protection and represent a total of 376,591.61 hectares protected in the state. There are two protected natural areas under federal jurisdiction, covering an area of 348,660 hectares, while the remaining 27,931.61 hectares correspond to protected natural areas under state jurisdiction.

Fauna and flora

Tabasco's wildlife inventory is made up of a total of 2,042 species, of which 1,222 are invertebrate species and 820 vertebrate species, the latter are made up of 500 bird species, 113 mammal species, 98 fish species, 85 reptile species and 24 amphibian species. Forty-seven percent of Mexico's bird species, 42% of the country's flying mammals and 23% of the country's vertebrate species are represented in the state. Of the total number of species, 241 are catalogued as threatened, endangered or subject to special protection. The iguana, one of the existing species in Tabasco, the pejelagarto, the most emblematic species of Tabasco and considered a "living fossil" and sacred species for the pre-Hispanic cultures.

In terms of flora, a total of 2,208 species have been catalogued in the state, of which 100 species of plants and trees are at risk or threatened.

Location of the Project

The state of Tabasco is divided into productive regions or sub regions, which group together municipalities with similar geographic and productive characteristics. Thus, the 17 municipalities of the state were grouped into five productive regions or sub-regions. This is the most widespread and widely used regionalization.

The project is carried out in the subregion called Chontalpa.

Chontalpa Sub-Region

It is located in the westernmost part of the state. Its name is derived from the "Chontal" ethnic group, which has been settlers in this area since before the arrival of the Spaniards. The most important city in this sub region is the city of Heroica Cardenas.

The municipalities in the state of Tabasco where the project is being developed are Cárdenas, Huimanguillo and Cunduacán

Municipality of Cardenas

Cardenas outstands for its flat terrain in areas of depression. Its climate is warm-humid with abundant rains in summer. The precipitation regime is characterized by a total rainfall of 2,643 mm and an average annual temperature of 26°C. The maximum height of the whole municipality is 10 meters above sea level (masl).

Most of the surface is classified as vertisols, which are soils that have a high content of expanding clay and that have at some time of the year deep wide cracks. They shrink when drying and swell when they become wetter. As part of the productive activities, the agricultural area represents 25% of the municipality, livestock 54%, forestry 6% (timber trees used for making furniture) and 15% corresponds to urban areas, bodies of water and unproductive areas.

Municipality of Huimanguillo

Huimanguillo is the largest municipality in the Mexican state of Tabasco. Due to its extent, this municipality presents three different forms of relief; in the western part it presents soils characteristic of coastal areas, which cover 2% of its surface; the southern part presents a mountainous relief, which covers 11% of the territory. The remaining 87% of the municipal area is occupied by the Tabasco plain, which is the dominant form of relief in the state.

The average annual rainfall in the state is 2,290 mm. Due to its orography, Huimanguillo presents two types of climates. The warm humid with abundant rains in summer and average annual temperature of 26.2°C. And in the areas of mountainous relief, the warm humid climate with rains throughout the year, which is the climate that the high jungles of the Tabasco Mountain range present; whose average temperature varies between 25.4 °C and 26.9 °C.

In the state you can find high evergreen forest with trees over 30 m tall and some medium evergreen forest from 15 to 30 m high such as cedar, mahogany and tatúan. Another important type of vegetation is the popales, low-lying soils prone to flooding, where corn, beans and squash are grown at different times of the year. The agricultural activity in the municipality is geared towards the production of citrus fruits and basic grains.

Municipality of Cunduacán

The municipality has a flat topography, with the highest elevation being 40 masl. The climate is hot-humid with abundant rains in summer, average annual temperature of 26.2°C, and a rainfall regime of 1,947

mm per year. This municipality does not present areas with original vegetation, except for a small portion of semi-evergreen forest adjacent to the municipality of Cárdenas. It has lacustrine areas and land suitable for plantation agriculture, as well as representative areas of usable forest resources.

As in Cardenas, most of the surface is classified as vertisols. Land use is divided as follows: 35% is agricultural, 57% is livestock, 1% forestry and 7% for urban areas, bodies of water and unproductive areas.

TAMAULIPAS STATE

The state of Tamaulipas is in the northeast of the country. The relief of the State is mainly made up of large plains that extend along the coast and penetrate inland. The average annual temperature of the State of Tamaulipas is 23.5 °C. The average state precipitation is 780 mm per year. The rains occur in the summer, during the months of June to September, 27.8% of the state surface is covered by agricultural areas, 25.3% by scrub, 22% grassland, 10.5% by jungle, 8% by forest, and the remaining 6.4% by other types of vegetation, bodies of water and urban areas. The main crops are corn, sorghum, soybeans and sugar cane.

Climate

The state of Tamaulipas has a tropical sub-humid climate. This climate is considered Cfa (temperate, no dry season, warm summer) according to the Köppen-Geiger climate classification. The average temperature is 22.1 °C and the average precipitation is 887 mm per year.¹⁰

Topography

The relief of the State of Tamaulipas is mainly made up of large plains that extend along the coast and penetrate inland, interrupted by the Sierras de San Carlos and Tamaulipas, until culminating in the foothills of the Sierra Madre Oriental, which covers the southwest of the state territory. To the extreme north, at the international border, the relief is made up of plains with flat hillsides. The hillsides cover 34.6% of the state's surface, the plains 31.5%, the mountain ranges 20.4%, the lowlands 7.9%, the plateaus 3.3%, the valleys 1.9% and the beaches 0.3%. The state's surface is part of the following physiographic provinces: Sierra Madre Oriental, Great Plains of North America and Northern Gulf Coastal Plain.

Hydrology

The surface waters of the State of Tamaulipas are distributed in four hydrologic regions: RH24 Bravos-Chonchos, RH25 San Fernando-Soto la Marina, RH26 Pánuco and RH37 El Salado.

¹⁰ <https://es.climate-data.org/america-del-norte/mexico-179/>

The hydrological region RH24 Bravos-Chonchos covers 18.07% of the state's surface area, draining the waters from the north of the state towards the Río Bravo to finally discharge its waters into the Gulf of Mexico. The hydrological region RH25 San Fernando-Soto la Marina covers 55.56% of the state surface, draining the waters from the center and east of the state towards the Soto la Marina and San Fernando rivers and the Madre, San Andres and Morales lagoons; to finally discharge its waters into the Gulf of Mexico. The hydrological region RH26 Pánuco covers 20.58% of the state's surface area, draining the waters from the south of the state to the Tamesí River, which flows into the Pánuco River and finally discharges its waters into the Gulf of Mexico. The hydrological region RH37 El Salado, with its Sierra Madre basin, covers 5.79% of the state's surface area, draining waters from the southwest of the state. It is an inland watershed made up of closed basins and lacks important surface streams.

Protected Natural Areas

There are 10 protected natural areas in the state, 4 of which are under federal jurisdiction, 5 under state jurisdiction and 1 under municipal jurisdiction.

Fauna and flora

The State of Tamaulipas ranks 7th among the 32 states nationwide in terms of wildlife biodiversity. Wildlife inventory as of April 2015 was 3,166 species: 2,262 invertebrate species and 904 vertebrate species (152 mammal species, 545 bird species, 40 amphibian species, 111 reptile species and 56 fish species). This region represents 49% of the avifauna that inhabits Mexico and 38% of the flying mammals present in the national territory. There are 52 mammals, 20 amphibians, 56 reptiles and 85 birds among the species that have a conservation status because they are probably extinct in the wild, endangered, threatened or subject to special protection.

The state's surface area is covered by 27.8% agricultural zones, 25.3% scrublands, 22% pasturelands, 10.5% jungles, 8% forests, 2% mesquite forests and the remaining 4.4% are comprised of other types of vegetation, bodies of water and urban areas.

The scrublands are found mainly in the hills in the center and northwest of the state and in the desert plain in the extreme southwest; xerophytic scrub predominates. The main species present and the uses to which they are put are: gavia (wood), corvagallina (firewood) and izote (fibers). The grasslands are found mainly in the hills of the northwestern part of the state and in the plains and hills of the southeast; cultivated grasslands predominate, with a small proportion of induced and natural grasslands. The main species present are: African star, privilege grass, pangola grass, buffel grass, and tres barbas grass, all of which are used for forage. The forests are found in the foothills of the sierras; the deciduous and thorny forests predominate. The main species present are: aguacatillo, tepeguaje, guácima, palo mulato and cruceto, all of which are used for timber. Forests are found in the higher parts of the sierras; oak and coniferous forests predominate. The main species present are: oak, copalillo, Chinese pine and nopal, all of which are used for timber. Mesquite forests are found mainly in the arid northeastern and southeastern areas of the state. The main species present and their uses are: mesquite (wood), ebony (wood), white nagua (fodder), cruceto (wood) and gavia (wood). The main agricultural crops are corn, safflower, sorghum, soybeans and sugar cane.

Location of the Project

The state of Tamaulipas is divided into five forest regions (Forest Management Units) with an average area of 1,586,000 hectares. The project is located within the Hydrological Region No. 26 of the Pánuco River, which is located in the southern part of the state of Tamaulipas and within the Forestry Management Unit (UMAFOR) 5 Huasteca. It includes the municipalities of Llera, González, Xicoténcatl, Gómez Farías, El Mante, Ocampo, Altamira, Antiguo Morelos, Tampico and Ciudad Madero.

The municipalities in the state of Tamaulipas where the project is being developed are El Mante and González.

Municipality of El Mante

The municipality is in the southern portion of the state of Tamaulipas in the Guayalejo or Tamesí river basin. To the west of El Mante is the Sierra de Cucharas, which delineates the limit of the municipality and has a maximum height 800 meters above sea level. The rest of the municipality has a uniform relief with elevations ranging between 15 and 90 masl. The region has an extreme semi-dry climate, with average temperatures of 40° to 46° C in the months of June and July, as well as minimum temperatures of 4° to 26° C in the months of November and precipitation that reaches 1,000 millimeters. The land use is fundamentally agricultural.

Municipality of González

The municipality is located in the south of the state of Tamaulipas. The predominant climate is subhumid, with an average annual temperature of 25°C, and precipitation of 850 millimeters. The municipality has an extensive area for raising cattle, land dedicated to agriculture and forestry production. The climate favours the plantation of fruit trees. The highest point of the municipality is represented by the Bernal de Horcasitas hill with a height of 1,116 masl and which is part of the shield of the state of Tamaulipas due to its geological appeal.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The forest plantations are registered by the Ministry of Environment and Natural Resources (SEMARNAT). The certificates, available in Supporting Documentation, prove that plantations legally comply with the General Law of Sustainable Forest Development of Mexico and do not require Environmental Impact Assessment.

The laws and regulations that applied for the XiCO2e: Mexican Reforestation Project are described below:

National Legislation

The article 27 of the National Constitution establishes that the lands and waters included within the boundaries of the national territory belong primarily to the country. The Nation has the right to transfer the domain of the lands to private individuals, constituting private property.

The National Climate Change Strategy published in 2013, establishes in its strategic axis M4, to promote better agricultural and forestry practices to increase and preserve natural carbon sinks, recognizing that forests are important carbon reservoirs.

General Law of Climate Change

The General Law of Climate Change was published in 2012 and in its article 26, it states the principle of sustainability in the exploitation or use of ecosystems and the natural elements that integrate them. In addition, it establishes the co-responsibility between the State and society in general, to implement actions to mitigate and adapt to the adverse effects of climate change.

Its article 31 states that the national climate change mitigation policy shall include, through planning, policy and economic instruments, a diagnosis, planning, measurement, monitoring, reporting, verification and evaluation of national emissions for the gradual achievement of specific emission reduction targets, by sector and taking as a reference the baseline scenarios and baselines by sector.

Article 32 establishes that the national mitigation policy will be implemented based on the principle of gradualism, promoting the strengthening of national capacities for the mitigation of emissions, prioritizing the sectors with the greatest reduction potential until reaching those that represent the highest costs, in addition to complying with international commitments. The activities that involve or transfer a cost to the private sector may be implemented through national capacity building on a voluntary basis.

Article 33 states the objectives of public policies for mitigation including the reduction of national emissions, through policies and programs that promote the transition to a sustainable, competitive and low-carbon economy, including market instruments, incentives and other alternatives. Moreover, to promote the alignment and of programs, policies and actions to mitigate and reverse deforestation and degradation of forest ecosystems.

At local level, article 34 of General Law of Climate Change states that federal entities and municipalities will promote the design and development of mitigation policies and actions associated with the corresponding sectors. Within this framework, the reduction of emissions and carbon sequestration in the agriculture sector, forests and other land uses, and maintenance and increase of carbon sinks are considered. Also, it remarks the aim of slowing and reversing deforestation and degradation of forest ecosystems.

General Law of Sustainable Forest Development

The main regulation in Mexico related to forestry projects is the General Law for Sustainable Forest Development - "Ley General del Desarrollo Forestal Sustentable". The objective of this law is to regulate and promote the conservation, protection, restoration, management, cultivation and use of forest ecosystems and their resources in the country. The national institution in charge of the approval of the project activity is the SEMARNAT.

In its article 3, the Law indicates as main objectives: to promote sustainable forest management to maintain and increase carbon stocks, reduce emissions from deforestation and forest degradation, as well as reduce vulnerability and strengthen resilience and adaptation to climate change. In its article 32, it establishes the contribution to carbon sequestration as one of the mandatory criteria for environmental and silvicultural forestry policy.

In addition, article 53 states that Official Mexican Standards on forestry and soil matters will be issued to promote the welfare of the population and the conservation, protection, production, use or restoration of forest resources and their ecosystems.

The Regulatory Document of the Law establishes that for the forest plantations with a surface equal or less than 800 hectares, it is not necessary to develop an environmental impact assessment, the project developer only needs to submit a written notice for forest planting and then SEMARNAT will issue a proof of registration.

Regarding the granting of benefits or incentives for afforestation/reforestation at the national and state level the law indicates in its article 134 that Economic measures, programs, and instruments aimed at promoting and developing forestry activities must comply with legal provisions on taxation, budgeting, accounting, and federal public expenditure, while ensuring effectiveness, selectivity, and transparency. These measures may include fiscal, financial, and market mechanisms established in other laws, and the Commission is responsible for coordinating and evaluating their implementation across public and private sectors and different levels of government.

Additionally, the article 135 discusses the responsibilities of the Commission to design, propose, and implement measures that encourage financial contributions from the state, society, and private individuals to support the conservation, protection, restoration, surveillance, silviculture, planning, and sustainable management of forest ecosystems. The Federation may also establish fiscal incentives to ensure the long-term continuity of forestry activities and support mechanisms to promote sustainable forestry development, such as the Forestry Development Programme and others.

The Commission must promote and disseminate forestry-related economic measures and establish advisory mechanisms for facilitating access and capacity building (article 137).

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project is not registered or seeking registration under other GHG Programs.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

GHG removals generated by the project will not be used for compliance with binding limits to GHG emissions since such limits are not enforced in Mexico, and there is no emissions trading program in place in the country.

The VCU's generated from this project will be used in the context of the Paris Agreement.

1.16.2 Other Forms of Environmental Credit

The project neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals, including renewable energy certificates.

1.16.3 Supply Chain (Scope 3) Emissions

N/A

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description




The National Development Plan of Mexico (NDP) (2019-2024)¹¹ prioritizes economic and social development with an emphasis on infrastructure, policies to fight against poverty and corruption, promote local development and improve social services including health. Furthermore, the Mexican Government stated its commitment in promoting the sustainable development goals through the NDP. Some of the strategies included in the NDP are geared towards addressing the well-being of the communities and balancing them with environmental safeguards and protection. Below are some of the sustainable development goals (SDGs) that are being considered in the NDP and are also linked to the project's contributions.

- The XiCO₂ Project generates sustainable livelihoods for the *land owners* owning the land, who, thanks to the lease agreements signed with PROXYLO, will benefit from sustainable forestry.
- Project implementation activities lead to an increase in labour demand among the local population. The activities related to the forest plantations and maintenance provide employment with decent work opportunities to the local communities which addresses poverty reduction.

¹¹ Plan Nacional de Desarrollo 2019-2024

- Reforestation with *Gmelina arborea* enables minimization of erosion of degraded soils, thereby increasing the resilience of these areas. Additionally, the plantations manage an undergrowth forest that protects the soil and creates refuges for fauna.
- Therefore, the project will generate net anthropogenic CO₂ removals by sinks. The project activities contribute directly to addressing climate change. Through the reforested areas, the trees capture CO₂ from the atmosphere and increases the resilience of the previously degraded areas. The presence of trees also contributes to responsible soil management that reduces further erosion.

Table 2. Contribution of the project to the Sustainable Development Goals.

| SDG | Name | Project Contribution |
|---|---------------------------------|--|
|  | No poverty | The XiCO ₂ Project generates sustainable livelihoods for the <i>land owner</i> contributing to reduce the national poverty line. |
|  | Decent work and economic growth | The activities related to the forest plantations provide employment with decent work opportunities to the local communities which addresses poverty reduction. |
|  | Climate action | The project activity contributes directly to addressing climate change. Through the reforested areas, the trees capture CO ₂ from the atmosphere and increases the resilience of the previously degraded areas. The presence of trees also contributes to responsible soil management that reduces further erosion. |
|  | Life on Land | The plantations manage a good undergrowth forest that protects the soil and creates refuges for fauna |

1.17.2. Sustainable Development Contributions Activity Monitoring

As mentioned before, the project aims to restore degraded areas through the plantation of *Gmelina* (*Gmelina arborea*). Thus, the silvicultural activities including sowing, timber harvesting and plantations monitoring contribute to sustainable forest development. The project activities will achieve GHG

removals, contributing to the mitigation of climate change, increasing ecosystem resilience to extreme weather, and fighting forest fires.

The project activities implemented during the monitoring period are related to the implementation and maintenance of forest plantations: site preparation, plantation establishment, pruning, thinning, weeding, harvesting, fertilization, operation of machinery, etc. To perform these activities, labour is required, thus the project employs with decent work opportunities to the local communities which addresses poverty reduction.

The Gmelina (*Gmelina arborea*) produced is mainly used as construction wood which promotes carbon sequestration that remains trapped in man-made constructions for long periods. The current monitoring period includes the reforestation of Gmelina (*Gmelina arborea*) in 1,219.01 ha of degraded lands in Tabasco and Tamaulipas states.

Finally, the XiCO2 Project generates sustainable livelihoods for the landowner, who, thanks to the lease agreements signed with PROXYLO, will benefit from an additional income improving their well-being.

| Row number | SDG Target | SDG Indicator | Net Impact on SDG Indicator | Current Project Contributions | Contributions Over Project Lifetime |
|------------|------------|--|------------------------------------|---|---|
| 1) | 1.1 | 1.2.1 Proportion of population below the national poverty line | Implemented activities to decrease | The project generates sustainable livelihoods for the 73 land owners , who, thanks to the lease agreements signed with PROXYLO will benefit from an additional income improving their well-being | The project has increased the 73 land owners' total daily income, contributing to reducing the national poverty line. |
| 2) | 8.5 | Total number of jobs created (men & women) | Implemented activities to increase | 60 full-time jobs per year related to forest plantations, maintenance, harvesting and manufacturing activities. | 300 full-time jobs throughout the project's lifetime |
| 3) | 13.0 | Tons of greenhouse gas emissions avoided or removed | Implemented activities to increase | 1,014.82 ha planted in the state of Tabasco and 204.18 ha planted in the state of Tamaulipas, the project has sequestered 99,531 (tCO2e) of the atmosphere during the monitoring period. | Sequestration of 99,531 (tCO2e) of the atmosphere during the monitoring period |

| Row number | SDG Target | SDG Indicator | Net Impact on SDG Indicator | Current Project Contributions | Contributions Over Project Lifetime |
|------------|------------|------------------------------|------------------------------------|---|---|
| 4) | 15.2 | Area under tree canopy cover | Implemented activities to increase | The project reported 1,219.01 ha. planted during the monitoring period 2017-2021. | The project is intended to increase the forest area (planted forest) in 9,000 ha during the project lifetime. |

1.18 Additional Information Relevant to the Project

1.18.1 Leakage Management

As described in section 4.3 Leakage below, the risk of generating leakage from agricultural activities derived from the project activity is considered to be zero.

1.18.2 Commercially Sensitive Information

Any commercially sensitive information has been excluded from the public version of the project description and briefly describe the items to which such information pertains.

Legal agreements, financial statements and related information data projects proponents is sensitive are available upon request.

1.18.3 Further Information

No further information may have considered the eligibility of the project.

2 SAFEGUARDS

2.1 No Net Harm

Socioeconomic impacts

The XiCO₂ project is developed in territories composed of several small plots of land for which the project proponent (PP) has leases, that grant land management rights to PROXYLO. These contractual documents have been agreed upon and signed by all parties, so it is understood that there is no legal conflict or negative socioeconomic impact (see contracts in support documentation).

The PPs or any other entity involved in project design or implementation is not involved in any form of discrimination or sexual harassment. PROXYLO is a registered company, compliant with local and national regulations regarding discrimination. Non-discrimination is part of the company's policy, providing same working opportunities without gender, colour, or religion considerations, as reflected in the anti-discrimination and anti-corruption declaration included in the Supporting Documentation.

Environmental impacts

The ARR activity developed in the frame of the XiCO₂ project does not require any form of Environmental Impact Assessment (EIA). As mentioned in Section 1.14 *Compliance with Laws, Statutes and Other Regulatory Frameworks*, the Regulatory Document of the General Law of Sustainable Forest Development

“Ley General del Desarrollo Forestal Sustentable” establishes that for every forest plantation with a surface equal or less than 800 hectares it is not necessary to develop an environmental impact assessment.

Gmelina arborea is a notoriously heliophyte species and its natural regeneration occurs only in clearings and forest edges. When the fruits reach maturity in April and May, they are detached from the tree and are harvested and processed, avoiding their uncontrolled propagation. In addition, it is considered that the fruit, due to its size and weight, cannot be dispersed by the wind.

The project activity is placed in rural areas where soils and landscapes have been anthropized or degraded. In conclusion, there is no relevant potential socio-economic nor environmental impact due to the project. On the contrary, starting from degraded, anthropized or over-exploited land, project activities can only issue environmental and socio-economic benefits as described further in this section and in 2.3.

However, potential negative environmental impacts that would be triggered by project activity were identified by PROXYLO and mitigation measures were established for each of them.

Table 3. Potential negative impacts and mitigation measures

| Activity | Impact | Mitigation Measures |
|--|---|---|
| Preparing the ground for establishment | Erosion, soil compaction, moisture loss | <p>It is only done once (before planting) so that root penetration is more efficient because it increases the porosity of the soil.</p> <p>Make the planting boards against slope.</p> <p>During the planting phase, anchoring the root system prevents soil erosion.</p> <p>Reforestation in degraded lands contributes to groundwater recharge.</p> |
| Plantation | Occupational health and safety issues | <p>Proper use of Personal Protective Equipment (PPE).</p> <p>Use of equipment and logistics that facilitate the activity, such as the transfer of the plants in boxes in good condition.</p> |
| Pruning | Occupational health and safety issues | <p>Proper use of Personal Protective Equipment (PPE).</p> <p>Use of tools (saws and scissors) in good condition to make the activity more efficient.</p> |
| Use of forestry tools | Occupational health and safety issues | <p>Provide training in the proper use of forestry tools.</p> <p>Ensure that the equipment is in good condition.</p> |

| Activity | Impact | Mitigation Measures |
|-----------------------------------|---|--|
| Use of agrochemicals (herbicides) | Occupational health and safety issues | Proper use of Personal Protective Equipment (PPE). |
| Use of agrochemicals (herbicides) | Contamination of water bodies | Minimum dose application necessary to avoid runoff. Agrochemical containers must be removed and deposited in the municipal garbage dump. After 2 years, herbicide application is reduced up to 2 times per year, because the shade of the trees helps weed control |
| Fires | Loss of net surface area, higher economic costs | Firebreaks on all properties Constant monitoring during fire season |

Below is a description of how mitigation measures listed in the table will be addressed.

Land preparation

To pass a light harrow to break up the clods of earth left by the heavy harrow is passed. After this, the soil is subsoiled to a depth of 70 cm to break up the first layers of soil so that the plant can develop its root system more efficiently during the first months of establishment. Finally, the drainage system is made, depending on the characteristics of the property, generally perimeter drains, and secondary indentations are made every 20 meters.

Planting

The planting stage in Tabasco is done months before the rainy season, between the months of July and September, it begins by making the planting layout in a real frame design, the distance between board is 3.6 m and the distance between plants is 2 m. The distance between plants is measured with the help of a rope and a beacon is used to dig the holes for planting. In addition, the technician in charge of the establishment trains the personnel to provide the necessary information on the proper handling of the plants, In addition, the technician in charge of the establishment trains the personnel to provide the necessary information on the proper handling of the plants, the logistics of the transfer and the distribution on the property, and also shows how the planting should be done on the borders, making sure that the root collar is flush with the ground and tamping around the plant, in order to avoid air pockets inside the stock and damage the root of the plant. During and at the end of the work, the technical personnel will supervise the work of the crews distributed along the planting lines.

Fertilizer application

In the first months of age, the plants are fertilized manually, approximately 20 cm away from the plant, a hole is dug 20 cm deep and 150 grams per plant are added; this activity is done a week after planting, 6 months later another fertilization is done with the same amount, after the first thinning a third fertilization is done at 300 grams per plant, in the rest of the planting shift, fertilization will depend on the behaviour of the trees. The fertilizer used is YaraMila, which is not a toxic product. However, the personnel wear latex gloves and masks to avoid direct contact with the product. New technologies have been implemented to fertilize the older plantations using drones.

Use of Agrochemicals

Herbicides are used to control weeds in the first years of the plantation; the weeds in the Tabasco area are fast-growing and too aggressive for the Gmelina plants, so herbicides must be used after mechanical control with mowers and tractors. In this activity, the technical personnel train and provide the appropriate protective equipment (latex gloves and masks) to prevent contamination of the soil and/or bodies of water. The minimum necessary dose is used according to the weeds to be eliminated. Once the work is finished, the field technician in charge removes the containers of agrochemicals used and takes them to the dumpster installed in the area. The use of herbicides decreases after 2 years of planting or when the tree canopy closes, because the shade of the trees reduces the growth of weeds, allowing the property to remain without mechanical or chemical control for up to 6 months.

Pruning

During the first months of planting, pruning is done with pruning shears; when the branches begin to lignify, special pruning saws are used; workers are trained on how to cut the trees properly so as not to damage them; pruners wear goggles to protect their eyes; and all pruning waste must be placed on the edge of the tree so that it does not damage the street mowing activity.

Fires

In the Chontalpa area, most *ejidatarios* grow sugarcane and during the harvest season, all plots of land are burned. To prevent fires, firebreaks are made around the perimeter of the plantation. The breaches are made with a harrow to leave the soil mineralized and eliminate leaf litter or branches that could cause the fire to spread. In the most at-risk properties that are next to sugarcane crops, we have spoken with the owners to receive their support in notifying us of the day on which the burning will take place so that we can be present to prevent the fire from spreading to the Melina plantations.

Use of forestry equipment and tools

It is necessary that the forestry tools used in the maintenance of the plantations are in good condition to ensure that the activity is always efficient, when workers are hired, they are given training at the beginning of each activity to avoid accidents, when new forestry equipment or tools are acquired the distributor sends personnel trained in the handling and maintenance of the equipment and tools who train our personnel.

Flooding

Due to the fact that the area of plan Chontalpa is located between 4 and 7 meters above sea level and is completely flat in most of the properties, it is necessary to create a drainage system to facilitate the exit of water during the rainy season so that it does not remain stagnant in the plantation for days. Drains measuring 5 m, as well as secondary drains are made every 20 m on the surface of the plantation, when the rains are constant, monitoring is carried out in each property to check that the drainage system is working properly. After 2 years, maintenance is performed on the indentations, which consists of passing the tractor again with the piece manufactured to drain the indentations (butterfly).

2.2 Local Stakeholder Consultation

A stakeholder is commonly defined as “a person or party that has an interest in a company and can either affect or be affected by the business”. In this case, stakeholders would be people or parties that have an interest in the project activities and can either affect or be affected by the project.

Such stakeholders can be categorized as either external (people outside of the organization or project) or internal (people within the organization or project).

The XiCO₂ project has a limited number of local stakeholders due to the existing lease agreements, which provides right of their land to PROXYLO.

Table 4. Stakeholders' mapping

| No. | Stakeholder Name | Interest | Influence Level |
|-----|--|----------|-----------------|
| 1 | Director and managers | 10 | 10 |
| 2 | Staff | 8 | 8 |
| 3 | Suppliers | 4 | 5 |
| 4 | Forestry Authorities | 8 | 9 |
| 5 | Municipal Authorities | 4 | 4 |
| 6 | Owners, <i>ejidatarios</i> / communal landowners | 3 | 2 |

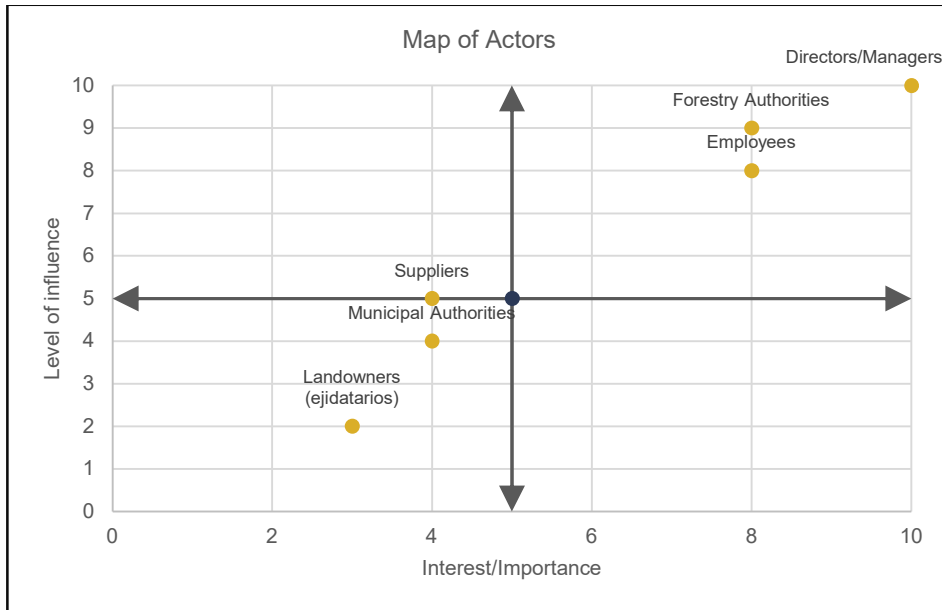


Figure 5. Stakeholder Mapping

The methods to engage local stakeholders will depend on their level of interest and influence on the project. For key/primary stakeholders (right upper quadrant), meetings were held to communicate information about project design and implementation, including the results of monitoring, risks, costs and any potential negative impacts. Along the same lines, these meetings inform about the project benefits, relevant laws and regulations, as well as VCS program validations and verification processes and the on-site visit by the validation/verification body.

Key/primary stakeholders (employees and forest authorities) and landowners were orally informed about the process of validation and verification under the Verified Carbon Standard (VCS), as well as the site-visit from a third-party Validation and Verification Body. To obtain evidence of this communication, the above-mentioned stakeholders have received printed summaries. The stakeholders signed the acknowledgement of receipt of the information and are available as supporting documentation,

The methods and procedures for documenting the feedback and outcomes from the local stakeholder consultation were dully documented in the minutes. Regular meetings were held with employees (see table 5). During the meetings, after the presentation and introduction, a round of question and answer was set up to collect doubts, comments, questions and feedback regarding the carbon project. At the end of the meeting the minutes are signed by all attendees. With forest authorities, the informational meetings were first conducted orally, and also a copy of this combined project document and monitoring report was provided so a summary of the project design and implementation, including the results of monitoring. Evidence of this was required by signing the project summaries. During the conversations

with the forest authorities doubts and comments were addressed. After sending the summaries there were no further comments received.

To ensure a dynamic communication process, the communication channels are defined according to the characteristics of the actors. For instance, periodic meetings will be held with relevant stakeholders to report on the progress of the carbon project and commitments made by PROXYLO. Additionally, the Forest Authorities (Tabasco and Tamaulipas) will be informed and updated about the project status and changes annually between the verification periods.

Two first socialization meetings were held in June and September 2022. These meetings were attended by the stakeholders rated highest in terms of interest and influence on the project, according to the stakeholder mapping. The outcomes of local stakeholders' meetings are documented by PROXYLO in the form of minutes and attendance registers, included in the Supporting Documentation. Table 5 depicts the scheduled meetings for 2023.

For other stakeholders, summaries of the project design will be shared by email or personal visit. The interested parties will be notified in writing of the date, time, place, purpose of the meeting and topics to be discussed; if this is not possible in writing, they will be notified by e-mail or telephone.

The following link, [PROYECTO_XiCO2e_\(Ala-BoOl.com\)](http://PROYECTO_XiCO2e_(Ala-BoOl.com)), has been created and communicated to stakeholders during the oral meeting. This link provides the most relevant information about the project, including its design, implementation, and monitoring results, as well as the risks, costs, and benefits it may bring to local stakeholders. It also includes all relevant laws and regulations regarding workers' rights in the host country, the validation and verification process of the VCS Program, and the on-site visit by the validation/verification body.

Considering the work performed by the administrative personnel, it was deemed necessary to inform them of the specific activities carried out in the field.

Table 5. Following up meetings schedule.

| Date (mm/dd/yy) | Time | Place | Objective | Responsible |
|--------------------|-------|-------------------------------------|--|-------------------------|
| 11/04/22 | 16:00 | Board Room, PROXYLO Office, Xalapa. | Provide information on PROXYLO's carbon project and commitments. | Juan José Masó Alvarado |
| 03/10/23 | 16:00 | Board Room, PROXYLO Office, Xalapa. | Provide information on PROXYLO's carbon project and commitments. | Juan José Masó Alvarado |
| 05/12/23 | 16:00 | Board Room, PROXYLO Office, Xalapa. | Provide information on PROXYLO's carbon project and commitments. | Juan José Masó Alvarado |

| Date (mm/dd/yy) | Time | Place | Objective | Responsible |
|--------------------|-------|-------------------------------------|--|-------------------------|
| 07/07/23 | 16:00 | Board Room, PROXYLO Office, Xalapa. | Provide information on PROXYLO's carbon project and commitments. | Juan José Masó Alvarado |
| 09/08/23 | 16:00 | Board Room, PROXYLO Office, Xalapa. | Provide information on PROXYLO's carbon project and commitments. | Juan José Masó Alvarado |
| 11/10/23 | 16:00 | Board Room, PROXYLO Office, Xalapa. | Provide information on PROXYLO's carbon project and commitments. | Juan José Masó Alvarado |

Administrative and Office personnel should be informed of the activities carried out in the field with photographs and videos, starting on November 4, 2022 meeting.

In the initial contract signed between landowners and PROXYLO and the subsequent renovation, landowners assign to PROXYLO the rights to market goods and products derived from the plantations, considering social safeguards. The project identifies potential environmental impacts and takes actions to remedy them, such as soil preparation to avoid compaction, personnel using protective equipment, minimal use of herbicides, removal and disposal of agrochemical containers, and after 2 years, herbicide application is reduced to twice a year as tree shade aids weed control. Fire control is done by creating firebreaks along the perimeter and constant monitoring is maintained during drought seasons.

Finally, to ensure bilateral and fluid communication, PROXYLO provides telephone numbers to address any doubts or concerns regarding the reforestation project.

There is no evidence of any legal or customary tenure access rights to territories and resources, including collective and/or conflicting rights, held by local stakeholders.

2.3 Environmental Impact

The forest plantations are registered by SEMARNAT. The certificates, available in Supporting Documentation, prove that the plantations legally comply with the General Law of Sustainable Forest Development of Mexico and do not require Environmental Impact Assessment.

2.4 Public Comments

Any public comment has been received during the consultation period.

2.5 AFOLU-Specific Safeguards

Local Stakeholder Identification

Stakeholders are defined as those groups or parties that have a stake/interest/right in the forest/land and those that will affect or be affected either negatively or positively by project's activities. They include relevant government agencies, formal and informal forest users, private sector entities, indigenous peoples and other forest-dependent communities. Such stakeholders can be categorized as either external (people outside of the organization or project) or internal (people within the organization or project).

The tool stakeholder Matrix (see figure 5) was used to identify the relevant stakeholders in the project area. The different stakeholders were attributed with levels of interest and influence in the carbon project. As a result, the figure in section 2.2 depicts the key stakeholders (high influence and high importance), those with medium influence and importance, and those with low importance and influence on the project.

The process of stakeholder identification involves several steps. In the case of private landowners, a responsible from PROXYLO went to the field searching for suitable lands for the establishment of commercial forestry plantations. Later, when suitable lands were found, the landowners were contacted and informed about the reforestation project's objectives and the company PROXYLO. Finally, if after the explanation, the landowner agrees to participate in the project, the process of leasing agreement starts (see support documentation for detailed information). As an outcome, a lease contract was signed.

Additionally, in communal lands, lands owned by Ejidos communities, the responsible PROXYLO had a meeting with the Ejidos commissariat to explain the purpose of leasing their lands for the reforestation project and PROXYLO's objectives. The commissariat held a meeting with the Ejidatarios (landowners) to explain and inform about PROXYLO's purposes. Finally, a last meeting between PROXYLO and the Ejidatarios (landowners) was held. Again, the process of leasing lands for commercial forestry plantations and the project objectives were presented and those who decided to participate in the project signed a participation list.

Even though PROXYLO has all the legal rights to operate these lands, the landowners are informed and updated periodically (at least once per year) about the project's progress. This communication is mainly verbal, however written notifications are handed with each contract renewal (see support documentation).

The harvesting of the commercial forest plantation is planned for year 6 of its development. Based on the experiences gained in the first monitoring period, renewals and new leases are being negotiated for periods of up to 10 years, instead of 7 years. This extension of the renewal period provides longer-term

agreements with landowners, which is considered a social safeguard for stakeholder engagement, including potential risks to plantation growth.

Table 6 depicts the results of the analysis of the stakeholders in terms of their rights, relevance and interest in the reforestation project XiCO2.

The XiCO2 project has a limited number of local stakeholders due to the existing lease agreements, which provide the right to PROXYLO.

The XiCO2e project is developed in territories composed of several small plots of land on which the PP holds leases. These contractual documents have been agreed upon and signed in conformity by all parties, so it is understood that there is no legal conflict.

Table 6. Stakeholders' analysis

| Stakeholder Group | Rights | Interest in the project | Relevance to the project |
|------------------------------|--|--|---|
| Director and Managers | <p>To have a team of people specialized in each area for the productivity of the project.</p> <p>Transparency in the movement of resources in each area for the development of the project</p> | <p>Having the right information to make continuous improvements in the main activities of each area</p> | <p>Delegate the management of each activity according to the project's objective</p> |
| Staff | <p>To carry out the necessary procedures to have their documentation in order by the Federal Labor Law.</p> <p>Have their rights respected in accordance with the Federal Labor Law.</p> <p>To have social security enrolled in the Mexican Social Security Institute.</p> | <p>Receive training and induction courses by company regulations.</p> <p>To have adequate work facilities that guarantee their well-being during the work shift.</p> <p>To have personal protective equipment.</p> | <p>Comply with the company's rules and regulations signed at the time of hiring.</p> <p>Commitment in the development of the work assigned to achieve the goals established in each area.</p> |

| Stakeholder Group | Rights | Interest in the project | Relevance to the project |
|---|--|--|---|
| Suppliers | <p>Obtain the necessary information on products and equipment needed.</p> <p>Efficient support in making payments.</p> | <p>Obtains economic benefits and promotion of its technology</p> | <p>Provide the necessary information from the moment of the quotations of materials and equipment to the purchase invoices.</p> <p>Keep updated with the innovations of each equipment to have more efficient tools in each practice.</p> |
| Forestry Authorities | <p>That the activities carried out in the commercial forestry plantation project comply with the regulations of the General Law for Sustainable Forestry Development.</p> | <p>Continue adding reforested areas that comply with established standards.</p> | <p>Comply with revisions for the generation of permits promptly.</p> <p>Provide information on government programs or support.</p> <p>Monitoring the development of plantations.</p> |
| Municipal Authorities | <p>To have the necessary information of the activities directly related to PROXYLO and the H. Ayuntamiento de Heroicas Cardenas.</p> | <p>The establishment of plantations develops beneficial activities such as job creation and economic growth in the municipality.</p> | <p>Keep PROXYLO informed regarding Civil Protection requirements.</p> <p>Comply with reviews under regulations in a timely manner.</p> |
| Owners, ejidatarios or communal landowners | <p>Fulfilment of the specifications established in the land rental contract.</p> <p>Knowing the direct or indirect benefits provided by commercial forest plantations.</p> | <p>Obtaining economic income from the rental of their land.</p> <p>The land benefits from the establishment of the plantations, such as soil retention that prevents erosion, soil fertility with the production of leaf litter.</p> | <p>Provide PROXYLO with the necessary documentation for the rental protocol.</p> <p>Keep PROXYLO informed about changes of documents or bank accounts.</p> |

Risks to local stakeholders

Risks to local stakeholders associated with the activities of the project and mitigation measures were identified and are exposed below.

Table 7. Potential project risks and their mitigation measures

| Potential risks to local stakeholders | Mitigation Measures |
|---|--|
| Negative employee perception of the project | <p>Adequate socialization of the project.</p> <p>Share the necessary information to make employees aware of the benefits of the project.</p> <p>Prioritize employees from neighbouring communities.</p> |
| Fires | <p>Frequent training of plantation maintenance personnel on fire prevention and management.</p> |
| Obstacles from Federal and Municipal authorities. | <p>Respect the guidelines of the Laws and Regulations inherent to the project.</p> <p>Comply in due time and form with the regulations issued.</p> |
| Risk to food security and land loss | <p>The principle of Free Prior and Informed Consent has been applied since the project formulation and will be applied throughout the project lifetime. The PP recognize, respect, and support local stakeholders (Ejidatarios)' property rights. Evidence of this is the land lease contracts signed with the landowners.</p> |

The following is a description of how the mitigation measures for the risks identified for the project will be addressed.

Negative perception of the project by employees

With the collaboration of Human Resources information about the benefits of the project to all those involved was distributed, such as production, maintenance, and administrative personnel, as well as to suppliers and owners of the land that is being rented, mainly to rank-and-file workers through meetings and informative talks where they are informed about the benefits and rights they have as collaborators. In general, thanks to the media, it has been shown that PROXYLO is a sustainable company that contributes to improving the social, economic and environmental conditions of the area.

Fires

The plantation maintenance technicians have worked with firefighting brigades at CONAFOR in the state government. They have basic knowledge of fire prevention and control, which has allowed them to have a group of field collaborators to support this activity; however, training should be ongoing to improve the deficiencies that persist.

Obstacles from Federal and Municipal authorities

PROXYLO as a company respects and adheres to the guidelines of the Laws and Regulations inherent to the project, obtaining licenses, permits, and authorizations by Federal, State, and Municipal Laws and Regulations. In addition to respecting the rights of workers.

To ensure communication and consultation with local stakeholders, as described in section 2.2, two measures will be maintained throughout the whole project life:

- Stakeholders will be able to make specific queries or complaints about the project with those responsible for monitoring the project. Contact details are provided.
- Mailboxes will be installed where the personnel can deposit in writing their complaint, consultation, recommendation, or opinion. The Human Resources area will be responsible for its follow-up, with a maximum of three working days for its response. Human Resources personnel will be in charge of reviewing the mailboxes and removing any written complaints, channelling them to the appropriate area for their corresponding attention.

Grievance Redress Procedure

- The project proponent has developed a process for receiving, hearing, responding and resolving any complaint. In this process, the stakeholders will be able to make specific queries or complaints about the project with those responsible for monitoring the project. To track these questions and queries contact details are provided (see support documentation for detailed information). Figures 6 and 7 represent the flow chart of this mechanism.
- Additionally, mailboxes will be installed where the personnel can deposit in writing their complaint, consultation, recommendation, or opinion. The Human Resources area will be responsible for its follow-up, with a maximum of three working days for its response. Human Resources personnel will oversee reviewing the mailboxes and remove any written complaints, channelling them to the appropriate area for their corresponding attention.
- All the stakeholders are aware of the grievance redress mechanism/procedure of the reforestation project XiCO₂ (see support documentation).



Figure 6. Grievance mechanism.

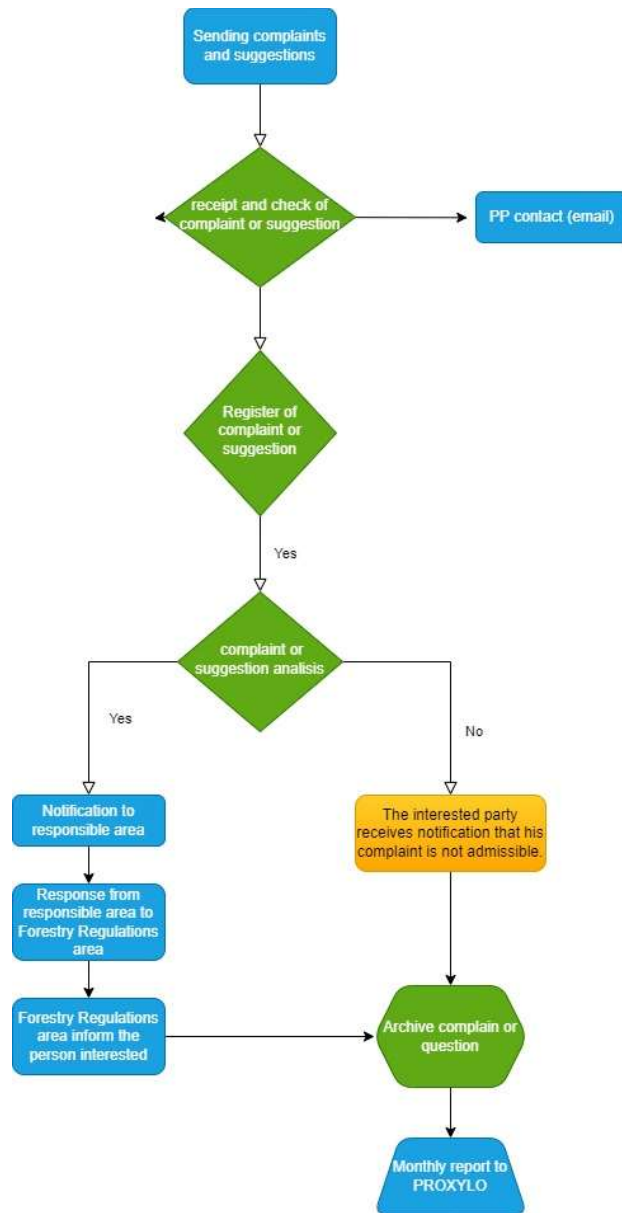


Figure 7. Grievance mechanism.

Respect for local stakeholders Resources

To ensure that the project proponent avoids any negative impact and that recognizes, respect and support local stakeholders’ property rights, the principle of Free Prior and Informed Consent (FPIC) has been applied since the project formulation and will be applied throughout the project lifetime.

Evidence of this is the strategy of the PP to approach the landowners. In the case of private landowners, a responsible person from PROXYLO went to the field searching for suitable lands for the establishment

of commercial forestry plantations. Later, when suitable lands were found, the landowners were contacted and informed about the reforestation project's objectives and the company PROXYLO. Finally, if after the explanation the landowner agrees to participate in the project, the process of leasing agreement starts (see support documentation for detailed information). As an outcome, a lease contract was signed.

Additionally, in communal lands (lands owned by Ejidos communities), the person responsible from PROXYLO had a meeting with the Ejidos commissariat to explain the purpose of leasing their lands for the reforestation project and PROXYLO's objectives. The commissariat held a meeting with the Ejidatarios (landowners) to explain and inform about PROXYLO's purposes. Finally, a last meeting between PROXYLO and the Ejidatarios (landowners) was held. Again, the process of leasing lands for commercial forestry plantations and the projects objectives were presented and those who decided to participate in the project signed a participation list.

Even though PROXYLO has all the legal rights to operate these lands, the landowners are informed and updated periodically (at least once per year) about the project progress. This communication is mainly verbal, however written notifications are handed with each contract renewal (see support documentation).

To reduce and avoid damage to the ecosystems, the PP is using an important and well-known timber species used in plantations in Mexico due to its rapid growth. *Gmelina arborea* is a notoriously heliophyte species and its natural regeneration occurs only in clearings and forest edges. When the fruits reach maturity in April and May, they are detached from the tree and are harvested and processed, avoiding their uncontrolled propagation. In addition, it is considered that the fruit, due to its size and weight, cannot be dispersed by the wind. Although it is an introduced species in Mexico, *G. arborea* has easily adapted to the humid tropical conditions in the states of Campeche, Tabasco, Veracruz, Quintana Roo, Chiapas, and Oaxaca. Also, it has adapted to the drier tropical conditions in the states of Colima, Guerrero, and Yucatan¹².

The use of fertilizers is extensively controlled in the plantations. Its use is necessary for the control of the intense and aggressive weeds. Therefore, some mechanical and manual weed control tasks will be carried out. The roads in the middle of the borders are mowed with a tractor and mower twice a year during the first two years, clearing the line of trees manually with a machete. Subsequently, the trees are cut around the trees. Agrochemicals are applied twice a year during the first two years. The elimination of weeds is carried out until the tree crowns reduce the penetration of the sun's rays and the shade produced is the best instrument of competition to achieve natural weed control.

The fertilization process helps the rapid establishment of the plantation, a better development of the trees and the production of good quality wood. Fertilization is done at the establishment of the plantation

¹² González, R., & Rodríguez, P. (2023). Remote sensing for the assessment of urban vegetation and its effects on microclimate: A case study of Mexico City. *Remote Sensing*, 15(19), 4751. <https://doi.org/10.3390/rs15194751>

by applying 50 gram per plant of Yaramila Star, after 30 days 75 grams per plant and 30 days later an additional 75 grams per plant. After three months of the 3rd application with Yaramila Complex 200 complementary grams were added.

Corporate Social Responsibility

PROXYLO is a company that respects the regulations of Federal, State and Municipal Laws, complying with Federal and Municipal permits for the establishment of its Forest Raw Material Storage and Transformation Center (Sawmill), the establishment of Commercial Forest Plantations and its offices. Establishing a fluid and transparent communication with government agencies.

Within Environmental Sustainability, PROXYLO implements practices to reduce its carbon footprint by using renewable energy in the Forest Raw Material Storage and Transformation Center and Offices, using Solar Panels, Waste Reduction and Management.

In terms of labour responsibility, PROXYLO complies with the regulations governing the rights of workers by providing them (with contract, social security, legal benefits, and protective equipment, among others) and promotes equal opportunities and diversity in its workforce, with training programs that include topics such as health, gender equality, safety at work, handling of agrochemicals, use of tools and equipment, among others. This improves the level of knowledge of operators and personnel in general.

Agreements are established with different actors in the health sector, optometrists, ophthalmologists, nutritionists, physical treatments, and pharmaceutical companies, among others, to benefit workers by obtaining discounts of up to 30% of the cost.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The methodology applied in this VCS ARR project is the CDM afforestation and reforestation methodology AR-ACM0003: Afforestation and reforestation of lands except for wetlands – Version 02.0, as well as the following methodological tools:

- “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities” (Version 01).
- “Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 04.0.0).
- “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities” (Version 03.1).
- “Estimation of carbon stocks and change in the carbon stocks of trees and shrubs in A/R CDM project activities” (Version 04.2).
- “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” (Version 02.0).
- “Tool for estimation of the change in soil organic carbon stocks due to the implementation of A/R CDM project activities” (Version 01.1.0).

The following tool was also used:

- “Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities” (Version 01.0.0)
- “Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities” (Version 01.0.1)
- “Calculation of the number of sample plots for measurements within A/R CDM project activities” (Version 02.1.0)

3.2 Applicability of Methodology

This section demonstrates that the methodology and previously listed tools are applicable to the project.

Applicability conditions of the Methodology

The CDM approved Methodology AR-ACM0003 Version 02.0 is applicable to the project since it meets the applicability criteria as described in the following table.

Table 8. Compliance to the applicability conditions prescribed by the methodology.

| Applicability Condition | Compliance |
|---|--|
| <p>The land subject to the project activity does not fall in the wetland category</p> | <p>Project activities will not take place in wetlands. This is demonstrated through the land eligibility analysis in which wetlands and water bodies were excluded from the project boundary.</p> |
| <p>Soil disturbance attributable to the project activity does not cover more than 10 per cent of the area in each of the following types of land when these lands are included within the project boundary:</p> <ul style="list-style-type: none"> • Land containing organic soils; • Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in appendices 1 and 2 to the methodology AR-ACM003. | <p>The soil disturbances attributable to the project activity cover less than 10% of the project area.</p> <p>The project activities are not taking place in organic soils. The baseline before the project start date was the continuation of the pre-project land use. Status Quo is land remaining with agricultural activities (Croplands and Grasslands. In the absence of the project activity, the baseline is expected to remain as agricultural activities that include crop cultivation and grazing activities in croplands and grasslands.(without receiving inputs such as listed in appendices 1 and 2 to the methodology AR-ACM003).</p> <p>In the case of croplands, they are mainly short-term or set-aside croplands without tillage and with low inputs. In the case of grasslands, they are degraded lands with low inputs.</p> <p>In this project case litter is not removed and soil disturbances are limited to those due to site preparation (pit digging).</p> |

Table 9. Compliance to the applicability conditions prescribed by the methodological tools applied.

| Tool | Applicability Condition | Compliance |
|--|---|---|
| <p>Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (Version 01).</p> | <p>a. AFOLU activities the same or similar to the proposed project activity on the land within the proposed project boundary performed with or without being registered as the VCS AFOLU project shall not lead to violation of any applicable law even if the law is not enforced.</p> <p>b. This tool does not apply to small - scale afforestation and reforestation project activities.</p> | <p>a. The project follows applicable legal and regulatory requirements (see section 1.14)</p> <p>b. This project is a project based on CDM rules (see section 1.10)</p> |

| Tool | Applicability Condition | Compliance |
|--|---|--|
| <p>Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 04.0.0)</p> | <p>a. The tool applies to all occurrences of fire within the project boundary.</p> <p>b. Non-CO2 GHG emissions resulting from any occurrence of fire within the project boundary shall be accounted for each incidence of fire which affects an area greater than the minimum threshold area reported by the host Party to define forest, provided that the accumulated area affected by such fires in a given year is $\geq 5\%$ of the project area.</p> | <p>Although the use of fire is not used for land preparation, in the event of forest fires, this tool will be used to account for emissions.</p> |
| <p>Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities” (Version 03.1).</p> | <p>This tool has no internal applicability conditions</p> | |
| <p>Estimation of carbon stocks and change in the carbon stocks of trees and shrubs in A/R CDM project activities (Version 04.2).</p> | <p>This tool has no internal applicability conditions</p> | |
| <p>Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” (Version 02.0)</p> | <p>This tool is not applicable if the displacement of agricultural activities is expected to cause, directly or indirectly, any drainage of wetlands or peat lands</p> | <p>Drainage of wetlands or peat lands will not occur in this project.</p> |

| Tool | Applicability Condition | Compliance |
|---|---|--|
| <p>Tool for estimation of the change in soil organic carbon stocks due to the implementation of A/R CDM project activities (Version 01.1.0)</p> | <p>This tool is applicable when the areas of land, the baseline scenario, and the project activity meet the following conditions:</p> <p>a. The areas of land to which this tool is applied: i) Do not fall into wetland category; or ii) Do not contain organic soils as defined in Annex A: glossary. of the IPCC GPG LULUCF 2003; iii) Are not subject to any of the land management practices and application of inputs as listed in the Tables 1 and 2 of the tool.</p> <p>b. The A/R CDM project activity meets the following conditions: (i) Litter remains on site and is not removed in the A/R CDM project activity; and (ii) Soil disturbance attributable to the A/R CDM project activity, if any, is: In accordance with appropriate soil conservation practices, e.g. follows the land contours; limited to soil disturbance for site preparation before planting and such disturbance is not repeated in less than twenty years.</p> | <p>a. Both the land features and the conservation practices applicability requirements are met by the Project making this tool applicable to it. The case of the land was previously discussed in this section.</p> <p>b. Litter remain on site and will not be removed. Soil preparation activities after the first cuts will be light tillage, where soil disturbance will be minimal.</p> |

Table 10. Compliance to the applicability conditions prescribed by the others tools applied.

| Tool | Applicability Condition | Compliance |
|--|---|------------|
| <p>Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities (Version 01.0.0)</p> | <p>This tool has no internal applicability conditions</p> | |

| Tool | Applicability Condition | Compliance |
|---|--|------------|
| Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities (Version 01.0.1) | This tool has no internal applicability conditions | |
| Calculation of the number of sample plots for measurements within A/R CDM project activities (Version 02.1.0) | This tool has no internal applicability conditions | |

3.3 Project Boundary

The selected carbon pools and emission sources in the project methodology and the justification or explanation for the inclusion or exclusion of different pools are outlined in the table below.

Table 11. Selected carbon pools for the project

| Source | Gas | Included? | Justification/Explanation | |
|----------|--------------------------------|-----------------|---------------------------|--|
| Baseline | Above and below ground biomass | CO ₂ | Yes | Carbon stock in this pool is expected to increase due to the implementation of the ARR VCS project activity |
| | Soil Organic Carbon | CO ₂ | Yes | Even stock changes in SOC in the baseline are not expected, this carbon pool has been considered because project activity is expected to lead to an increase of SOC stock changes |
| | Dead wood and Litter | CO ₂ | Yes | It is expected that the baseline litter carbon pools will not show a permanent net increase. It is therefore conservative to assume that the sum of the changes in the carbon stocks of dead wood and litter carbon pools is zero in the baseline scenario |
| | Burning of woody biomass | CO ₂ | No | Potential emissions are negligibly small as there is no burning of woody biomass. |

| Source | Gas | Included? | Justification/Explanation | |
|---------|----------------------|-----------------|---------------------------|---|
| Project | Aboveground biomass | CO ₂ | Yes | This is the major carbon pool subjected to project activity. |
| | Belowground biomass | CO ₂ | Yes | Carbon stock in this pool is expected to increase due to the implementation of the project activity |
| | Soil organic carbon | CO ₂ | Yes | Carbon stock in these pools may increase due to implementation of the project activity |
| | Dead wood and Litter | CO ₂ | Yes | Carbon stock in these pools may increase due to implementation of the project activity |

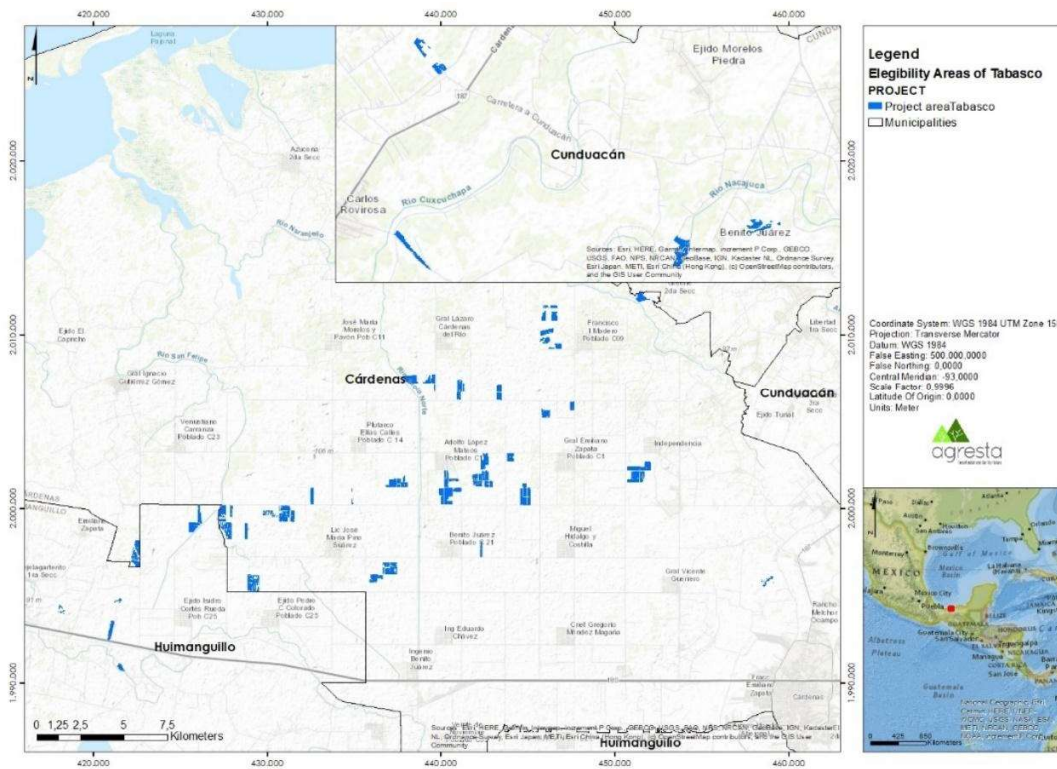


Figure 8. First project activity instance in the state of Tabasco

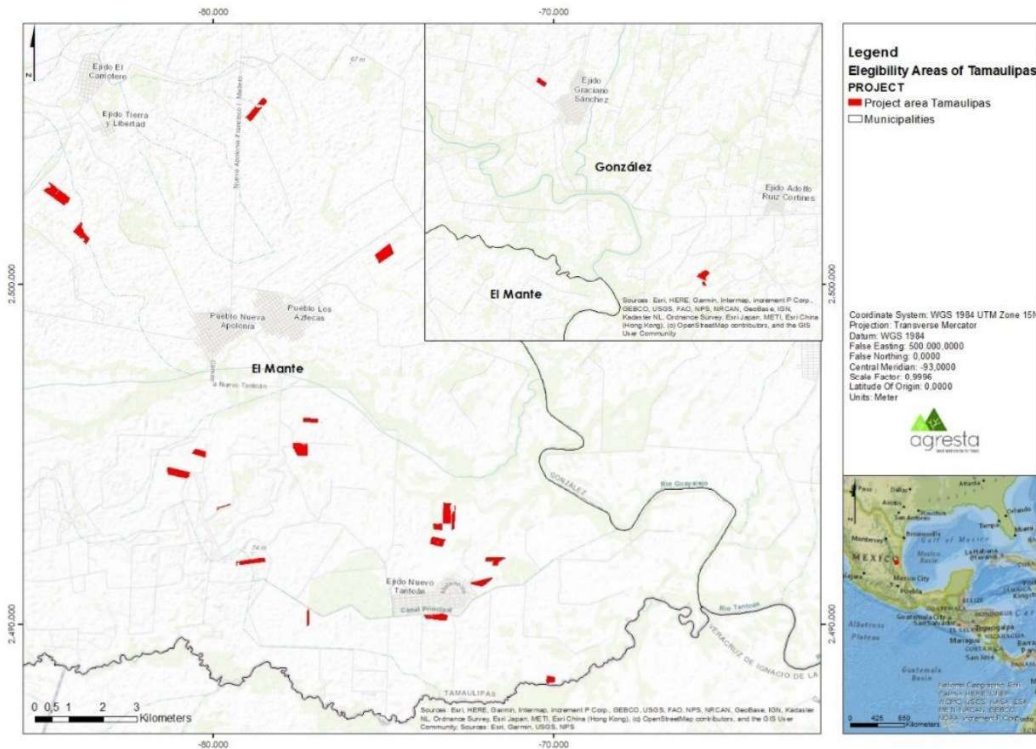


Figure 9. First project activity instance in the state of Tamaulipas.

3.4 Baseline Scenario

The baseline scenario is justified using the “Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, version 01”, as is required in the selected methodology (AR-ACM0003 v02.0).

The following steps were undertaken to establish the baseline and evaluate the additionality of the project.

- Step 0: Preliminary screening based on the starting date of the ARR project activity.
- Step 1. Identification of alternative scenarios.
- Step 2. Barrier analysis.
- Step 3. Investment analysis (not conducted); and
- Step 4. Common practice analysis

STEP 0: Preliminary screening based on the starting date of the ARR project activity

The starting date of the project is January 11, 2017;

The evidence provided to support this starting date is available as supporting documentation.

The evidence that the incentive from the planned sale of credits was seriously considered in the decision to proceed with the project activity is available as supporting documentation and is credited by these two documents:

- The Return on investment model, where it is projected the revenues and costs during the crediting period. In this model, as it can be seen the breakeven point happens in year 17, so the planned sale of CER was seriously considered.
- A document signed by Proxylo in 2016 in which it specifies the income from the VCU is necessary for the project viability. This document was available to third parties.

The minutes signed in 2016 by Proxylo, as well as the financial model and the document “estados auditados 2016” are evidence of the compliance with step 0 criteria.

STEP 1. Identification of alternative scenarios

Sub-step 1a. Identify credible alternative land use scenarios to the proposed project activity.

Scenario 1: Continuation of the pre-project land use. Status Quo is land remaining with agricultural activities (Croplands and Grasslands).

As outlined throughout this document, the baseline scenario at the project boundaries is characterized by agriculture activities in the project land uses: croplands and grasslands. Per tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” (Version 02) 13, agricultural activities refer to crop cultivation activities and grazing activities.

The croplands present in the project area before the project activity consisted primarily of rice and sugar cane. Conversely, grasslands were predominantly utilized for extensive grazing, either through cultivated pastures or by relying on the natural vegetation cover.

PROXYLO has provided documentary evidence for each land property prior to the plantation activity, entailing both land-use categories (croplands and grasslands) and specific agricultural practices, such as crop cultivation and grazing. This assessment utilized high-resolution imagery from the Google Earth platform, analysing spatial images dated March 2017 and February 2019 based on the year of plantation

¹³ United Nations Framework Convention on Climate Change (UNFCCC). (2019). *Tool for estimation of net anthropogenic greenhouse gas removals by sinks* (AR-AM-Tool-15 v2.0). <https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf>

establishment¹⁴. The documentation indicates that, prior to the plantation activity, the entire project area was classified as agricultural, comprising 35% grasslands and 65% croplands.

Table 12. Land Use by Municipality (in hectares):

| Municipalities | Croplands | Grasslands | Total |
|----------------|-----------|------------|---------|
| Tabasco | 592.41 | 422.21 | 1014.82 |
| Tamaulipas | 204.18 | | 204.18 |
| Grand Total | 796.59 | 422.21 | 1218.80 |
| Total (%) | 65% | 35% | |



Figure 10. Land uses and agricultural practices within the Project area. Elaborated by PROXYLO de S.A.P.I.

¹⁴ Please review supporting documentation provided elaborated by the Project Proponent "Conjunto de datos vectoriales de uso del suelo y vegetación escala 1:250 000, SERIE VI (CONJUNTO NACIONAL)" INEGI and supported by field data elaborated by Proxylo

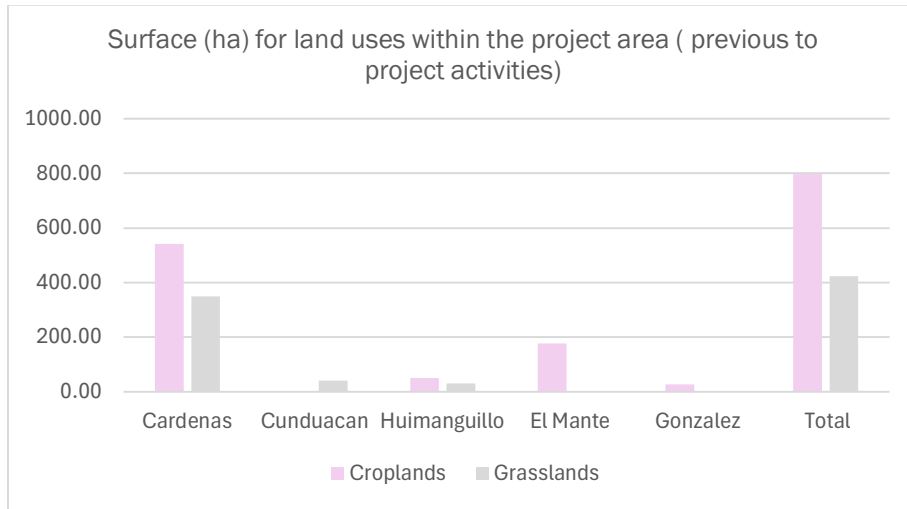


Figure 11. Project area land uses by Proxylo de S.A.P.I:

Additionally, two reports were created by Forliance:

- The Land Use and Land Cover Change report involved an in-depth review of the Dynamic World V1 dataset and Sentinel-2 land cover time series. These datasets were overlaid on PlanetScope¹⁵ imagery to verify that polygons and classifications accurately represented observed satellite data. Figures 15 and 16 illustrate that the surrounding area consists primarily of croplands and grasslands, with recent trends showing an increase in grassland conversion to croplands, creating a baseline scenario that includes both.
- The Land Use Report, provided as supporting documentation, includes a classification provided by INEGI (2009, 2014 and 2017¹⁶) at the national level. INEGI generated these maps through a supervised classification of Landsat images from 2007, 2011 and 2014. Figure 12 presents the areas classified as croplands and grasslands, showing variations over the past decade. The data indicate a trend of increasing cropland areas and a decreasing proportion of grasslands. This demonstrates that the LUS1 project area is agricultural, encompassing both croplands and grasslands.

¹⁵ Planet Team (2017). Planet Application Program Interface: NICFI satellite data program. San Francisco, CA.

¹⁶ Publication year

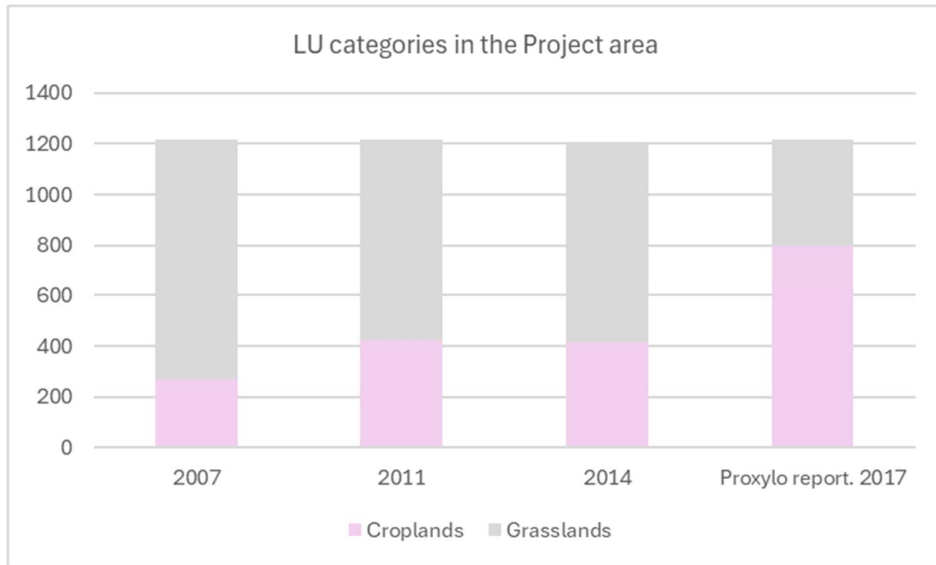


Figure 12. Land use classes in the project area in the period 2007-2017

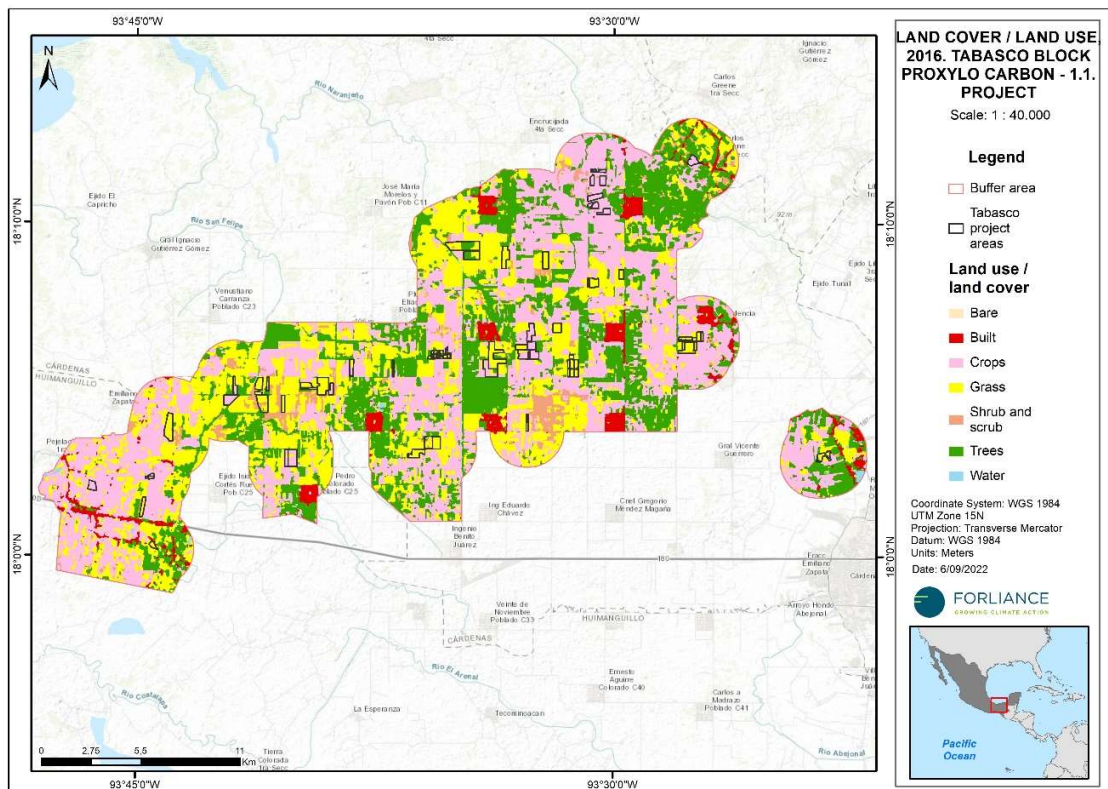


Figure 13. Land use classes 2016.

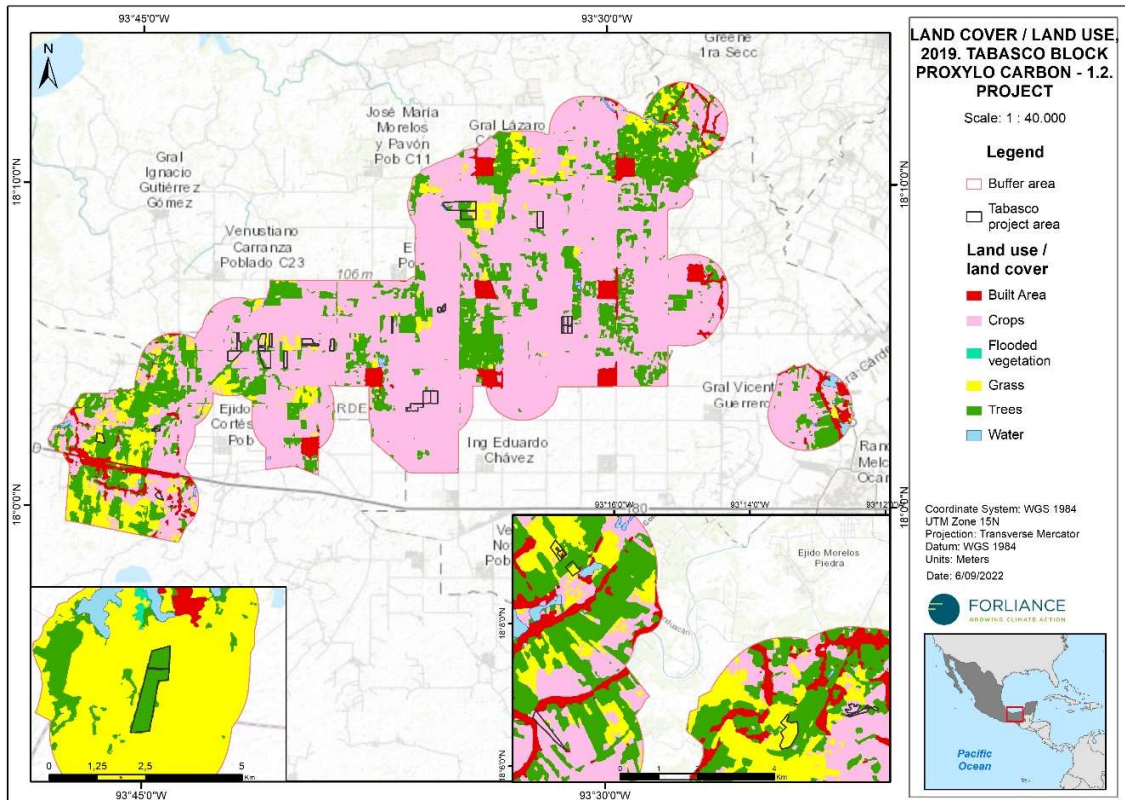


Figure 14. Land use classes. 2019.

Municipalities of Tabasco

In Tabasco, more than half of the land area is suitable for agricultural activities, with most areas relying on machinery and, in a small percentage, animal or manual labour. Irrigated agriculture is concentrated in well-defined areas, where machinery, improved seeds, fertilizers, and pesticides are common.

In 2016, agricultural use accounted for 65.4% of Tabasco’s total land area¹⁷. Tabasco is an important contributor to the international market, especially through the production and export of crops such as plantain, sugar cane, cocoa, pineapple, and citrus. Given its favourable soil and climate conditions, Tabasco holds significant potential for further agricultural development. The state's agricultural economy is heavily reliant on three primary crops: cocoa (32% of the total value of agricultural production), corn (18%), and sugar cane (15%)—which together make up about 65% of the overall agricultural output value.

¹⁷ Ramos-Reyes, F., & Palomeque de la Cruz, M. (2023). Impacto de los programas de reforestación en el uso del suelo en Tabasco. *Revista de Estudios Ambientales*, 12(3), 45-57.

This focus on specific crops underscores the importance of these commodities in shaping the state's economic landscape.

Despite the region's agricultural potential, agricultural and livestock activities in Tabasco contribute only 4.54% to the national agricultural income, suggesting these activities remain primarily subsistence-based rather than strong economic drivers (INEGI, 2007).

According to Lopez et al. (2021)¹⁸ the municipality of Cárdenas in Tabasco has medium to high productive potential for rice cultivation. However, the project area falls outside the zones identified with medium or high productive potential for rice.

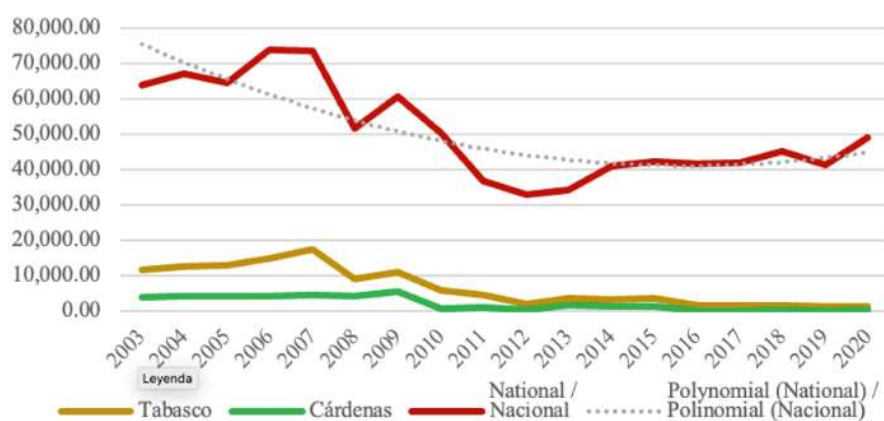


Figure 1. Sown area (ha) with rice in Mexico, in the state of Tabasco and Cárdenas during the period 2003 – 2020 and trend line. Source: Own elaboration with data from the SIAP, SIACON, SADER, database 2003 – 2020.

Figure 15. Sown area with rice in Mexico, Cárdenas (Tabasco), and at the national level.

¹⁸ López, G., Miranda, R., Hernández, A. & Sánchez, E. (2021). Tecnología de potencial productivo de arroz (*Oryza sativa* L.) en el estado de Tabasco, México y su aportación a la soberanía alimentaria. *Revista Chapingo Serie Agricultura Tropical*. 1. 9-23. 10.5154/r.rchsagt.2021.02.02

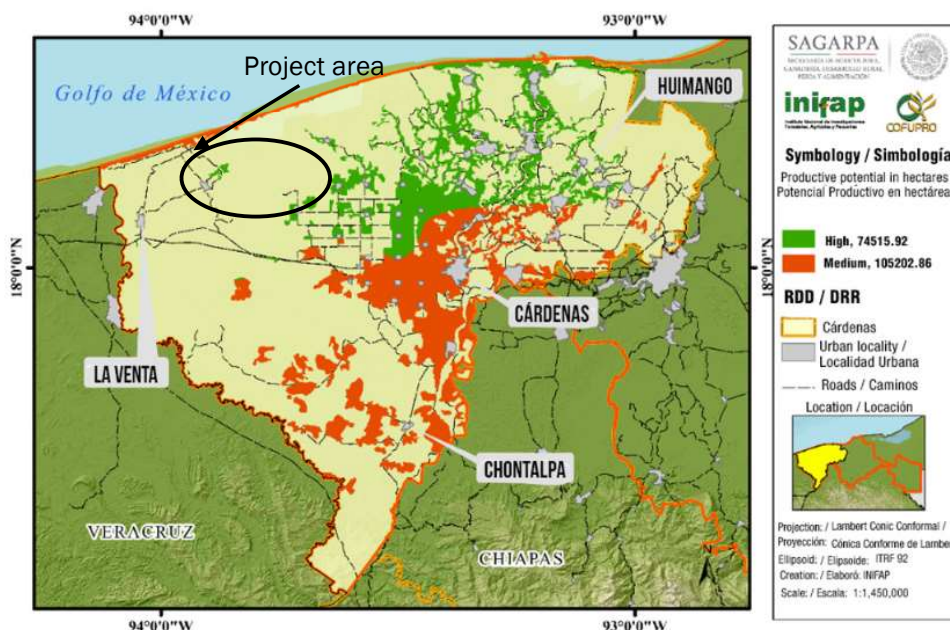


Figure 4. Map of the medium and high productive potential of rice in the Rural Development District, Cárdenas of the state of Tabasco.

Source: Agricultural Technical Agenda. State of Tabasco. 2017. INIFAP.

Figure 16. Map of medium and high productive potential for rice in the Rural Development District

In Mexico, sugar cane production is concentrated in six regions with the Gulf region (Veracruz, Oaxaca, and Tabasco) producing 48.2% of national output, while the Northwest region (Tamaulipas and San Luis Potosí) contributes 12.9% (Herrera et al., 2014)¹⁹. In recent years, sugar cane production has declined due to socioeconomic and technological factors that affect yields. In the project area, land is most commonly used for grasslands or sugar cane fields with limited productivity (see Figure 14 for area conditions before plantation).²⁰

In the 1960s and 1970s, federal policies promoted agricultural development through land-use change initiatives and subsidy programs that shifted lands toward agriculture and livestock without planning for sustainable land management. Due to shifts in national economic policy, by the 1980s, Tabasco's share

¹⁹ Senties-Herrera, C., Trejo-Téllez, L. I., & Sánchez-Herrera, M. (2014). The agro-industrial sugarcane system in Mexico: Current status, challenges, and opportunities. *Journal of Agricultural Science*, 6(4), 26-45. <https://doi.org/10.5539/jas.v6n4p26>

²⁰ Comisión Nacional de Acuacultura y Pesca (CONADESUCA). (2016). *Censo Agrícola 2016: Informe sobre el sector agrícola en México*. Gobierno de México. <https://www.gob.mx/conadesuca>

of the national beef supply had dropped to 25%, and it has not recovered as imported beef remains less costly²¹.

The study *Cambio de uso del suelo y escenarios prospectivos en el Estado de Tabasco* (2023)²² provides a concise analysis of land-use dynamics in Tabasco. Utilizing the Land Change Modeler (LCM), it examines changes from 2001 to 2016 and projects scenarios to 2030 using Markov Chains and Cellular Automata. Over the last two decades, Tabasco has experienced significant land-use changes driven by agricultural and urban expansion, impacting the region's ecosystems.

While secondary vegetation has increased by 106,572 hectares at an annual rate of 1.6%, largely due to forest restoration initiatives such as PRODEFOR, substantial conversions have occurred, with 82,696 hectares shifting from agricultural use to secondary vegetation between 2001 and 2016. Despite these restoration efforts, continued agricultural and urban expansion presents risks to the region's natural ecosystems, particularly affecting wetlands and forests.

The grazing system in Tabasco is a low-intensity system that has remained largely unchanged since the 1940s. As of 2015, there were approximately 1.727 million head of cattle grazing on 1.617 million hectares, with an estimated 43,000 producers. This results in low animal density per hectare and a carrying capacity of just 9 heads per producer. Consequently, rural families often struggle to rely solely on livestock income and typically seek additional sources of income to meet their needs^{23 24}.

Municipalities of Tamaulipas within the project zone

The project area is located in the south of Tamaulipas in the municipalities of El Mante and Gonzalez. In these municipalities, a variety of crops can be found rice, sorghum, corn, safflower, citrus, sugar cane and cotton.

As can be observed in the following figure, the states of Tabasco or Tamaulipas are not declared as strategic municipalities for rice production in Mexico²⁵.

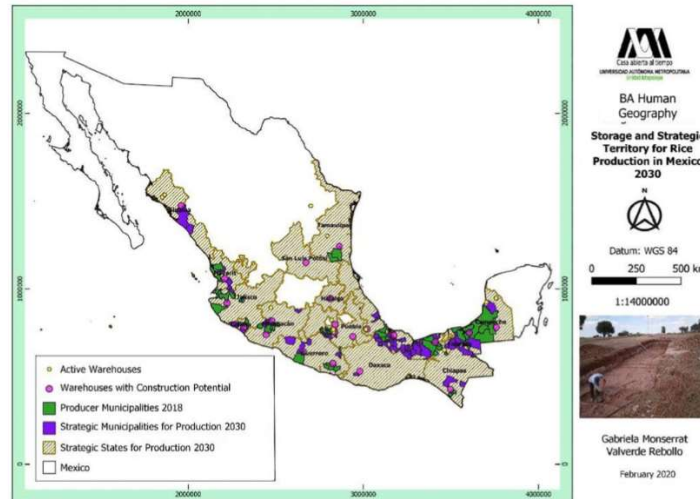
²¹ Manjarrez-Muñoz, F., Pérez-Vázquez, J. L., & Flores-Perales, J. (2007). *The impact of federal policies on land-use change and agricultural development in Mexico: A historical perspective*. *Agroforestry Systems*, 81(2), 271-283. <https://doi.org/10.1007/s10457-007-9096-x>

²² Ramos Reyes, R., & Palomeque de la Cruz, M. Á. (2023). Cambio de uso del suelo y escenarios prospectivos en el Estado de Tabasco (México). *Anales de Geografía de la Universidad Complutense*, 43(1), 1-15. <https://doi.org/10.5209/aguc.85944>

²³ Villanueva-López, G., P. Martínez-Zurimendi y H. Van der Wal. 2015. Árboles y arbustos en áreas ganaderas de Tabasco: un recurso prometedor. *Ecofronteras* 19(54): 14 -17 (2015).

²⁴ Ayantunde, A., J. de Leeuw, M.D. Turner and M. Said. 2011. Challenges of assessing the sustainability of (agro)-pastoral systems, *Livestock Science*, Volume 139, (1-2) 201: 30-43. ISSN 1871-1413. <https://doi.org/10.1016/j.livsci.2011.03.019>

²⁵ Valverde-Rebollo, G. & Morales, J. C. & Valtierra-Pacheco, E. & Escalona-Maurice, M. (2022). Geographical analysis of rice production and storage in Mexico, 1980 – 2018. *Agro Productividad*.



Map 6. Strategic storage for rice production in Mexico (2030 scenario).

Figure 17. Strategic municipalities for rice production in Mexico.

Tamaulipas has a high potential for agricultural expansion. Of the 28,886.76 km² of the sub province, 87% (25,274.64 km²) are suitable for agriculture, while only 5,701.15 km² are used. Agricultural production has been affected by economic, social and environmental aspects such as price declines, droughts, floods and aflatoxin contamination²⁶

In the 1930s, a federal land-clearing program began that resulted in the loss of the original thorny forest vegetation to cotton cultivation areas, which were highly productive and led to the establishment of the first technician irrigation districts²⁷. In the 1970s, cotton was replaced by sorghum and corn, and in the 1990s sugarcane and rice were added.

In the last 20 years, the extreme drought in Tamaulipas, caused water restrictions for irrigation, sown area, accentuated soil degradation problems, due to wind erosion and salinity²⁸. In the project area exists a declining rice production. In these areas, there is a great amount of land available for rice cultivation, however not used.

²⁶ Martínez-Flores, R., & García-Aguirre, L. A. (2003). *Situación actual de los sistemas de producción de grano de maíz en Tamaulipas, México*. Investigación y Ciencia de la Universidad Autónoma de Aguascalientes, 62, 69-75. [https://doi.org/10.1016/S0185-3309\(07\)70014-7](https://doi.org/10.1016/S0185-3309(07)70014-7)

²⁷ Andrade-Limas, J. A., Souza, F. S., & Oliveira, R. M. (2010). Changes in land use in Latin American tropical regions: The case of Mexico. *Journal of Sustainable Agriculture*, 18(3), 123-145. <https://doi.org/10.1080/15487733.2010.10533789>

²⁸ Ortega-Gaucin, D., De la Cruz Bartolón, J., & Castellano Bahena, H. V. (2018). Drought vulnerability indices in Mexico. *Water*, 10(11), 1671. <https://doi.org/10.3390/w10111671>

As a conclusion of LUS1 (Land Use Scenario 1), the credible alternative land use scenario 1 to the proposed project activity is the Continuation of the pre-project land use. Status Quo is land remaining with agricultural activities (Croplands and Grasslands). AS explained in section 5.1 the entire project is characterised as an agricultural area, with 35% being grasslands and 65% being croplands²⁹.

Forest plantations certified under VCS and carried out by PROXYLO seem to be an alternative for them in the project area.

In the following figures, it can be observed the land area previous to the start of the Project activities.



Figure 14. Pictures of the area before the plantation activity. Tamaulipas.

²⁹ The assessment utilized high-resolution imagery from the Google Earth platform, analyzing spatial images dated March 2017 and February 2019 based on the year of plantation establishment



Figure 15. Proxylo project activity in Tabasco (2019). In the adjacent land to treeless areas, presence of weed. Tabasco

Scenario 2: Forest plantations not certified under the VCS

Mexico has fostered the production of commercial forest plantations. The goal is to increase forest land to meet a deficit in the supply of raw forest materials and promoting the development of rural areas in the country³⁰. It is estimated that there are approximately 7 million hectares of land suitable for developing commercial forest plantations. Eighty percent of these land is located in tropical and sub-tropical regions of Mexico. Moreover, it the soil types and climates of these areas have been found suitable for commercial forestry with high rates of yield. In addition, there is an internal market demands for raw forest materials³¹.

In 2015, different states including Tabasco and Tamaulipas were prioritized to establish forest plantations by a previous assessment of the soils which were defined with high potential for forestry. However, forestry is still subordinate to livestock and agriculture due to the young average age of the plantations shows that the industry is still in its primary stages. Moreover, forestry is not considered as a primary activity for economy in rural areas. For instance, wood extraction and industrialization are considered part-time or temporary work in most communities³². In addition, the establishment of forest plantations requires significant investment plus long-term returns, and forestry needs for land

³⁰ The Forest Plantations in Mexico. Electronic Magazine of Forestry Scientific Disclosure. Ministry of Environment and Natural Resources (SEMARNAT), National Forestry Commission (CONAFOR) and Fund CONACYT. Retrieved from http://www.conafor.gob.mx/innovacion_forestal/?p=2350.

³¹ Commercial Forest Plantations. National Forestry Commission (CONAFOR). Retrieved from <http://www.conafor.gob.mx/web/temas-forestales/plantaciones-forestales/>.

³² Achievements and perspectives of forestry development in Mexico 2007-2012. Ministry of Environment and Natural Resources (SEMARNAT) and National Forestry Commission (CONAFOR). Retrieved from <http://www.conafor.gob.mx:8080/biblioteca/ver.aspx?articulo=489>.

management are high in terms of technological requirements for land preparation. Hence, the Forestry sector is still faded by agriculture and livestock.

Nevertheless, there were actions aiming to foster the forestry sector to push the production of this sector. For instance, the National Forestry Program 2013-2018 (PRONAFOR) aimed to increase sustainable production of wood and forest productivity by establishing commercial forest plantations. Proxlyo cannot apply for this subsidies because is out of the typologies of applicants (see information provided in supporting documentation³³).

The trend of establishment of commercial forest plantations is decreasing even though there are incentives established by CONAFOR³⁴. In Tabasco and Tamaulipas, timber harvesting is almost non-existent³⁵.

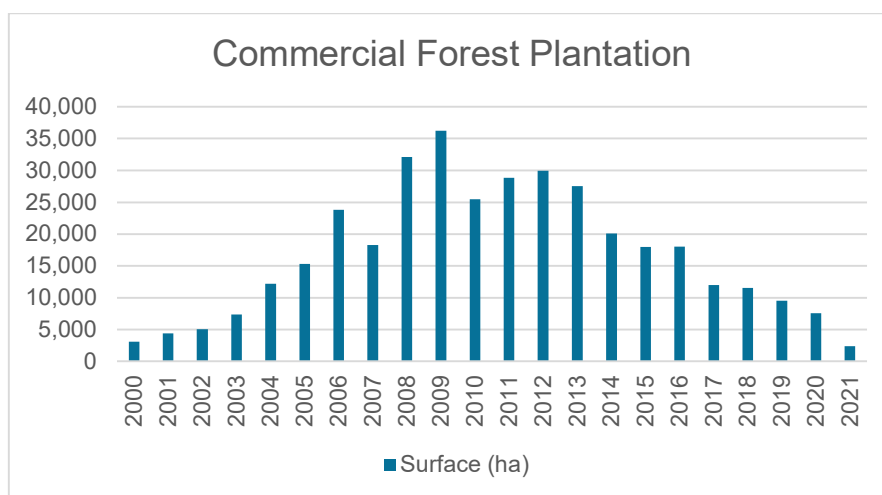


Figure 16. Commercial Forest Plantation nationwide³⁶

³³ Comisión Nacional Forestal (CONAFOR). (n.d.). *Programa de financiamiento a plantaciones forestales comerciales*. Gobierno de México. <https://www.gob.mx/conafor/acciones-y-programas/programa-de-financiamiento-a-plantaciones-forestales-comerciales>

³⁴ Dashboard oficial PFC_Corte 2021 available as supporting documentation.

³⁵ Comisión Nacional Forestal (CONAFOR). (n.d.). *Producción y productividad*. https://snif.cnf.gob.mx/produccion_y_productividad/

³⁶ Comisión Nacional Forestal (CONAFOR). (n.d.). *Producción y productividad*. <https://snif.cnf.gob.mx/datos-abiertos/?tax%5Bwpdmtag%5D=base-de-datos>

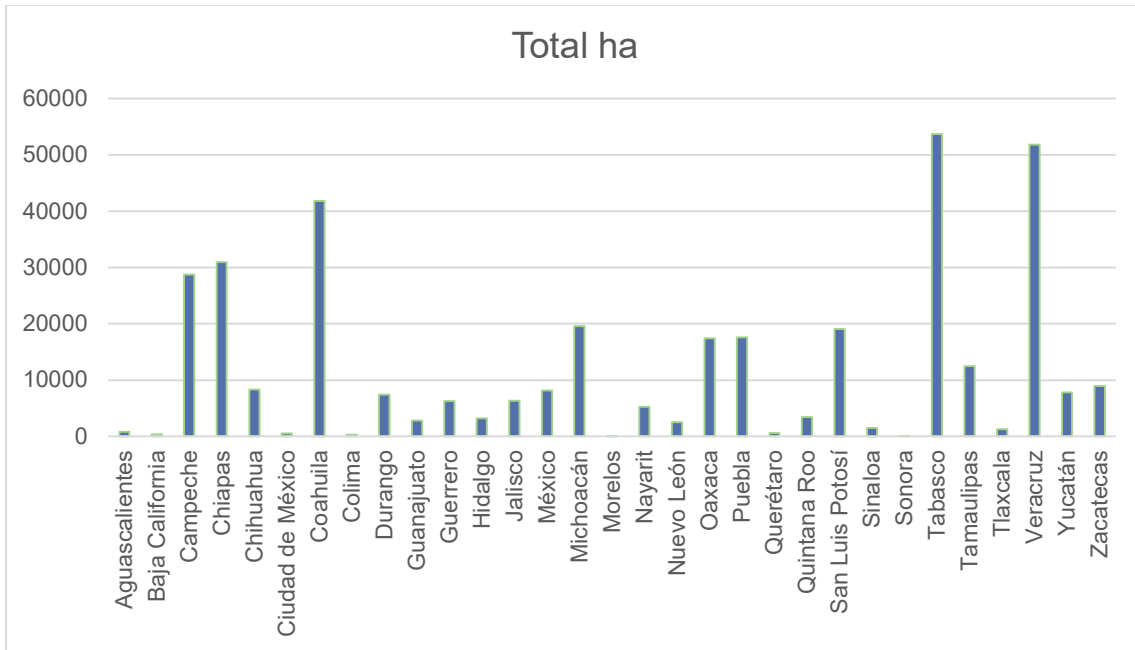


Figure 17. Commercial Forest Plantation in the States of Mexico³⁷

Forest plantations certified under VCS and carried out by Proxylo seem to be an alternative for forest plantations not certified in the project area.

Outcome sub-step 1a: List of credible alternative land use scenarios that would have occurred on the land within the project boundary of the A/R project activity.

The alternative baseline scenario outcomes for the project, that are credible to occur in the project boundary are:

- Scenario 1: Continuation of the pre-project land use. Status Quo is land remaining with agricultural activities (Croplands and Grasslands).
- Scenario 2: Forest plantations not certified under the VCS

Sub-step 1b. Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations.

The land use scenarios resulting from sub-step 1a apply and are governed by national and State policies focused on promoting the development of these activities. . Hence, all the scenarios considered under

³⁷ Comisión Nacional Forestal. (2022). *Superficies de Plantaciones Forestales Comerciales establecidas con apoyos de la CONAFOR periodo 2010-2021*. Gerencia de Plantaciones Forestales Comerciales, CONAFOR. <https://snif.cnf.gob.mx/datos-abiertos/?tax%5Bwpdmtag%5D=base-de-datos>

the analysis of the previous step are plausible to occur in the project area. There is no specific regulation for the states of Tabasco and Tamaulipas. Mandatory laws and regulation are applicable nationwide.

Moreover, Article 27 of the Political Constitution of the United Mexican States establishes the right to regulate the use of natural elements susceptible to appropriation to the government, who will also dictate the necessary measures to establish adequate provisions, uses, reserves and destinations of lands, waters and forests for the promotion of agriculture, livestock, forestry and other economic activities in rural areas³⁸. In addition, in 2020 the Agreement was released announcing the rules of operation of the program for the promotion of agriculture, livestock, fishing and aquaculture for fiscal year 2021, which aims to contribute to food self-sufficiency and security by increasing the productivity of agriculture, livestock, fisheries and aquaculture, through sustainable practices, the development of regional value chains and generating the conditions of equality necessary for territorial development with inclusion and social justice³⁹.

In 1995, the 1995-2000 Forestry and Soil Sector Program was announced, which included a package of direct incentives for carrying out studies, technical assistance and a credit scheme with the incorporation of development and commercial banks. Among the former initiatives were the following:

- 1) Forestry Development Program (PRODEFOR), aimed at carrying out management studies, technical assistance and general attention to commercial areas without infrastructure.
- 2) National Reforestation Program (PRONARE), aimed at the recovery of areas through reconversion, subsidizing the plant and some concepts, such as transportation, hole digging and fencing.
- 3) Forest Plantation Development Program (Programa de Desarrollo Forestal - PRODEFOR), aimed at the recovery of areas through reconversion, subsidizing the plant and some concepts, such as transportation, hole digging and fencing.
- 4) The Commercial Forest Plantation Development Program (PRODEPLAN), aimed at stimulating the establishment of plantations for commercial purposes, through direct subsidies, fiscal incentives and special support for the construction of infrastructure such as roads and paths (Castillo, 1999). In 1997,
- 5) the Sustainable Forest Conservation and Management Program (PROCYMAF) came into effect with the objective of supporting sustainable forest management strategies among different types of producers. Finally, in October 2003, the Payment for Environmental Services Program came into effect with the objective of encouraging the development of a market for environmental water services.

³⁸ National Secretariat of the Interior. (2014). *Political Constitution of the United Mexican States*. Retrieved from http://www.dof.gob.mx/constitucion/marzo_2014_constitucion.pdf

³⁹ Secretaría de Agricultura y Desarrollo Rural. (2021). *Acuerdo por el que se dan a conocer las reglas de operación del programa de fomento a la agricultura, ganadería, pesca y acuicultura para el ejercicio 2021*. Diario Oficial de la Federación

Outcome of Sub-step 1b: List of plausible alternative land use scenarios to the ARR project activity that are in compliance with mandatory legislation and regulations taking into account their enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

The two scenarios comply with the existing legislation and regulations in the country and the region and are enforced by those. Therefore, the list is:

- Scenario 1: Continuation of pre-project land use. Status Quo is land remaining with agricultural activities (croplands and grasslands)
- Scenario 2: Forest plantations not certified under the VCS

The project continues with these 2 scenarios to step 2.

STEP 2. Barrier analysis

Sub-step 2a. Identification of barriers that would prevent the implementation of at least one alternative land use scenario.

Continuation of the pre-project land use. Status Quo is land remaining with agricultural activities (Croplands and Grasslands).

There is a deficit in qualified and properly trained labor for agricultural activities in the project area. Slash and burn is the most common form of agriculture. Under this system, the soil's fertility and productivity are reduced, making assistance necessary for its recovery.

There are some specific crops, as Armida-Alcudia et al., 2011 described socioeconomic and technological factors that affect the implementation of sugarcane crops in Chontalpa, Tabasco. Regarding rice cultivation, in general terms, agricultural with high production faces different barriers: technological, as it has been mentioned, the deterioration of genetic and natural resources and the effect of global climate change⁴⁰.

Several factors limit the development of cattle raising in the project states. Among the first are the traditionalism of production schemes, low livestock potential, scarce adoption of technology, lack of knowledge of production and profitability of the registration system. Despite the region's agricultural potential, agricultural activities in Tabasco contribute only 4.54% to the national agricultural income, suggesting these activities remain primarily subsistence-based rather than strong economic drivers (INEGI, 2007).

⁴⁰ Torres Rojo, J. M. (2004). Estudio de tendencias y perspectivas del sector forestal en América Latina al año 2020: Informe Nacional, México. FAO. <https://www.fao.org/3/j2215s/j2215s04.htm>

According to the above mentioned the defined scenario land remaining with the current agricultural activities (Croplands and Grasslands) does not seem to present barriers.

Forest plantations not certified under the VCS.

Investments in forest plantations (without carbon credit sales) are generally considered unattractive due to the long investment period required and subsequent payback periods for most investors (approximately 15-25 years), even at despite financial tax incentives provided by the government. Investors and banks are usually unwilling to invest that long before seeing positive cash flows.

Economic investments are relevant to scale existing plantations in the region, improve access and energy conditions, and provide the tools required to monitor and avoid management operations that lead to soil compaction and erosion. Funding is also necessary to control personnel in the forestry area. The adequate management of silvopastoral activities that are in line with good quality plantations must be guaranteed.

Activities in forest plantations require specialized knowledge of handling machinery, calculations and inventories, and chemical use, among other skills that the traditionally local livestock population lacks. For this reason, technical training and the transfer of knowledge are necessary to make adequate use of the land and guarantee the production and good management of the plantations.

The National Forestry Commission (CONAFOR), a decentralized agency in charge of forestry production and promotion activities, owns a program to incentivise the Commercial Forest Plantation. Despite the increase in support to the sector, there is still an enormous backlog, especially in those areas that do not have any sustained productive alternative. Most of the support is distributed among traditional clients (timber producers), while those far from population centres and without timber harvesting generally continue without support⁴¹.

Outcome of Step 2a: List of barriers that may prevent one or more land use scenarios identified in the Step 1b

Among the most common barriers are:

- Similar activities have only been implemented with grants or other non-commercial finance terms. In this context, similar activities are defined as activities of a similar scale that take place in a comparable environment concerning regulatory framework and are undertaken in the relevant geographical area (investment barrier)
- Lack of access to necessary materials, for example, planting materials (technological barrier)

⁴¹ Torres Rojo, J. M. (2004). *Estudio de tendencias y perspectivas del sector forestal en América Latina al año 2020: Informe Nacional, México*. FAO. <https://www.fao.org/3/i2215s/i2215s04.htm>

- Lack of infrastructure for implementation of the technology (technological barrier)
- Traditional knowledge or lack thereof, laws and customs, market conditions and practices (local tradition barriers)
- Degraded soil (e.g. water/wind erosion, salination, etc.) (local ecological conditions barrier)
- Barriers due to social conditions, inter alia: Lack of skilled and/or properly trained labour force and lack of organisation of local communities.

Land-use change in Tabasco and Tamaulipas from 2001 to 2030 is characterized by a persistent trend of agricultural and urban expansion at the expense of natural ecosystems, particularly wetlands and forests. While restoration programs have contributed to the growth of secondary vegetation, it is crucial to implement more effective measures for the conservation and sustainable management of the state's natural resources. Without such measures, there is a risk of losing the valuable ecosystem services these environments provide.

Sub-Step 2b. Elimination of land use scenarios that are prevented by the identified barriers.

The barriers identified would prevent the implementation of scenario 2, which is limited by economic, technical, climatic, and institutional barriers. This means that the limited scenario is:

- Reforestation without registration under VCS standard

Outcome of Sub-step 2b: List of land use scenarios that are not prevented by any barrier.

As a result, the scenarios that are not prevented by any barrier is:

- **Scenario 1 Continuation of the pre-project land use. Status Quo is land remaining with agricultural activities (Croplands and Grasslands).**

In the absence of the project activity, the baseline is expected to remain as agricultural activities that include crop cultivation and grazing activities in croplands and grasslands.

Sub-Step 2c. Determination of the baseline scenario (if allowed by the barrier analysis)

The most likely scenario in the absence of the project will be the continuation of agricultural activities in croplands and grasslands that include crop cultivation and grazing activities. This scenario is the simplest and cheapest way to take advantage of the land, not only for the population in nearby communities but also for migrants from other regions of the country.

As the forestation scenario without VCS is not feasible by step 2b, and the list has 1 scenario, the analysis continues with Step 4: Common practice test.

STEP 3. Investment analysis (if necessary)

According to the methodology, this step will not be performed.

STEP 4. Common practice analysis

Establishing and managing forest plantations is not a common practice in the expansion area of the grouped project. Commercial reforestation in Mexico is a sector with high economic potential not exploited in the country. Although the development of commercial forest plantations has been identified as a priority economic activity in the country, different barriers hinder its implementation in the project area. Of these, the most significant barriers are financing, technological management and the participation of state entities. Additionally, up until now, established forestry plantations have had a strong dependence on i) technological packages of the species and ii) community knowledge of the timber species, when introducing new technologies, skilled staff is required, so the local population must be trained. This represents an important difference in traditional livestock areas whose activities do not require specialization; therefore, they do not provide great development opportunities for workers.

In Tamaulipas Commercial Forest Plantations (CFP) are almost non-existent and in Tabasco, even though there are some CFP, there are no other similar forest activities to the one proposed ARR project activity implemented previously or are currently underway. Documentary evidence has been included in this section in sub-step1a.

The proposed project activities aim to change the land use from agricultural activities to activities with a less negative impact on the land. This will allow for the recovery of the natural environment and connectivity between forest cover. The financial income from carbon sequestration will help the Project Proponent tackle the barriers presented and continue with the activities of the plantation

In this way, sustainable alternatives for consumption and economic growth are provided in areas where its inhabitants would not have alternatives for employment or developing complementary economic activities if this project did not exist.

Therefore, the activity proposed by the project is not the baseline scenario and hence it is additional.

3.5 Additionality

The combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (Version 01) was used. See section 3.4 for more details.

3.6 Methodology Deviations

The project and project monitoring plan meet all the requirements of the applied methodology and does not deviate from the baseline scenario, additionality determination, or inclusion of project GHG sources, sinks and reservoirs.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

The plantation and restoration campaigns started in January 2017. As detailed in section 1.3 the eligible area is 1,219.01 ha. The project activities are implemented as described in the PD, which has been prepared after project start. Both the monitoring report and the Non-Permanence Risk assessment report have also been prepared simultaneously with the PD, assuring congruence among the different documents.

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline net GHG removals by sinks are estimated using the equation 1 in section 5.4 of the methodology AR ACM0003 (Version 02.0)⁴²:

$$\Delta C_{BSL,t} = \Delta C_{TREE_BSL,t} + \Delta C_{SHRUB_BSL,t} + \Delta C_{DW_BSL,t} + \Delta C_{LI_BSL,t}$$

Where:

| | |
|---------------------------|--|
| $\Delta C_{BSL,t}$ | = Baseline net GHG removals by sinks in year t ; t CO ₂ -e |
| $\Delta C_{TREE_BSL,t}$ | = Change in carbon stock in baseline tree biomass within the project boundary in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO ₂ -e |
| $\Delta C_{SHRUB_BSL,t}$ | = Change in carbon stock in baseline shrub biomass within the project boundary, in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO ₂ -e |

⁴² CDM A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/RCDM project activities. . [CDM: Afforestation and reforestation of lands except wetlands --- Version 2.0 \(unfccc.int\)](#)

| | |
|------------------------|--|
| $\Delta C_{DW_BSL,t}$ | = Change in carbon stock in baseline dead wood biomass within the project boundary, in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO ₂ -e |
| $\Delta C_{LI_BSL,t}$ | = Change in carbon stock in baseline litter biomass within the project boundary, in year t , as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO ₂ -e |

As confirmed in section 3.4 of this document the most likely baseline scenario is agricultural activities that include crop cultivation in croplands and grazing activities in grasslands.

Many of the planting sites were bare ground with very few and scattered trees and shrubs not corresponding to the definition of forest in Mexico, i.e., minimum area 1 ha, minimum canopy cover 30% and minimum tree height 4m. Pre-existing trees and shrubs at these locations in the project area were removed prior to the start of planting.

Pre-existing tree cover was estimated by on-site visual assessment in each of the planting plots by the PROXYLO team. In addition, the average shrub crown cover was assessed by visual interpretation using Collect Earth Online (CEO), which is an open source, customized satellite imagery interpretation system developed by the SERVIR network, NASA, FAO and USAID, in partnership with regional technical organizations around the world, as a tool for use in projects requiring land use and land cover information. The next steps were followed:

- A total of 100 sample units were allocated over the entire project area. The spatial sampling unit for each sample point is defined as a plot of 50 x 50 m (0.25 ha), with an internal grid of 25 points. Each point weights 4%.





Figure 18. Cluster point identification method for baseline estimation

- Land cover (shrubland or bare ground) was visually analysed for each point in Google Earth for the year previous to plantation.

From these visual assessments, it can be confirmed that crown cover of trees at the time of plantation was 3.70% and shrub crown cover was 24.32%.

It is expected that the baseline dead wood and litter carbon pools will not show a permanent net increase. It is therefore conservative to assume that the sum of the changes in the carbon stocks of dead wood and litter carbon pools is zero in the baseline scenario.

Changes in the carbon stocks in the living biomass – ($C_{TREE_BSL,t} + C_{SHRUB_BSL,t}$)

All trees and shrubs in the project area were removed at the beginning of the cropping period. Thus, baseline emissions from trees and shrubs are estimated following the ⁴³A/R Methodological Tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (Version 04.2). For the calculations baseline carbon stocks the following equations are used:

Baseline carbon stocks in shrubs are calculated following the equation of the AR-TOOL14 “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities” (Version 4.2).

The pre-existing tree carbon stock is calculated using equations 20 and 21 from the AR-Tool14:

⁴³ CDM A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/RCDM project activities. . CDM: [Afforestation and reforestation of lands except wetlands --- Version 2.0 \(unfccc.int\)](#)

$$C_{TREE_{BSL}} = \sum_{i=1}^M C_{TREE_{BSL},i}$$

$$C_{TREE_{BSL},i} = \frac{44}{12} \times CF_{TREE} \times b_{FOREST} \times (1 + R_{TREE_{BSL}}) \times CC_{TREE_{BSL},i} \times A_{BSL,i}$$

Where:

| | | |
|---------------------|---|---|
| $C_{TREE_{BSL}}$ | = | Carbon stock in pre-project tree biomass; t CO2-e |
| $C_{TREE_{BSL},i}$ | = | Carbon stock in pre-project tree biomass in stratum i ; t CO2-e |
| CF_{TREE} | = | Carbon fraction of tree biomass; t C (t.d.m.) ⁻¹ A default value of 0.47 t C (t.d.m.) ⁻¹ is used. |
| b_{FOREST} | = | Default above-ground biomass content in forest in the region/country where the A/R CDM project activity is located; t d.m. ha ⁻¹ Values from Table 3A.1.4 of IPCC GPG-LULUCF 2003 are used unless transparent and verifiable information can be provided to justify different values. |
| $R_{TREE_{BSL}}$ | = | Root-shoot ratio for trees in the baseline; dimensionless. A default value of 0.25 is used unless transparent and verifiable information can be provided to justify a different value. |
| $CC_{TREE_{BSL},i}$ | = | Crown cover of trees in baseline stratum i , at the start of the A/R CDM project activity, expressed as a fraction (e.g., 10 per cent crown cover implies $CC_{TREE_{BSL},i} = 0.10$); dimensionless |
| $A_{BSL,i}$ | = | Area of baseline stratum i , delineated on the basis of tree crown cover at the start of the A/R CDM project activity; ha |

Shrub carbon stock is calculated using equation 26 of AR-TOOL 14:

$$C_{SHRUB,t} = \frac{44}{12} \times CF_S \times (1 + R_S) \times \sum_i A_{SHRUB,i} \times b_{SHRUB,i}$$

$$b_{SHRUB,i} = BDR_{SF} \times b_{forest} \times CC_{SHRUB,i}$$

Where:

| | | |
|----------------|---|--|
| $C_{SHRUB,t}$ | = | Carbon stock in shrubs within the project boundary at a given point of time in year t ; t CO ₂ -e |
| CF_S | = | Carbon fraction of shrub biomass; t C (t.d.m.) ⁻¹ A default value of 0.47 t C (t.d.m.) ⁻¹ is used. |
| R_S | = | Root-shoot ratio for shrubs; dimensionless. The default value of 0.40 is used unless transparent and verifiable information can be provided to justify a different value. |
| $A_{SHRUB,i}$ | = | Area of shrub biomass estimation stratum i ; ha |
| $b_{SHRUB,i}$ | = | Shrub biomass per hectare in shrub biomass estimation stratum i ; t d.m. ha ⁻¹ |
| BDR_{SF} | = | Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e., 100 per cent) and the default above-ground biomass content per hectare in forest in the region/country where the A/R CDM project activity is located; dimensionless. A default value of 0.10 should be used unless transparent and verifiable information can be provided to justify a different value. |
| b_{FOREST} | = | Default above-ground biomass content in forest in the region/country where the A/R CDM project activity is located; t d.m. ha ⁻¹ . Values from Table 3A.1.4 of IPCC GPG-LULUCF 2003 are used unless transparent and verifiable information can be provided to justify different values. |
| $CC_{SHRUB,i}$ | = | Crown cover of shrubs in shrub biomass estimation stratum i at the time of estimation, expressed as a fraction (e.g. 10 per cent crown cover implies= 0.10); dimensionless |

According to section 5 of the AR-TOOL 14, changes in carbon stocks in trees and shrubs in the baseline may be accounted as zero since, as described in section 3.4 of this PD, slash and burn is a common practice within the project area. Thus, the land is subjected to periodic cycles and the biomass oscillates between a minimum and a maximum value in the baseline. Moreover, the project area is degraded due to poor agricultural practices.

Changes in the carbon stocks in baseline dead wood biomass ($\Delta C_{DW_BSL,t}$, $\Delta C_{LI_BSL,t}$)

The conservative default factors in equations 9 and 15 of AR-TOOL 12 is used to estimate carbon stocks in dead wood and litter biomass in the baseline:

$$C_{DW_BSL,t} = C_{TREE_BSL,t} \times DF_{DW}$$

Where:

- $C_{DW_BSL,t}$ = Carbon stock in dead wood at a given point of time in year t ; t CO₂-e
- $C_{TREE_BSL,t}$ = Carbon stock in trees biomass in stratum i at a point of time in year t , as calculated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO₂-e
- DF_{DW} = Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass; per cent.

$$C_{LI_BSL,t} = C_{TREE_BSL,t} \times DF_{LI}$$

Where:

- $C_{LI_BSL,t}$ = Carbon stock in litter at a given point of time in year t ; t CO₂-e
- $C_{TREE_BSL,t}$ = Carbon stock in trees biomass in stratum i at a point of time in year t , as calculated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO₂-e
- DF_{LI} = Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass; per cent.

Table 13. Conservative default values used to estimate carbon stocks in the baseline in dead wood and litter biomass.

| Temperature / Moisture Regime | Parameter | Value | Unit | Source |
|-------------------------------|-----------|-------|------|---------------------|
| Tropical moist | DF_{Dw} | 6 | % | AR-TOOL 12. Table 5 |
| | DF_{LI} | 1 | % | AR-TOOL 12. Table 6 |
| Tropical dry | DF_{Dw} | 2 | % | AR-TOOL 12. Table 5 |
| | DF_{LI} | 4 | % | AR-TOOL 12. Table 6 |

It is expected that the baseline dead wood and litter carbon pools will not show a permanent net increase. It is therefore conservative to assume that the sum of the changes in the carbon stocks of dead wood and litter carbon pools is zero in the baseline scenario.

Total carbon stocks in the baseline

The total carbon stocks in the baseline are summarized below:

Table 14. Baseline emissions.

| Project year | Planted area | Baseline C_{TREE} carbon stock | Baseline C_{SHRUB} carbon stock | Baseline C_{DW} carbon stock | Baseline C_{LI} carbon stock | Cumulative carbon stock change | Annual carbon stock change |
|------------------------------------|--------------|----------------------------------|-----------------------------------|--------------------------------|--------------------------------|--------------------------------|----------------------------|
| | | tCO2 | tCO2 | tCO2 | tCO2 | | |
| 11/01/2017–10/01/2018 | 314.42 | 1,124 | 24 | 68 | 12 | 1,226 | 221 |
| 11/01/2018-10/01/2019 | 264.42 | 1,069 | 34 | 65 | 11 | 1,178 | 213 |
| 11/01/2019-10/01/2020 | 196.83 | 1,408 | 40 | 85 | 15 | 1,546 | 279 |
| 11/01/2020-10/01/2021 | 41.36 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11/01/2021-10/01/2022 (Tabasco) | 197.79 | 2,720 | 0 | 164 | 28 | 2,910 | 525 |
| 11/01/2021-10/01/2022 (Tamaulipas) | 204.18 | 86 | 0 | 2 | 4 | 91 | 17 |

5.2 Project Emissions

The actual net GHG removals by sinks are estimated using the equations in section 5.5 of the methodology AR ACM0003 (Version 02.0).

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t}$$

Where:

| | | |
|-----------------------|---|--|
| $\Delta C_{ACTUAL,t}$ | = | Annual actual net greenhouse gas removals by sinks at time t; t CO ₂ -e yr-1 |
| $\Delta C_{P,t}$ | = | Change in carbon stocks in project, occurring in the selected carbon pools, at time t; t CO ₂ -e yr-1 |
| $GHG_{E,t}$ | = | Increase of non-CO ₂ GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year t, t CO ₂ -e |

Change in the carbon stocks in project, occurring in the selected carbon pools in year t shall be calculated as follows:

$$\Delta C_{P,t} = \Delta C_{TREE_PROJ,t} + \Delta C_{SHRUB_PROJ,t} + \Delta C_{DW_PROJ,t} + \Delta C_{LI_PROJ,t} + \Delta SOC_{AL,t}$$

Where:

| | | |
|----------------------------|---|---|
| $\Delta C_{P,t}$ | = | Change in carbon stocks in project, occurring in the selected carbon pools, at time t; t CO ₂ -e |
| $\Delta C_{TREE_PROJ,t}$ | = | Change in carbon stock in tree biomass in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO ₂ -e |
| $\Delta C_{SHRUB_PROJ,t}$ | = | Change in carbon stock in shrub biomass in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities”; t CO ₂ -e |
| $\Delta C_{DW_PROJ,t}$ | = | Change in carbon stock in dead wood in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO ₂ -e |
| $\Delta C_{LI_PROJ,t}$ | = | Change in carbon stock in litter in project in year t, as estimated in the tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities”; t CO ₂ -e |
| $\Delta SOC_{AL_PROJ,t}$ | = | Change in carbon stock in SOC in project, in year t, in areas of land meeting the applicability conditions of the tool “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities”, as estimated in the same tool; t CO ₂ -e |

Change in carbon stock in tree biomass - $\Delta C_{TREE_PROJ,t}$

The change in carbon stock in tree biomass in this grouped project is estimated following section 8.2 of AR-TOOL 14 (*Estimation by modelling of tree growth and stand development*). The ex-ante estimation of carbon stock changes is based on an average growth assumption (MAI). The ex-ante growth model, available as supporting documentation, was developed based on the following specific conditions:

$C_{TREE,t,i}$ is calculated following equations:

$$C_{TREE_PROJ,t} = \sum_{i=1}^M C_{TREE_PROJ,t,i}$$

where:

$C_{TREE_PROJ,t}$ = Carbon stock in the project trees in year t ; t d.m. ha⁻¹

$C_{TREE_PROJ,t,i}$ = Carbon stock in the project trees in stratum i in year t ; t d.m. ha⁻¹

$$C_{TREE_PROJ,t,i} = \frac{44}{12} \times b_{TREE,t,i} \times CF_{TREE} \times A_i$$

where:

$C_{TREE_PROJ,t,i}$ = Carbon stock in the project trees in stratum i in year t ; t d.m. ha⁻¹

$b_{TREE,t,i}$ = Tree above ground biomass in stratum i in year t ; t d.m. ha⁻¹

CF_{TREE} = Carbon fraction of tree biomass; t C (t.d.m.)⁻¹.

A default value of 0.47 t C (t.d.m.)⁻¹ is used.

A_i = Area of stratum i , of the A/R CDM project activity; ha.

$b_{TREE,t,i}$ is calculated following this equation:

$$b_{TREE,t,i} = AGB_{TREE,t,i} \times (1 + R_{TREE})$$

where:

$b_{TREE,t,i}$ = Tree above ground biomass in stratum i in year t ; t d.m. ha⁻¹

$AGB_{TREE,t,i}$ = Aboveground tree biomass in in stratum i in year t ; t d.m. ha⁻¹

R_{TREE} = Root-shoot ratio for tree species j ; dimensionless. The value of R_j is estimated as ($R_j = e^{(-1.085 + 0.9256 \cdot \ln b) / b}$) where b is the above-ground tree biomass per hectare (in t d.m. ha⁻¹), unless transparent and verifiable information can be provided to justify a different value

$AGB_{TREE,t,i}$ is calculated using the next equation:

$$AGB_{TREE,t,i} = AGB_{MAI,i} \times PA$$

where:

$AGB_{MAI,i}$ = Aboveground tree biomass mean annual increment in stratum i ; t d.m. ha⁻¹

PA = Plantation age of stratum i , in years

$AGB_{MAI,i}$ is calculated as follow:

$$AGB_{MAI,i} = V_{MAI,i} \times D_j \times BEF_{2,j}$$

where:

$AGB_{MAI,i}$ = Mean annual increment in aboveground tree biomass in stratum i ; t d.m. ha⁻¹

D_j = Density (over-bark) of tree species j ; t d.m. m⁻³

A value of 0.370 from *Balcorta y Vargas 2004* is used.

$V_{MAI,i}$ = Mean Annual Increase in volume of tree species j ; m³ ha⁻¹

A value of 25.7 from *Martinez Zurimendi, 2015* is used⁴⁴. This value was derived from site index-calibrated yield curves for *Gmelina arborea* plantations with a 7-year rotation time. The estimation approach is described in detail in the Annex.

$BEF_{2,j}$ = Biomass expansion factor for conversion of tree stem biomass to above-ground tree biomass, for tree species j ; dimensionless.

A value of 1.21 from *Fonseca-González et al. 2021*.

Table 15. Mean carbon stock in project trees per hectare in the different years of the crediting period.

⁴⁴ Martínez-Zurimendi, P., Juárez-García, A., Domínguez-Domínguez, M., López-López, L. M., de-la-Cruz-Arias, V., & Álvarez-Martínez, J. (2015). ÍNDICE DE SITIO Y PRODUCCIÓN MADERABLE EN PLANTACIONES FORESTALES DE *Gmelina arborea* EN TABASCO, MÉXICO. *Rev. Fitotec. Mex.*, 38(4), 415–425.

| Age of plantation | $C_{TREE, t}$ | $\Delta C_{TREE, t}$ |
|-------------------|------------------------|-----------------------|
| Years | tCO ₂ e /ha | tCO ₂ e/ha |
| 0 | 0 | |
| 1 | 12.51 | 12.51 |
| 2 | 37.52 | 25.01 |
| 3 | 62.53 | 25.01 |
| 4 | 87.54 | 25.01 |
| 5 | 112.55 | 25.01 |
| 6 | 137.57 | 25.01 |
| 7 | 0.00 | -137.57 |
| 8 | 12.51 | 12.51 |
| 9 | 37.52 | 25.01 |
| 10 | 62.53 | 25.01 |
| 11 | 87.54 | 25.01 |
| 12 | 112.55 | 25.01 |
| 13 | 137.57 | 25.01 |
| 14 | 0.00 | -137.57 |
| 15 | 12.51 | 12.51 |
| 16 | 37.52 | 25.01 |
| 17 | 62.53 | 25.01 |
| 18 | 87.54 | 25.01 |
| 19 | 112.55 | 25.01 |
| 20 | 137.57 | 25.01 |

| Age of plantation | $C_{TREE, t}$ | $\Delta C_{TREE, t}$ |
|-------------------|------------------------|-----------------------|
| Years | tCO ₂ e /ha | tCO ₂ e/ha |
| 21 | 0.00 | -137.57 |
| 22 | 12.51 | 12.51 |
| 23 | 37.52 | 25.01 |
| 24 | 62.53 | 25.01 |
| 25 | 87.54 | 25.01 |
| 26 | 112.55 | 25.01 |
| 27 | 137.57 | 25.01 |
| 28 | 0.00 | -137.57 |
| 29 | 12.51 | 12.51 |
| 30 | 37.52 | 25.01 |

For the first project activity instance $\Delta C_{TREE_PROJ, t}$ is calculated based on the information of the previous table and on the following planting plan:

Table 16. Planting plan

| Planting year | Strata | Surface (ha) |
|---------------|--------|--------------|
| 2017 | 1 | 314.42 |
| 2018 | 2 | 264.42 |
| 2019 | 3 | 196.83 |
| 2020 | 4 | 41.36 |
| 2021 | 5 | 197.79 |
| 2021 | 6 | 204.18 |
| Total | | 1,219.01 |

Table 17. Change in carbon stock in tree biomass by project strata.

| Year | C _{TREE,t} (tCO ₂) | | | | | | ΔC _{TREE_PROJ,t} (tCO ₂) |
|-------------------------------|---|--------|--------|-------|--------|--------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| 11/01/2017 - 10/01/2018 | 3,932 | 0 | 0 | 0 | 0 | 0 | 3,932 |
| 11/01/2018 - 10/01/2019 | 11,796 | 3,307 | 0 | | 0 | 0 | 15,103 |
| 11/01/2019 -10/01/220 | 19,661 | 9,920 | 2,462 | 0 | 0 | 0 | 28,111 |
| 11/01/2020 - 10/01/2021 | 27,525 | 16,534 | 7,385 | 517 | 0 | 0 | 36,858 |
| 11/01/2021 - 10/01/2022 | 35,389 | 23,148 | 12,308 | 1,552 | 2,474 | 2,553 | 45,381 |
| 11/01/2022 - 10/01/2023 | 43,253 | 29,761 | 17,231 | 2,586 | 7,421 | 7,660 | 55,952 |
| 11/01/2023 - 10/01/2024 | 0 | 36,375 | 22,154 | 3,621 | 12,368 | 12,767 | 9,861 |
| 11/01/2024 - 10/01/2025 | 3,932 | 0 | 27,077 | 4,655 | 17,315 | 17,874 | -37,059 |
| 11/01/2025 - 10/01/2026 | 11,796 | 3,307 | 0 | 5,690 | 22,262 | 22,981 | -21,249 |
| 11/01/2026 - 10/01/2027 | 19,661 | 9,920 | 2,462 | 0 | 27209 | 28,088 | 16,486 |

| Year | C _{TREE,t} (tCO ₂) | | | | | | ΔC _{TREE_PROJ,t} (tCO ₂) |
|-------------------------------|---|--------|--------|-------|--------|--------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| 11/01/2027 - 10/01/2028 | 27,525 | 16,534 | 7,385 | 517 | 0 | 0 | -14,075 |
| 11/01/2028 - 10/01/2029 | 35,389 | 23,148 | 12,308 | 1,552 | 2,474 | 2,553 | -9,916 |
| 11/01/2029 - 10/01/2030 | 43,253 | 29,761 | 17,231 | 2,586 | 7,421 | 7,660 | 55,952 |
| 11/01/2030 - 10/01/2031 | 0 | 36,375 | 22,154 | 3,621 | 12,368 | 12,767 | 9,861 |
| 11/01/2031 - 10/01/2032 | 3,932 | 0 | 27,077 | 4,655 | 17,315 | 17,874 | -37,059 |
| 11/01/2032 - 10/01/2033 | 11,796 | 3,307 | 0 | 5,690 | 22,262 | 22,981 | -21,249 |
| 11/01/2033 - 10/01/2034 | 19,661 | 9,920 | 2,462 | 0 | 27,209 | 28,088 | 16,486 |
| 11/01/2034 - 10/01/2035 | 27,525 | 16,534 | 7,385 | 517 | 0 | 0 | -14,075 |
| 11/01/2035 - 10/01/2036 | 35,389 | 23,148 | 12,308 | 1,552 | 2,474 | 2,553 | -9,916 |
| 11/01/2036 - 10/01/2037 | 43,253 | 29,761 | 17,231 | 2,586 | 7,421 | 7,660 | 55,952 |

| Year | C _{TREE,t} (tCO ₂) | | | | | | ΔC _{TREE_PROJ,t} (tCO ₂) |
|-------------------------------|---|--------|--------|-------|--------|--------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| 11/01/2037 - 10/01/2038 | 0 | 36,375 | 22,154 | 3,621 | 12,368 | 12,767 | 9,861 |
| 11/01/2038 - 10/01/2039 | 3,932 | 0 | 27,077 | 4,655 | 17,315 | 17,874 | -37,059 |
| 11/01/2039 - 10/01/2040 | 11,796 | 3,307 | 0 | 5,690 | 22,262 | 22,981 | -21,249 |
| 11/01/2040 - 10/01/2041 | 19,661 | 9,920 | 2,462 | 0 | 27,209 | 28,088 | 16,486 |
| 11/01/2041 - 10/01/2042 | 27,525 | 16,534 | 7,385 | 517 | 0 | 0 | -14,075 |
| 11/01/2042 - 10/01/2043 | 35,389 | 23,148 | 12,308 | 1,552 | 2,474 | 2,553 | -9,916 |
| 11/01/2043 - 10/01/2044 | 43,253 | 29,761 | 17,231 | 2,586 | 7,421 | 7,660 | 55,952 |
| 11/01/2044 - 10/01/2045 | 0 | 36,375 | 22,154 | 3,621 | 12,368 | 12,767 | 9,861 |
| 11/01/2045 - 10/01/2046 | 3,932 | 0 | 27,077 | 4,655 | 17,315 | 17,874 | -37,059 |
| 11/01/2046 - 10/01/2047 | 11,796 | 3,307 | 0 | 5,690 | 22,262 | 22,981 | -21,249 |

Change in carbon stock in shrub biomass – $\Delta C_{SHRUB_PROJ,t}$

For the purpose of ex-ante estimation of carbon stock and change in carbon stock in the project scenario, change in carbon stock of shrubs is conservatively estimated as zero as stated in Paragraph 13 of AR-TOOL 14.

Change in carbon stock in dead wood - $\Delta C_{DW_PROJ,t}$

Change in carbon stocks in dead wood biomass in the project is ex-ante estimated based on the A/R Methodological Tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities” (Version 03.1), AR-TOOL 12.

The conservative default-factor based method for estimation of carbon stock in litter is selected for the assessment of this carbon pool. Following equation 9 of section 6.2 of this tool

$$C_{DW,i,t} = C_{TREE,i,t} \times DF_{DW}$$

where:

- $C_{DW,i,t}$ = Carbon stock in dead wood in stratum *i* at a given point of time in year *t*; *t* CO₂-e.
- $C_{TREE,i,t}$ = Carbon stock in trees biomass in stratum *i* at a point of time in year *t*; *t* CO₂-e.
- DF_{DW} = Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass; per cent.

For ex ante and ex post estimations in Tabasco areas, the conservative value for tropical biome, elevation below 2000 m and precipitation over 1600 mm has been selected from the table 5 of section 8 of the tool, resulting a value of 6%.

For ex ante and ex post estimations in Tamaulipas areas, the conservative value for tropical biome, elevation below 2000 m and precipitation less than 1000 mm has been selected from the table 5 of section 8 of the tool, resulting a value of 2%.

Change in carbon stock in litter – $\Delta C_{LI_PROJ,t}$

Change in carbon stocks in litter biomass in the project is ex-ante estimated based on the A/R Methodological Tool “Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities” (Version 03.1), AR-TOOL 12.

The conservative default-factor based method for estimation of carbon stock in litter is selected for the assessment of this carbon pool. Following equation 15 of section 7.2 of this tool:

$$C_{LI,i,t} = C_{TREE,i,t} \times DF_{LI}$$

where:

$C_{LI,i,t}$ = Carbon stock in litter in stratum i at a given point of time in year t ; t CO₂-e.

$C_{TREE,i,t}$ = Carbon stock in trees biomass in stratum i at a point of time in year t ; t CO₂-e.

DF_{LI} = Conservative default factor expressing carbon stock in litter as a percentage of carbon stock in tree biomass; per cent.

For ex ante and ex post estimations in Tabasco areas, the conservative value for tropical biome, elevation below 2000 m and precipitation over 1600 mm has been selected from the table 6 of section 8 of the tool, resulting a value of 1%.

For ex ante and ex post estimations in Tamaulipas areas, the conservative value for tropical biome, elevation below 2000 m and precipitation less than 1000 mm has been selected from the table 6 of section 8 of the tool, resulting a value of 4%.

Change in carbon stock in the soil organic carbon (SOC) - $\Delta C_{SOC_PROJ,t}$,

Changes in carbon stocks in the SOC pool is calculated as indicate in the A/R Methodological “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities” (Version 01.1.0).

The change in SOC stock for all the strata of the areas of land, in year t , is calculated applying equation 8:

$$\Delta SOC_{AL,t} = \frac{44}{12} \times \sum_{t=1}^t A_i \times dSOC_{t,i} \times 1year$$

where:

$\Delta SOC_{AL,t}$ = Change in SOC stock in areas of land meeting the applicability conditions of this tool, in year t ; t CO₂-e.

A_i = The area of stratum i of the areas of land; ha.

$dSOC_{t,i}$ = The rate of change in SOC stocks in stratum i of the areas of land; t C ha⁻¹ yr⁻¹.

$$dSOC_{t,i} = \frac{SOC_{REF,i} - (SOC_{INITIAL,i} - SOC_{LOSS,i})}{20 \text{ years}} \text{ for } t_{PREP,i} < t \leq t_{PREP,i} + 20$$

where:

| | | |
|-------------------|---|---|
| $dSOC_{t,i}$ | = | The rate of change in SOC stock in stratum i of the areas of land, in year t ; t C ha ⁻¹ yr ⁻¹ . |
| $t_{PREP,i}$ | = | The year in which first soil disturbance takes place in stratum i of the areas of land. |
| $SOC_{LOSS,i}$ | = | Loss of SOC caused by soil disturbance attributable the A/R CDM project activity, in stratum i of the areas of land; t C ha ⁻¹ . |
| $SOC_{REF,i}$ | = | Reference SOC stock corresponding to the reference condition in native lands (i.e., non-degraded, unimproved lands under native vegetation. normally forest) by climate region and soil type applicable to stratum i of the areas of land; t C ha ⁻¹ . |
| $SOC_{INITIAL,i}$ | = | SOC stock at the beginning of the A/R CDM project activity in stratum i of the areas of land; t C ha ⁻¹ . |

As all strata are subjected to soil disturbance attributable to project activity greater than 10% of the area of the stratum, $SOC_{LOSS,i}$ is estimated following equation 2 of the tool as 10% of $SOC_{INITIAL,i}$.

The initial SOC stock at the start of the project is estimated as follows:

$$SOC_{INITIAL,i} = SOC_{REF,i} \times f_{LU,i} \times f_{MG,i} \times f_{IN,i}$$

where:

| | | |
|------------|---|---|
| $f_{LU,i}$ | = | Relative stock change factor for baseline land-use in stratum i of the areas of land; dimensionless. |
| $f_{MG,i}$ | = | Relative stock change factor for baseline management regime in stratum i of the areas of land; dimensionless. |
| $f_{IN,i}$ | = | Relative stock change factor for baseline input regime (e.g., crop residue returns, manure) in stratum i of the areas of land; dimensionless. |

For ex ante estimations $SOC_{REF,i}$ and stock change factors ($f_{LU,i}$, $f_{MG,i}$ and $f_{IN,i}$) have been derived from tables 3, 4, 5 and 6 of the tool.

- SOC_{REF} : A value of 65 from table 3 for tropical moist climate region and soils with high activity clay (HAC) is used. For Tamaulipas area 38 value is used to the same table for tropical dry climate region and soils with high activity clay (HAC).
- f_{LU} :
Tropical moist climate region in Tabasco

- Cropland: 0.82. Value from table 4, short term cultivation. This represent to most conservative stock change factor.
- Grassland: 1. Value from table 6, unique value.

Tropical dry climate region in Tamaulipas

- Cropland: 0.93. Value from table 4, short term cultivation. This represent to most conservative stock change factor.
- Grassland: 1. Value from table 6, unique value.

- f_{MG} :

Tropical moist climate region in Tabasco

- Cropland: 1.15. Value from table 6, reduced tillage.
- Grassland: 1. Value from table 6, non-degraded lands. This represent to most conservative stock change factor.

Tropical dry climate region in Tamaulipas

- Cropland: 1.09. Value from table 6, reduced tillage.
- Grassland: 1. Value from table 6, non-degraded lands. This represent to most conservative stock change factor.

- f_{IN} :

Tropical moist climate region in Tabasco

- Cropland: 0.92. Value from table 5, low nutrient input.
- Grassland: 1. Value from table 6, low nutrient input.

Tropical dry climate region in Tamaulipas

- Cropland: 0.95. Value from table 5, low nutrient input.
- Grassland: 1. Value from table 6, low nutrient input.

Ex ante estimations for the first project activity instance have been done considering the values of previous list and the planting plan:

Table 18. Initial land use vs. planting year

| Initial land use | Planting year Tabasco | | | | | |
|------------------|-----------------------|--------|--------|-------|--------|------------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | Total (ha) |
| Cropland | 266.48 | 74.52 | 130.24 | 41.36 | 80.46 | 593.04 |
| Grassland | 47.95 | 189.91 | 66.59 | 0.00 | 117.34 | 421.78 |

| | Planting year Tamaulipas | | | | | |
|------------------|--------------------------|------|------|------|--------|------------|
| Initial land use | 2017 | 2018 | 2019 | 2020 | 2021 | Total (ha) |
| Cropland | 0 | 0 | 0 | 0 | 204.18 | 204.18 |
| Grassland | 0 | 0 | 0 | 0 | 0 | 0 |

Table 19. Change in SOC stock.

| Project year | SOC stock per planting year (tCO ₂) Tabasco | | | | | | ΔSOCAL,t |
|--------------|---|-------|-------|-------|-------|--------|----------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | Total | |
| 0 | | | | | | | |
| 1 | 740 | | | | | 740 | 740 |
| 2 | 1,479 | 434 | | | | 1,913 | 1,173 |
| 3 | 2,219 | 867 | 420 | | | 3,506 | 1,593 |
| 4 | 2,959 | 1,301 | 839 | 108 | | 5,207 | 1,701 |
| 5 | 3,698 | 1,734 | 1,259 | 216 | 350 | 7,257 | 2,051 |
| 6 | 4,438 | 2,168 | 1,678 | 324 | 700 | 9,308 | 2,051 |
| 7 | 5,178 | 2,602 | 2,098 | 432 | 1,050 | 11,359 | 2,051 |
| 8 | 5,917 | 3,035 | 2,517 | 540 | 1,400 | 13,410 | 2,051 |
| 9 | 6,657 | 3,469 | 2,937 | 648 | 1,750 | 15,461 | 2,051 |
| 10 | 7,396 | 3,902 | 3,356 | 756 | 2,100 | 17,511 | 2,051 |
| 11 | 8,136 | 4,336 | 3,776 | 864 | 2,450 | 19,562 | 2,051 |
| 12 | 8,876 | 4,770 | 4,195 | 972 | 2,800 | 21,613 | 2,051 |
| 13 | 9,615 | 5,203 | 4,615 | 1,080 | 3,150 | 23,664 | 2,051 |
| 14 | 10,355 | 5,637 | 5,035 | 1,188 | 3,500 | 25,715 | 2,051 |

| Project year | SOC stock per planting year (tCO ₂) Tabasco | | | | | | ΔSOCAL,t |
|--------------|---|-------|-------|-------|-------|--------|----------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | Total | |
| 15 | 11,095 | 6,070 | 5,454 | 1,296 | 3,850 | 27,765 | 2,051 |
| 16 | 11,834 | 6,504 | 5,874 | 1,404 | 4,200 | 29,816 | 2,051 |
| 17 | 12,574 | 6,938 | 6,293 | 1,512 | 4,550 | 31,867 | 2,051 |
| 18 | 13,314 | 7,371 | 6,713 | 1,620 | 4,900 | 33,918 | 2,051 |
| 19 | 14,053 | 7,805 | 7,132 | 1,728 | 5,250 | 35,969 | 2,051 |
| 20 | 14,793 | 8,239 | 7,552 | 1,836 | 5,600 | 38,019 | 2,051 |
| 21 | 14,793 | 8,672 | 7,971 | 1,945 | 5,950 | 39,331 | 1,311 |
| 22 | 14,793 | 8,672 | 8,391 | 2,053 | 6,300 | 40,208 | 878 |
| 23 | 14,793 | 8,672 | 8,391 | 2,161 | 6,650 | 40,666 | 458 |
| 24 | 14,793 | 8,672 | 8,391 | 2,161 | 7,000 | 41,016 | 350 |
| 25 | 14,793 | 8,672 | 8,391 | 2,161 | 7,000 | 41,016 | 0 |
| 26 | 14,793 | 8,672 | 8,391 | 2,161 | 7,000 | 41,016 | 0 |
| 27 | 14,793 | 8,672 | 8,391 | 2,161 | 7,000 | 41,016 | 0 |
| 28 | 14,793 | 8,672 | 8,391 | 2,161 | 7,000 | 41,016 | 0 |
| 29 | 14,793 | 8,672 | 8,391 | 2,161 | 7,000 | 41,016 | 0 |
| 30 | 14,793 | 8,672 | 8,391 | 2,161 | 7,000 | 41,016 | 0 |

| Project year | SOC stock per planting year (tCO ₂) Tamaulipas | | | | | | ΔSOCAL,t |
|--------------|--|------|------|------|------|-------|----------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | Total | |
| 0 | | | | | | | |
| 1 | 0.00 | | | | | 0.00 | 0.00 |
| 2 | 0.00 | 0.00 | | | | 0.00 | 0.00 |

| Project year | SOC stock per planting year (tCO ₂) Tamaulipas | | | | | | ΔSOCAL,t |
|--------------|--|------|------|------|----------|----------|----------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | Total | |
| 3 | 0.00 | 0.00 | 0.00 | | | 0.00 | 0.00 |
| 4 | 0.00 | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 |
| 5 | 0.00 | 0.00 | 0.00 | 0.00 | 189.60 | 189.60 | 189.60 |
| 6 | 0.00 | 0.00 | 0.00 | 0.00 | 379.20 | 379.20 | 189.60 |
| 7 | 0.00 | 0.00 | 0.00 | 0.00 | 568.79 | 568.79 | 189.60 |
| 8 | 0.00 | 0.00 | 0.00 | 0.00 | 758.39 | 758.39 | 189.60 |
| 9 | 0.00 | 0.00 | 0.00 | 0.00 | 947.99 | 947.99 | 189.60 |
| 10 | 0.00 | 0.00 | 0.00 | 0.00 | 1,137.59 | 1,137.59 | 189.60 |
| 11 | 0.00 | 0.00 | 0.00 | 0.00 | 1,327.18 | 1,327.18 | 189.60 |
| 12 | 0.00 | 0.00 | 0.00 | 0.00 | 1,516.78 | 1,516.78 | 189.60 |
| 13 | 0.00 | 0.00 | 0.00 | 0.00 | 1,706.38 | 1,706.38 | 189.60 |
| 14 | 0.00 | 0.00 | 0.00 | 0.00 | 1,895.98 | 1,895.98 | 189.60 |
| 15 | 0.00 | 0.00 | 0.00 | 0.00 | 2,085.58 | 2,085.58 | 189.60 |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 | 2,275.17 | 2,275.17 | 189.60 |
| 17 | 0.00 | 0.00 | 0.00 | 0.00 | 2,464.77 | 2,464.77 | 189.60 |
| 18 | 0.00 | 0.00 | 0.00 | 0.00 | 2,654.37 | 2,654.37 | 189.60 |
| 19 | 0.00 | 0.00 | 0.00 | 0.00 | 2,843.97 | 2,843.97 | 189.60 |
| 20 | 0.00 | 0.00 | 0.00 | 0.00 | 3,033.56 | 3,033.56 | 189.60 |
| 21 | 0.00 | 0.00 | 0.00 | 0.00 | 3,223.16 | 3,223.16 | 189.60 |
| 22 | 0.00 | 0.00 | 0.00 | 0.00 | 3,412.76 | 3,412.76 | 189.60 |
| 23 | 0.00 | 0.00 | 0.00 | 0.00 | 3,602.36 | 3,602.36 | 189.60 |

| Project year | SOC stock per planting year (tCO ₂) Tamaulipas | | | | | | ΔSOCAL,t |
|--------------|--|------|------|------|----------|----------|----------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | Total | |
| 24 | 0.00 | 0.00 | 0.00 | 0.00 | 3,791.95 | 3,791.95 | 189.60 |
| 25 | 0.00 | 0.00 | 0.00 | 0.00 | 3,791.95 | 3,791.95 | 0.00 |
| 26 | 0.00 | 0.00 | 0.00 | 0.00 | 3,791.95 | 3,791.95 | 0.00 |
| 27 | 0.00 | 0.00 | 0.00 | 0.00 | 3,791.95 | 3,791.95 | 0.00 |
| 28 | 0.00 | 0.00 | 0.00 | 0.00 | 3,791.95 | 3,791.95 | 0.00 |
| 29 | 0.00 | 0.00 | 0.00 | 0.00 | 3,791.95 | 3,791.95 | 0.00 |
| 30 | 0.00 | 0.00 | 0.00 | 0.00 | 3,791.95 | 3,791.95 | 0.00 |

Increase of non-CO₂ GHG emissions within the project boundary - GHG_{e,t}

Increase of non-CO₂ GHG emissions is estimated using the CDM A/R Methodological Tool “Estimation of non-CO₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity”. Following equation 1 of the tool:

$$GHG_{e,t} = GHG_{SPF,t} + GHG_{FMF,t} + GHG_{FF,t}$$

where:

$GHG_{e,t}$ = Emission of non-CO₂ GHGs resulting from burning of biomass and forest fires within the project boundary in year t ; t CO₂-e.

$GHG_{SPF,t}$ = Emission of non-CO₂ GHGs resulting from use of fire in site preparation in year t ; t CO₂-e.

$GHG_{FMF,t}$ = Emission of non-CO₂ GHGs resulting from use of fire to clear the land of harvest residue prior to replanting of the land or other forest management, in year t ; t CO₂-e.

$GHG_{FF,t}$ = Emission of non-CO₂ GHGs resulting from fire in year t ; t CO₂-e.

It can be assumed that emissions of non-CO₂ GHGs resulting from use of fire in site preparation in year t are zero ($GHG_{SPF,t} = 0$) following in the tool (Paragraph 7, a): *For all areas of land where: (i) Slash-and-burn is a common practice in the baseline, and (ii) Fire has been used in the area at least once during*

the period of ten years preceding the start of the A/R CDM project activity: $GHG_{SPF,t} = 0$. Fire will not be used to clear the land of harvest residues, therefore $GHG_{FMF,t} = 0$.

If forest fires occur, they will be reported and monitored. Emission of non-CO₂ GHGs resulting from forest fire ($GHG_{FF,t}$) will be calculated ex-post using specifically equations 6, 7 and 8 of the mentioned A/R CDM Methodological tool.

$$GHG_{FF,t} = GHG_{FF_TREE,t} + GHG_{FF_DOM,t}$$

$$GHG_{FF_TREE,t} = 0.001 \times \sum_{i=1}^M A_{BURN,i,t} \times b_{TREE,i,t_L} \times COMF_i \times (EF_{CH_4,i} \times GWP_{CH_4} + EF_{N_2O,i} \times GWP_{N_2O})$$

$$GHG_{FF_DOM,t} = 0.07 \times \sum_{i=1}^M A_{BURN,i,t} \times (C_{DW,i,t_L} + C_{LI,i,t_L})$$

where:

$GHG_{FF_TREE,t}$ = Emission of non-CO₂ GHGs resulting from the loss of aboveground biomass of trees due to forest fire, in year t ; t CO₂-e.

$GHG_{FF_DOM,t}$ = Emission of non-CO₂ GHGs resulting from the loss of dead organic matter due to forest fire, in year t ; t CO₂-e.

$A_{BURN,i,t}$ = Area burnt in stratum i in year t ; ha.

b_{TREE,i,t_L} = Mean aboveground tree biomass per hectare in stratum i in year t which is the year in which last verification was carried out before occurrence of the fire; t d.m. ha⁻¹

Where aboveground biomass of living trees is not burnt by fire b_{TREE,i,t_L} may be set equal to zero.

$COMF_i$ = Combustion factor for stratum i ; dimensionless.

$EF_{CH_4,i}$ = Emission factor for CH₄ in stratum i ; g CH₄ (kg dry matter burnt)⁻¹.

GWP_{CH_4} = Global warming potential for CH₄; dimensionless
Default value of 21 is used.

$EF_{N_2O,i}$ = Emission factor for N₂O in stratum k ; g N₂O (kg dry matter burnt)⁻¹.

GWP_{N_2O} = Global warming potential for N₂O; dimensionless
Default value of 310 is used.

C_{DW,i,t_L} = Carbon stock in dead wood in stratum i in year t which is the year in which last verification was carried out before occurrence of the fire,

as estimated using the Tool for estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.; t CO₂-e.

$C_{LI,i,tL}$ = Carbon stock in litter in stratum i in year tL which is the year in which last verification was carried out before occurrence of the fire, as estimated using the Tool for estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities.; t CO₂-e.

For ex ante estimations emission of non-CO₂ GHGs resulting from fires are considered zero since no information about forest fire inside the project area is available, therefore in the ex-ante estimations it is not possible to estimate potential emissions due to this type of fires.

Actual net greenhouse gas removals by sinks - $\Delta C_{ACTUAL,t}$

The ex-ante actual net GHG removals by sink are calculated in an Excel file available to VVB on request (Ex ante GHG_assessment.xls), based on equation 2 of the methodology ($\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t}$), where $GHG_{E,t} = 0$ and therefore $\Delta C_{ACTUAL,t} = \Delta C_{P,t}$. Summary result of $\Delta C_{ACTUAL,t}$ are included in the following table.

Table 20. Ex ante actual net GHG removals by sinks.

| Year | Tree biomass carbon pool | | Dead wood carbon pool | | Litter carbon pool | | Soil organic carbon pool | | Actual net GHG removals by sinks | |
|-----------------------|---|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|
| | Annual carbon stock change ΔC_{TREE_P} ROJ,t | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change |
| | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e |
| 0 | | 0 | | 0 | | 0 | | 0 | | 0 |
| 11/01/2017-10/01/2018 | 3932 | 3,932 | 209 | 209 | 59 | 59 | 740 | 740 | 4,940 | 4,940 |
| 11/01/2018-10/01/2019 | 15103 | 15,103 | 803 | 803 | 228 | 228 | 1,173 | 1,913 | 13,107 | 18,048 |
| 11/01/2019-10/01/220 | 28111 | 32043 | 1,495 | 1,705 | 424 | 484 | 1,593 | 3,506 | 19,689 | 37,737 |
| 11/01/2020-10/01/2021 | 36858 | 51,961 | 1,961 | 2,764 | 557 | 785 | 1,701 | 5,207 | 22,980 | 60,716 |
| 11/01/2021-10/01/2022 | 45381 | 77,424 | 2,414 | 4,119 | 685 | 1,169 | 2,240 | 7,447 | 29,442 | 90,158 |

| Year | Tree biomass carbon pool | | Dead wood carbon pool | | Litter carbon pool | | Soil organic carbon pool | | Actual net GHG removals by sinks | |
|-----------------------|---|--------------------------------|------------------------------------|--------------------------------|------------------------------------|--------------------------------|------------------------------------|--------------------------------|------------------------------------|--------------------------------|
| | Annual carbon stock change ΔC_{TREE_P} ROJ,t | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change |
| | tCO _{2e} yr ⁻¹ | tCO _{2e} | tCO _{2e} yr ⁻¹ | tCO _{2e} | tCO _{2e} yr ⁻¹ | tCO _{2e} | tCO _{2e} yr ⁻¹ | tCO _{2e} | tCO _{2e} yr ⁻¹ | tCO _{2e} |
| 11/01/2022-10/01/2023 | 55952 | 107,913 | 2,977 | 5,741 | 845 | 1,629 | 2,240 | 9,687 | 34,812 | 124,971 |
| 11/01/2023-10/01/2024 | 9861 | 87,285 | 525 | 4,644 | 149 | 1,318 | 2,240 | 11,928 | -19,797 | 105,174 |
| 11/01/2024-10/01/2025 | -37059 | 70,854 | -1,972 | 3,769 | -560 | 1,070 | 2,240 | 14,168 | -15,313 | 89,861 |
| 11/01/2025-10/01/2026 | -21249 | 66,036 | -1,130 | 3,513 | -321 | 997 | 2,240 | 16,409 | -2,906 | 86,955 |
| 11/01/2026-10/01/2027 | 16486 | 87,340 | 877 | 4,646 | 249 | 1,319 | 2,240 | 18,649 | 24,999 | 111,954 |
| 11/01/2027-10/01/2028 | -14075 | 51,961 | -749 | 2,764 | -213 | 785 | 2,240 | 20,889 | -35,555 | 76,399 |

| Year | Tree biomass carbon pool | | Dead wood carbon pool | | Litter carbon pool | | Soil organic carbon pool | | Actual net GHG removals by sinks | |
|-----------------------|---|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|
| | Annual carbon stock change ΔC_{TREE_P} ROJ,t | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change |
| | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e |
| 11/01/2028-10/01/2029 | -9,916 | 77,424 | -528 | 4,119 | -150 | 1,169 | 2,240 | 23,130 | 29,442 | 105,841 |
| 11/01/2029-10/01/2030 | 55,952 | 107,913 | 2,977 | 5,741 | 845 | 1,629 | 2,240 | 25,370 | 34,812 | 140,654 |
| 11/01/2030-10/01/2031 | 9,861 | 87,285 | 525 | 4,644 | 149 | 1,318 | 2,240 | 27,611 | -19,797 | 120,857 |
| 11/01/2031-10/01/2032 | -37,059 | 70,854 | -1,972 | 3,769 | -560 | 1,070 | 2,240 | 29,851 | -15,313 | 105,544 |
| 11/01/2032-10/01/2033 | -21,249 | 66,036 | -1,130 | 3,513 | -321 | 997 | 2,240 | 32,091 | -2,906 | 102,638 |
| 11/01/2033-10/01/2034 | 16,486 | 87,340 | 877 | 4,646 | 249 | 1,319 | 2,240 | 34,332 | 24,999 | 127,637 |

| Year | Tree biomass carbon pool | | Dead wood carbon pool | | Litter carbon pool | | Soil organic carbon pool | | Actual net GHG removals by sinks | |
|-----------------------|---|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|
| | Annual carbon stock change ΔC_{TREE_P} ROJ,t | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change |
| | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e |
| 11/01/2034-10/01/2035 | -14,075 | 51,961 | -749 | 2,764 | -213 | 785 | 2,240 | 36,572 | -35,555 | 92,082 |
| 11/01/2035-10/01/2036 | -9,916 | 77,424 | -528 | 4,119 | -150 | 1,169 | 2,240 | 38,813 | 29,442 | 121,524 |
| 11/01/2036-10/01/2037 | 55,952 | 107,913 | 2,977 | 5,741 | 845 | 1,629 | 2,240 | 41,053 | 34,812 | 156,337 |
| 11/01/2037-10/01/2038 | 9,861 | 87,285 | 525 | 4,644 | 149 | 1,318 | 1,501 | 42,554 | -20,536 | 135,800 |
| 11/01/2038-10/01/2039 | -37,059 | 70,854 | -1,972 | 3,769 | -560 | 1,070 | 1,067 | 43,621 | -16,486 | 119,314 |
| 11/01/2039-10/01/2040 | -21,249 | 66,036 | -1,130 | 3,513 | -321 | 997 | 648 | 44,269 | -4,499 | 114,815 |

| Year | Tree biomass carbon pool | | Dead wood carbon pool | | Litter carbon pool | | Soil organic carbon pool | | Actual net GHG removals by sinks | |
|-----------------------|---|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|
| | Annual carbon stock change ΔC_{TREE_P} ROJ,t | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change |
| | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e |
| 11/01/2040-10/01/2041 | 16,486 | 87,340 | 877 | 4,646 | 249 | 1,319 | 540 | 44,808 | 23,298 | 138,113 |
| 11/01/2041-10/01/2042 | -14,075 | 51,961 | -749 | 2,764 | -213 | 785 | 0 | 44,808 | -37,795 | 100,318 |
| 11/01/2042-10/01/2043 | -9,916 | 77,424 | -528 | 4,119 | -150 | 1,169 | 0 | 44,808 | 27,202 | 127,520 |
| 11/01/2043-10/01/2044 | 55,952 | 10,7913 | 2,977 | 5,741 | 845 | 1,629 | 0 | 44,808 | 32,572 | 160,092 |
| 11/01/2044-10/01/2045 | 9,861 | 87,285 | 525 | 4,644 | 149 | 1,318 | 0 | 44,808 | -22,037 | 138,055 |
| 11/01/2045-10/01/2046 | -37,059 | 70,854 | -1,972 | 3,769 | -560 | 1,070 | 0 | 44,808 | -17,554 | 120,501 |

| Year | Tree biomass carbon pool | | Dead wood carbon pool | | Litter carbon pool | | Soil organic carbon pool | | Actual net GHG removals by sinks | |
|-----------------------|---|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|-------------------------------------|--------------------------------|
| | Annual carbon stock change ΔC_{TREE_P} ROJ,t | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change | Annual carbon stock change | Cumulative carbon stock change |
| | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e | tCO ₂ e yr ⁻¹ | tCO ₂ e |
| 11/01/2046-10/01/2047 | -21,249 | 66,036 | -1,130 | 3,513 | -321 | 997 | 0 | 44,808 | -5,146 | 115,355 |

5.3 Leakage

According to the methodology AR-ACM0003 (Version 02.0), the leakage emission must be assessed using the tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity” (Version 02) ⁴⁵.

The following methodological formula (equation 4 of AR-ACM0003) is used for calculating the GHG emissions due to leakage:

$$LK_t = LK_{AGRIC,t}$$

Where:

LK_t = GHG emissions due to leakage, in year t; t C

$LK_{AGRIC,t}$ = Leakage due to the displacement of agricultural activities in year t, as estimated in the tool “Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity”; t CO₂-e

The tool estimates the increase in emissions based on changes in carbon stocks in the affected carbon pools in the land receiving the displaced activities.

As described in section 3.4, the entire project is characterised as an agricultural area, with 35% being grasslands and 65% being croplands. According to the mentioned tool, displacement of an agricultural activity by itself does not result in leakage emission. Leakage emission occurs when the displacement leads to an increase in GHG emissions relative to the GHG emissions attributable to the activity as it exists within the project boundary.

Leakage emission attributable to the displacement of agricultural activities in the project are considered insignificant and hence accounted as zero because of the following reasons:

Profile of the landowner

- Landowners In Tabasco are typically smallholders from villages who inherited portions of land in the 50’s because of the Chontalpa Plan, where land has been passed down through families.

⁴⁵ <https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf>

- In general, the owners of the acquired lands are adults who rented their lands to move away from field-based activities in particular moving to some cities and/or migrating to areas already degraded (See section 1.7), which therefore presents no likelihood of displacement of the preexisting agricultural activity.
- The main form of land tenure in the area is ejido and currently a large amount of the land in this category is either disused or leased by the rights holders, no longer by the original ejidatarios, but by their heirs, who have emigrated and no longer live in the ejido. The profile of PROXYLO's land lessors is as follows: ejidatario; heir to the property; migrated to the state capital, to Mexico City and even to the United States. However, interest in renting land for crop cultivation is declining as landowners age and their children migrate to cities.
- Moreover, by renting out their properties, the current ejidatarios are no longer looking for new land to continue farming, as their livelihood is already different, and the leasing is a complement to their income. These landowners are named as semi-capitalised producers these are known as social sector producers and do not have a defined market for the sale of their crops⁴⁶;

Land use practices at the moment of the leasing

- In the Muestreo de vegetación preexistente elaborated by Proxylo it is indicated the state of the land use before the leasing to PROXYLO. In this report, presented as evidence, it can be observed that many properties present an abandoned use before the leasing of lands to Proxylo. Proxylo interviews the landowners and do not seem interested in keeping their agricultural activities. The areas that are suitable for forest plantation used to be not interesting for productive crop cultivation.
- The change of land use from areas of natural vegetation to agricultural use is not a viable scenario due to the current legislation that promotes the conservation of forest ecosystems encouraging their delimitation and sustainable management, avoiding the change of land use for agricultural purposes or of any other nature affects their permanence and potential⁴⁷.
- As described in Section 3.4, According to Lopez et al. (2021)⁴⁸ the municipality of Cárdenas in Tabasco has medium to high productive potential for rice cultivation. However, the project area falls outside the zones identified with medium or high productive potential for rice.

⁴⁶ Palma-López, D. J., & Triano-Sarabia, A. (Comps.). (2007). *Suelos de Tabasco: Su uso y manejo sustentable*. Villahermosa, Tabasco, México: Colegio de Postgraduados-Campus Tabasco; Instituto para el Desarrollo de Sistemas de Producción del Trópico Húmedo de Tabasco; Fundación Produce Tabasco

⁴⁷ Palma-López, D. J., & Triano-Sarabia, A. (Comps.). (2007). *Suelos de Tabasco: Su uso y manejo sustentable*. Villahermosa, Tabasco, México: Colegio de Postgraduados-Campus Tabasco; Instituto para el Desarrollo de Sistemas de Producción del Trópico Húmedo de Tabasco; Fundación Produce Tabasco

⁴⁸ López, G., Miranda, R., Hernández, A. & Sánchez, E. (2021). Tecnología de potencial productivo de arroz (*Oryza sativa* L.) en el estado de Tabasco, México y su aportación a la soberanía alimentaria. *Revista Chapingo Serie Agricultura Tropical*. 1. 9-23. 10.5154/r.rchsagt.2021.02.02

Pre-project land use as Croplands

- According to the 11th Statistical Report on the sugar cane agro-industrial sector in Mexico, harvests 2014-2015 / 2023-2024, the industrialised area in Tabasco averaged 38.56 hectares, having its peak in the 2017-2018 harvest when it reached 40.0 thousand hectares; the minimum was during the 2019-2020 harvest, as it dropped to 37.5 thousand hectares⁴⁹. In recent times their main problem is the price and the overproduction of sugar in the country, as well as the import of high production of sugar in the country, as well as the import of high fructose to very low prices⁵⁰;
- The availability of agricultural land in Tabasco State is high due to decades of policies promoting land clearing for farming and livestock. Programs like PRONADE and the National Farming Program incentivized deforestation, significantly expanding agricultural areas and leading to widespread land degradation. As a result, large tracts of land remain available for agriculture, reducing pressure on the remaining forests⁵¹
- On the other hand, the note "Impulso al sector cañero en Tabasco⁵³" ("Boost to the sugarcane sector in Tabasco") The main challenges facing sugar cane in the state of Tabasco include climatic factors, labour shortages, high production costs and low field technification.

Pre-project land use as Grasslands

As per section 6.10 of the "Estimation of the increase in GHG emissions attributable to the displacement of pre-project agricultural activities in A/R CDM project activity" tool, leakage emission attributable to the displacement of grazing activities is considered insignificant and hence accounted as zero for a given list of specified conditions (from option (a) to (e)). In the project, there will not be leakage because the animals existing or displaced will never exceed the carrying capacity of the receiving area (conditions a) and b) of the tool).

(a) Animals are displaced to existing grazing land and the total number of animals in the receiving grazing land (displaced and existing) does not exceed the carrying capacity of the grazing land.

⁴⁹ En: https://www.siiiba.conadesuca.gob.mx/siiaca/docext/11vo_Informe_Estadistico.pdf

⁵⁰ Palma-López, D. J., & Triano-Sarabia, A. (Comps.). (2007). *Suelos de Tabasco: Su uso y manejo sustentable*. Villahermosa, Tabasco, México: Colegio de Postgraduados-Campus Tabasco; Instituto para el Desarrollo de Sistemas de Producción del Trópico Húmedo de Tabasco; Fundación Produce Tabasco

⁵¹ Cerdeño Gilardi Heidi y Pérez Salicrup Diego R. La legislación forestal y su efecto en la restauración en México. Instituto nacional de Ecología y Cambio Climático. 2007. Disponible en <http://www2.inecc.gob.mx/publicaciones2/libros/467/cedenoyperrez.html>

⁵² Moreno Unda, Arcelia A. Efectos ambientales del Programa Nacional de Desmontes, 1972-1982. 2011. Disponible en <http://ninive.uaslp.mx/jspui/handle/i/3541> y comunidadpmpca.uaslp.mx/documento.aspx?idT=123

⁵³ En <https://www.eleconomista.com.mx/opinion/impulso-sector-canero-tabasco-20241001-728260.html>, consultada el 30/ene/25

(b) Animals are displaced to existing non-grazing grassland and the total number of animals displaced does not exceed the carrying capacity of the receiving grassland.

If the previous landowners continue farming, the activities will likely shift to already-degraded areas, ensuring that the number of livestock remains within the land's carrying capacity for the following reasons. Leakage is unlikely to occur due to the following reasons:

- **Historical Agricultural Policies** : The Tabasco region has been heavily influenced by decades of policies aimed at promoting agricultural production. One key initiative was the National Tree Clearing Program (PRONADE), where the government provided land to peasants and loans to encourage land clearance. This was complemented by the National Farming Program, which incentivized converting forest areas into pastures or agricultural land. As a result, agriculture is the predominant land use in the region. Additionally, the rural migration phenomenon has made land more affordable compared to other parts of Mexico, further promoting agricultural use. However, changing natural vegetation into pasture or croplands is no longer a feasible option due to high soil preparation costs and current regulations that prohibit such conversions in forested areas.^{54,55}
- **Agricultural Practices**: In Tabasco, the prevailing farming method is extensive livestock management, primarily for milk and beef production. This low-intensity system, largely unchanged since the 1940s, results in low livestock density (just 9 head per producer). Consequently, many rural families are unable to rely solely on livestock income and often seek additional sources of income to meet their needs.
- **Carrying Capacity**: To increase livestock density, more animals would need to be introduced. However, the migration of younger generations to urban areas has reduced the ability of previous landowners to maintain their farming operations. As a result, the total number of livestock on existing grazing lands is unlikely to exceed the land's carrying capacity, even if animals from pre-project areas are relocated.

Mexico is experiencing a decline in its rural population, driven by migration from rural areas to urban centres. In the expansion areas of the project, including Tabasco and Tamaulipas, the number of emigrants outweighs the number of immigrants, leading to an overall decrease in the rural population.⁵⁶

⁵⁴ Cerdeño Gilardi, H., & Pérez Salicrup, D. R. (2007). *La legislación forestal y su efecto en la restauración en México*. Instituto Nacional de Ecología y Cambio Climático. Available at: <http://www2.inecc.gob.mx/publicaciones2/libros/467/cedenoyperes.html>

⁵⁵ Moreno Unda, A. A. (2011). *Efectos ambientales del Programa Nacional de Desmontes, 1972-1982*. Retrieved from <http://ninive.uaslp.mx/jspui/handle/i/3541> and comunidadpmpca.uaslp.mx/documento.aspx?idT=123

⁵⁶ Instituto Nacional de Estadística y Geografía (INEGI). (n.d.). *Población rural y urbana en México*. Retrieved November 14, 2024, from http://cuentame.inegi.org.mx/poblacion/rur_urb.aspx?tema=P

As conclusion, the risk of generating leakage from displacement of previous activities either in croplands or grasslands is zero according to the inexistence of any of the three types of leakage :

1) Market leakage occurs when projects significantly reduce the production of a commodity, causing a change in the supply and market demand equilibrium that results in a shift of production elsewhere to make up for the lost supply.

The land of the project activity does not significantly reduce the production of a commodity due to the availability of land in the surrounding area, as explained in section 3.4. Also, the existing croplands are not relevant from the economic point of view, which is why the landowners decided to establish a new contract to reforest their properties to obtain better rentability.

2) Activity-shifting leakage can result from, inter alia, the shifting of grazing animals, shifting of households or communities, shifting of aquacultural or agricultural activities or shifting of fuelwood collection (from non-tree sources). Leakage emissions may also result from transportation and machinery use.

The project activity is not related to the shifting of grazing animals, households, or communities; therefore, this condition is neglected.

3) Ecological leakage occurs in WRC projects where a project activity causes changes in GHG Emissions or fluxes of GHG emissions from ecosystems that are hydrologically connected to the project area.

The project activity is not involved with a Wetland Restoration and Conservation project; therefore, this leakage is not included.

All the plantations have been established in areas where pre-project land use. is land remaining with agricultural activities (Croplands and Grasslands) where ecological leakage is not considered. This assumption is supported by the photo of previous land uses and the information provided by PROXYLO with the previous activities for every land property and with a report analysing the uses before the project activity in the Project area and surroundings.

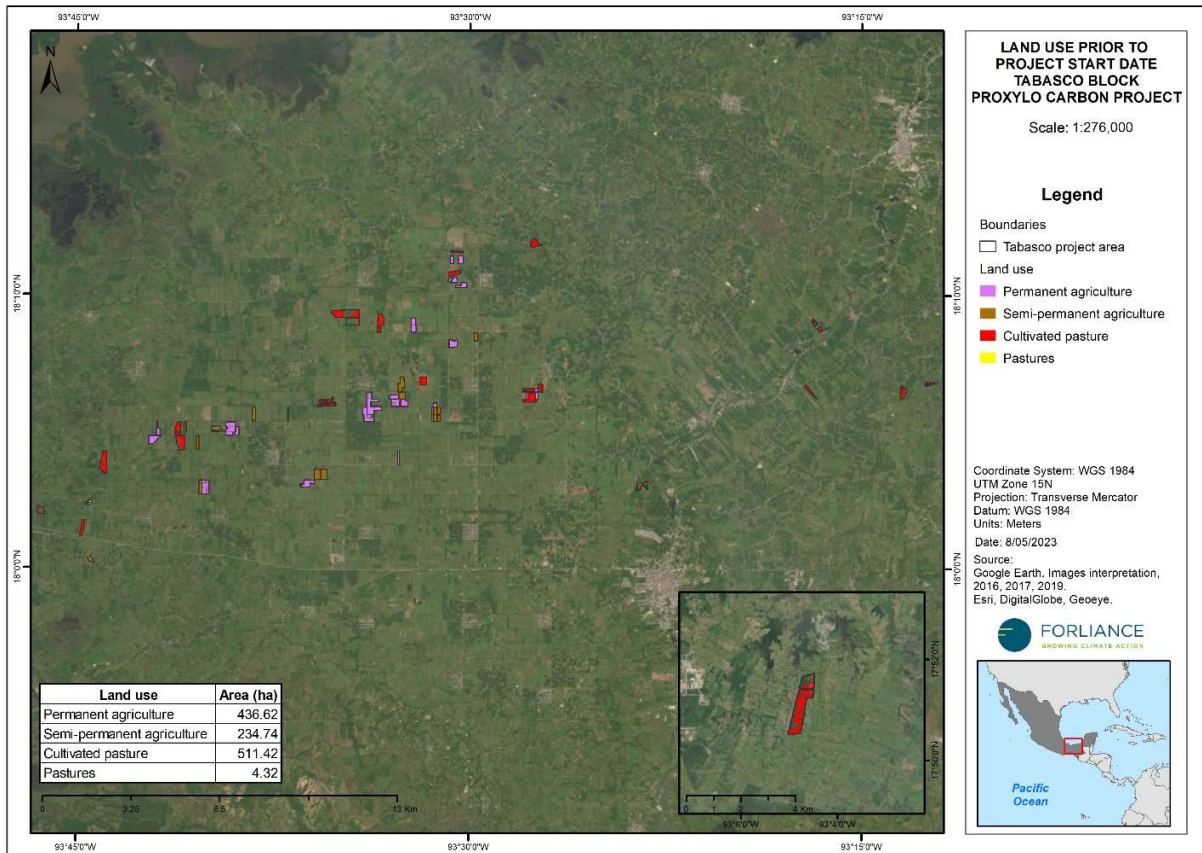


Figure 19. Land use previous to the project start date in the state of Tabasco

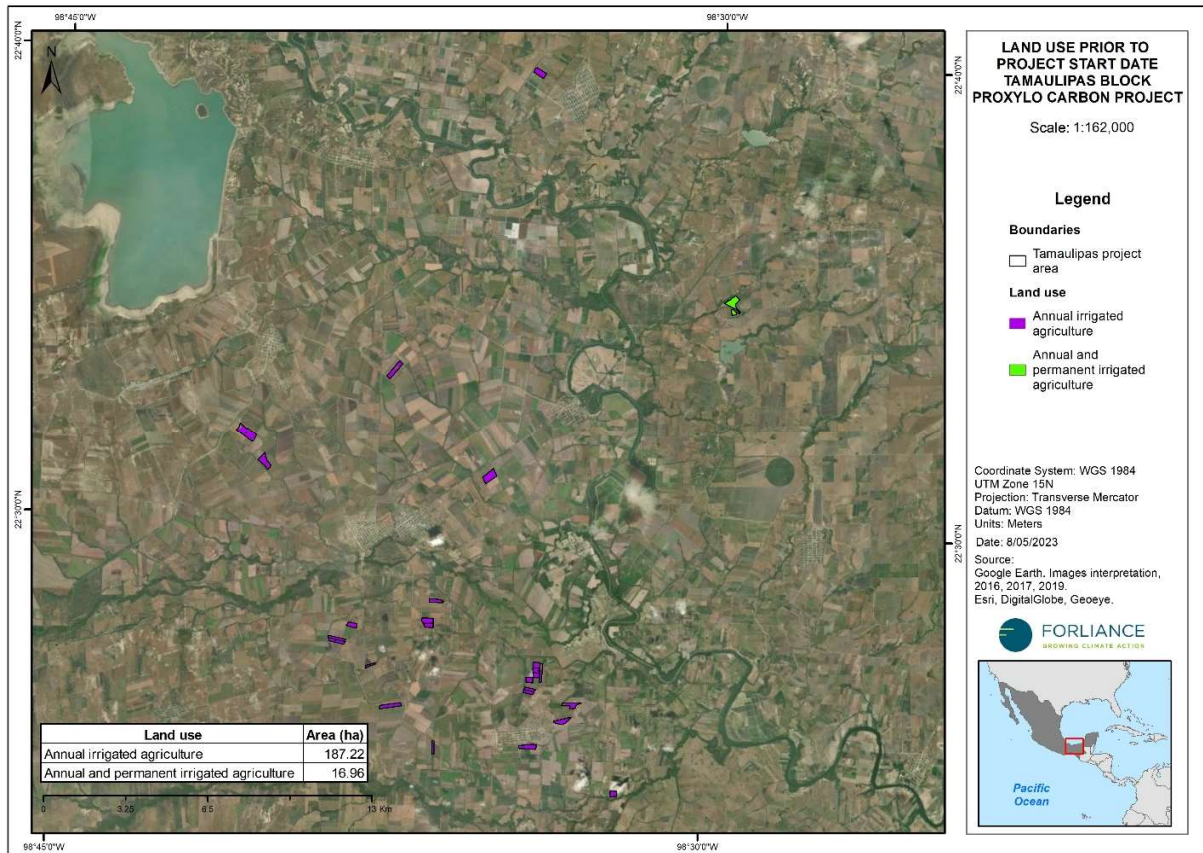


Figure 20. Land use previous to the project start date in the state of Tamaulipas

Therefore, the approach of section 6.11 will be followed to estimate the leakage, in which leakage emission resulting from displacement of the activities is estimated as follows (equations 1, 2 and 3 of AR-TOOL15):

$$LK_{AGRIC,t} = \frac{44}{12} \times \Delta C_{BIOMASS,t} + \Delta SOC_{LUC,t}$$

$$\Delta C_{BIOMASS,t} = [1.1 \times b_{TREE} \times (1 + R_{TREE}) + b_{SHRUB} \times (1 + R_S)] \times CF \times A_{DISP,t_5}$$

$$\Delta SOC_{LUC,t} = SOC_{REF} \times (f_{LUP} \times f_{MGP} \times f_{INP} - f_{LUD} \times f_{MGD} \times f_{IND}) \times A_{DISP,t_t}$$

Where:

LK_{t0} = Leakage emission resulting from displacement of agricultural activities in year t; t CO2-e

$\Delta C_{BIOMASS,t}$ = Decrease in carbon stock in the carbon pools of the land receiving the activity displaced in year t; t d.m.

CF_e = Carbon fraction of woody biomass; dimensionless.

$A_{DISP,t}$ = Area of land from which agricultural activity is being displaced in year t; ha

b_{TREE} = Mean above-ground tree biomass in land receiving the displaced activity; t d.m. ha⁻¹

R_{TREE} = Root-shoot ratio for trees in the land receiving the displaced activity; dimensionless.

b_{SHRUB} = Mean above-ground shrub biomass in land receiving the displaced activity; t d.m. ha⁻¹

R_S = Root-shoot ratio for shrubs in the land receiving the displaced activity; dimensionless.

$\Delta SOC_{LUC,t}$ = Change in soil organic carbon (SOC) stock due to land-use change in the land receiving the displaced activity in year t; tC ha⁻¹

SOC_{REF} = SOC stock corresponding to the reference condition in native lands by climate region and soil type applicable to the land receiving the displaced activity; t C ha⁻¹

$f_{LUP}, f_{MGP}, f_{INPe}$ = Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land before the displaced activity is received; dimensionless.

$f_{LUD}, f_{MGD}, f_{IND}$ = Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land after the displaced activity has been received; dimensionless.

$t_p = 1, 2, 3, \dots$ years elapsed since the start of the A/R CDM project activity.

Thus, the area of land from which agricultural activity is being displaced ($A_{DISP,t}$) is deemed as zero, leaving a change in SOC stock due to land-use change in the land receiving the displaced activity ($\Delta SOC_{LUC,t}$) of zero, a decrease in carbon stock in the carbon pools of the land receiving the activity displaced ($\Delta CBIO_{MASS,t}$) of zero and a leakage emission resulting from displacement of agricultural activities ($LK_t = LK_{AGRIC,t}$) are zero too.

Thus,

$$A_{DISP,t} = 0$$

If the value of displaced area is substituted in each equation, it can be seen that the result of agricultural leakage will be equal to 0.

$$\Delta C_{BIOMASS,t} = [1.1 \times b_{TREE} \times (1 + R_{TREE}) + b_{SHRUB} \times (1 + R_S)] \times CF \times 0 = 0_s$$

$$\Delta SOC_{LUC,t} = SOC_{REF} \times (f_{LUP} \times f_{MGP} \times f_{INP} - f_{LUD} \times f_{MGD} \times f_{IND}) \times 0 = 0_e$$

$$LK_{AGRIC,t} = \frac{44}{12} \times 0 + 0 = 0$$

Thus, according to AR-Tool15, leakage is to be considered as zero.

$$LK_t = 0_e$$

Given the explanation above, the project scenario does not consider likely the displacement of agricultural activities outside the project boundary, so the leakage emission is accounted as zero, given that nondecreasing carbon stocks (biomass and SOC) are expected from lands outside the project boundary associated with those activities.

5.4 Estimated Net GHG Emission Reductions and Removals

Net GHG removals by sink are calculated using the following equation of AR-ACM0003:

$$\Delta C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t$$

Where:

- $\Delta C_{AR-CDM,t}$ = Net anthropogenic GHG removals by sinks, in year t; t CO2-e
- $\Delta C_{ACTUAL,t}$ = Actual net GHG removals by sinks, in year t; t CO2-e
- $\Delta C_{BSL,t}$ = Baseline net GHG removals by sinks, in year t; t CO2-e
- LK_t = GHG emissions due to leakage, in year t; t CO2-e

Ex ante estimations of the net GHG removals by sinks in the first project activity instance are described in the following table.

Table 21. Estimated Net GHG Emission Reductions and Removals

| Year | Estimated baseline emissions or removals (tCO ₂ e) | Estimated project emissions or removals (tCO ₂ e) | Estimated leakage emissions (tCO ₂ e) | Estimated net GHG emission reductions or removals (tCO ₂ e) |
|--------|---|--|--|--|
| Year 0 | 0 | 0 | 0.00 | 0.00 |

| Year | Estimated baseline emissions or removals (tCO ₂ e) | Estimated project emissions or removals (tCO ₂ e) | Estimated leakage emissions (tCO ₂ e) | Estimated net GHG emission reductions or removals (tCO ₂ e) |
|--------------------------|---|--|--|--|
| 11-01-2017 to 10-01-2018 | 2,170 | 4,940 | 0.00 | 2,770 |
| 11-01-2018 to 10-01-2019 | 2,305 | 13,107 | 0.00 | 10,802 |
| 11-01-2019 to 10-01-2020 | 2,525 | 19,689 | 0.00 | 17,164 |
| 11-01-2020 to 10-01-2021 | 0 | 22,980 | 0.00 | 22,980 |
| 11-01-2021 to 10-01-2022 | 1,322 | 29,442 | 0.00 | 28,120 |
| 11-01-2022 to 10-01-2023 | 1,674 | 34,812 | 0.00 | 33,138 |
| 11-01-2023 to 10-01-2024 | 0 | -19,797 | 0.00 | -19,797 |
| 11-01-2024 to 10-01-2025 | 0 | -15,313 | 0.00 | -15,313 |
| 11-01-2025 to 10-01-2026 | 0 | -2,906 | 0.00 | -2,906 |
| 11-01-2026 to 10-01-2027 | 0 | 24,999 | 0.00 | 24,999 |
| 11-01-2027 to 10-01-2028 | 0 | -35,555 | 0.00 | -35,555 |
| 11-01-2028 to 10-01-2029 | 0 | 29,442 | 0.00 | 29,442 |
| 11-01-2029 to 10-01-2030 | 0 | 34,812 | 0.00 | 34,812 |
| 11-01-2030 to 10-01-2031 | 0 | -19,797 | 0.00 | -19,797 |
| 11-01-2031 to 10-01-2032 | 0 | -15,313 | 0.00 | -15,313 |
| 11-01-2032 to 10-01-2033 | 0 | -2,906 | 0.00 | -2,906 |

| Year | Estimated baseline emissions or removals (tCO ₂ e) | Estimated project emissions or removals (tCO ₂ e) | Estimated leakage emissions (tCO ₂ e) | Estimated net GHG emission reductions or removals (tCO ₂ e) |
|--------------------------|---|--|--|--|
| 11-01-2033 to 10-01-2034 | 0 | 24,999 | 0.00 | 24,999 |
| 11-01-2034 to 10-01-2035 | 0 | -35,555 | 0.00 | -35,555 |
| 11-01-2035 to 10-01-2036 | 0 | 29,442 | 0.00 | 29,442 |
| 11-01-2036 to 10-01-2037 | 0 | 34,812 | 0.00 | 34,812 |
| 11-01-2037 to 10-01-2038 | 0 | -20,536 | 0.00 | -20,536 |
| 11-01-2038 to 10-01-2039 | 0 | -16,486 | 0.00 | -16,486 |
| 11-01-2039 to 10-01-2040 | 0 | -4,499 | 0.00 | -4,499 |
| 11-01-2040 to 10-01-2041 | 0 | 23,298 | 0.00 | 23,298 |
| 11-01-2041 to 10-01-2042 | 0 | -37,795 | 0.00 | -37,795 |
| 11-01-2042 to 10-01-2043 | 0 | 27,202 | 0.00 | 27,202 |
| 11-01-2043 to 10-01-2044 | 0 | 32,572 | 0.00 | 32,572 |
| 11-01-2044 to 10-01-2045 | 0 | -22,037 | 0.00 | -22,037 |
| 11-01-2045 to 10-01-2046 | 0 | -17,554 | 0.00 | -17,554 |
| 11-01-2046 to 10-01-2047 | 0 | -5,146 | 0.00 | -5,146 |
| Total | 9997 | 115,355 | 0.00 | 105,358 |

6 MONITORING

6.1 Data and Parameters Available at Validation

| | |
|--|--|
| Data / Parameter | $A_{BSL,i}$ |
| Data unit | ha |
| Description | Area of baseline stratum i, delineated on the basis of tree crown cover at the start of the A/R CDM project activity |
| Source of data | AR-TOOL14 |
| Value applied: | Value depends on each stratum |
| Justification of choice of data or description of measurement methods and procedures applied | GIS or/and GPS |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|--|--|
| Data / Parameter | R_{TREE_BSL} |
| Data unit | Dimensionless |
| Description | Root-shoot ratio for trees in the baseline |
| Source of data | AR-TOOL14 |
| Value applied: | 0.25 |
| Justification of choice of data or description of measurement methods and procedures applied | Default value of AR-TOOL14 is used unless transparent and verifiable information can be provided to justify a different value. |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | |

| | |
|---|--|
| Data / Parameter | $CC_{TREE_BSL,i}$ |
| Data unit | Dimensionless |
| Description | Crown cover of trees in baseline stratum i, at the start of the A/R CDM project activity, expressed as a fraction (e.g., 10 per cent crown cover implies $CC_{TREE_BSL,i} = 0.10$) |
| Source of data | AR-TOOL14 |
| Value applied: | Value depends on each stratum |
| Justification of choice of data or description of measurement methods and procedures applied | GIS or/and GPS |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|--|
| Data / Parameter | CF_{TREE} |
| Data unit | t C (t d.m.) ⁻¹ |
| Description | Carbon fraction of tree biomass |
| Source of data | AR-TOOL14 |
| Value applied: | 0.47 |
| Justification of choice of data or description of measurement methods and procedures applied | Default value of AR-TOOL14 is used unless transparent and verifiable information can be provided to justify a different value. |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|-------------------------|-------------------------------------|
| Data / Parameter | R_j |
| Data unit | Dimensionless |
| Description | Root-shoot ratio for tree species j |

| | |
|--|--|
| Source of data | Fonseca-González, W., Murillo-Cruz, R., Ávila-Arias, C., Rojas-Vargas, M., & Spínola Parallada, R. M. (2021). Modelos de biomasa y carbono para árboles de Gmelina arborea en plantaciones clonales. Revista de Ciencias Ambientales, 55(1), 143–159. https://doi.org/10.15359/rca.55-1.7 |
| Value applied: | 0.26 |
| Justification of choice of data or description of measurement methods and procedures applied | Species-specific values from peer-reviewed literature for plantations grown Gmelina arborea. |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | Source identical with source for BEF. This ensures consistency between the two applied values. Note, that value applied to calculate total biomass from aboveground biomass in ex-ante calculations is 1.26. This factor is derived from the equation: Total biomass = Aboveground biomass * (1+ R _j) = Aboveground biomass + Belowground biomass, Where: Belowground biomass = Aboveground biomass*R _j |

| | |
|--|---|
| Data / Parameter | $V_{TREE,j}(x_{1,l}, x_{2,l}, x_{3,l}, \dots)$ |
| Data unit | m ³ |
| Description | Stem volume of tree l of species j in sample plot p of stratum i, estimated from the tree dimension(s) as entry data into a volume table or volume equation |
| Source of data | Application of the equation to monitoring tree data |
| Value applied: | Result of the application of the equation |
| Justification of choice of data or description of measurement methods and procedures applied | AR-TOOL14 |
| Purpose of Data | Calculation of ex-post project emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | D_j |
| Data unit | t d.m. m ⁻³ |
| Description | Density (over-bark) of tree species j |
| Source of data | Hernández, J. V., & Martínez, H. B. (2004). Variación fenotípica y selección de árboles en una plantación de melina (<i>Gmelina arborea</i> Linn., Roxb.) de tres años de edad. <i>Revista Chapingo. Serie Ciencias Forestales y del Ambiente</i> , 10(1), 13-19. (https://www.redalyc.org/pdf/629/62910102.pdf) |
| Value applied: | 0.370 |
| Justification of choice of data or description of measurement methods and procedures applied | Default value is used unless transparent and verifiable information can be provided to justify different values. |
| Purpose of Data | Calculation of ex-ante emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | $BEF_{2,j}$ |
| Data unit | Dimensionless |
| Description | Biomass expansion factor for conversion of tree stem biomass to above-ground tree biomass |
| Source of data | Fonseca-González, W., Murillo-Cruz, R., Ávila-Arias, C., Rojas-Vargas, M., & Spínola Parallada, R. M. (2021). Modelos de biomasa y carbono para árboles de <i>Gmelina arborea</i> en plantaciones clonales. <i>Revista de Ciencias Ambientales</i> , 55(1), 143–159. https://doi.org/10.15359/rca.55-1.7 |
| Value applied: | 1.21 |
| Justification of choice of data or description of measurement methods and procedures applied | Species-specific values from peer-reviewed literature for plantations grown <i>Gmelina arborea</i> . This value is more conservative than the default value of AR-TOOL14 or IPCC. |
| Purpose of Data | Calculation of ex-ante project emissions/removals |

| | |
|-----------------|--|
| Comments | Source identical with source for root-to-shoot ratio. This ensures consistency between the two applied values. |
|-----------------|--|

| | |
|---|---|
| Data / Parameter | CF_s |
| Data unit | t C (t.d.m.) ⁻¹ |
| Description | Carbon fraction of shrub biomass |
| Source of data | AR-TOOL14 |
| Value applied: | 0.47 |
| Justification of choice of data or description of measurement methods and procedures applied | A default value of is used unless transparent and verifiable information can be provided to justify a different value |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | $A_{SHRUB,i}$ |
| Data unit | Ha |
| Description | Area of shrub biomass estimation stratum i; |
| Source of data | Application of the equation to monitoring shrub data |
| Value applied: | Result of the application of the equation |
| Justification of choice of data or description of measurement methods and procedures applied | - |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | $b_{SHRUB,i}$ |
| Data unit | t d.m. ha ⁻¹ |
| Description | Shrub biomass per hectare in shrub biomass estimation stratum i |
| Source of data | Application of the equation to monitoring shrub data |
| Value applied: | Result of the application of the equation |
| Justification of choice of data or description of measurement methods and procedures applied | AR-TOOL14 |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | R_s |
| Data unit | Dimensionless |
| Description | Root-shoot ratio for shrubs |
| Source of data | AR-TOOL14 |
| Value applied: | 0.40 |
| Justification of choice of data or description of measurement methods and procedures applied | The default value is used unless transparent and verifiable information can be provided to justify a different value. |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|--|
| Data / Parameter | BDR_{SF} |
| Data unit | Dimensionless |
| Description | Ratio of shrub biomass per hectare in land having a shrub crown cover of 1.0 (i.e. 100 per cent) and the default above-ground biomass content per hectare in forest in the region/country where the A/R CDM project activity is located. |
| Source of data | AR-TOOL14 |
| Value applied: | 0.10 |
| Justification of choice of data or description of measurement methods and procedures applied | A default value is used unless transparent and verifiable information can be provided to justify a different value. |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | b_{FOREST} |
| Data unit | t d.m. ha ⁻¹ |
| Description | Default above-ground biomass content in forest in the region/country where the A/R CDM project is located |
| Source of data | Table 3A.1.4 of IPCC GPG-LULUCF 2003 |
| Value applied: | 54 |
| Justification of choice of data or description of measurement methods and procedures applied | Default values from Table 3A.1.4 of IPCC GPG-LULUCF 2003 |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | DF_{DW} |
| Data unit | per cent |
| Description | Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass |
| Source of data | AR-TOOL12, Data / Parameter table 5. |
| Value applied: | 6/2 |
| Justification of choice of data or description of measurement methods and procedures applied | <p>The most conservative value for tropical biome, elevation below 2000 m and precipitation over 1600mm has been selected from the table (value 6).</p> <p>The most conservative value for tropical biome, elevation below 2000 m and precipitation less than 1000 mm has been selected from the table (value 2).</p> |
| Purpose of Data | Calculation of ex-post project emissions/removals |
| Comments | - |

| | |
|---|---|
| Data / Parameter | DF_{LI} |
| Data unit | per cent |
| Description | Conservative default factor expressing carbon stock in dead wood as a percentage of carbon stock in tree biomass |
| Source of data | AR-TOOL12, Data / Parameter table 6. |
| Value applied: | $\frac{1}{4}$ |
| Justification of choice of data or description of measurement methods and procedures applied | <p>The most conservative value for tropical biome, elevation below 2000 m and precipitation over 1600mm has been selected from the table (value 1).</p> <p>The most conservative value for tropical biome, elevation below 2000 m and precipitation less than 1000 mm has been selected from the table (value 4).</p> |
| Purpose of Data | Calculation of ex-ante and ex-post project emissions/removals |
| Comments | - |

| | |
|---|--|
| Data / Parameter | <i>COMFi</i> |
| Data unit | Dimensionless |
| Description | Combustion factor for stratum i |
| Source of data | CDM A/R Methodological Tool “Estimation of non-CO ₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 04.0.0) |
| Value applied: | Default value depending on the age: 3-5 years = 0.46; 6-10 years = 0.67; 11-17 years = 0.5 ; ≥ 18 years = 0.32 (unless transparent and verifiable information can be provided to justify a different value) |
| Justification of choice of data or description of measurement methods and procedures applied | <p>Default emission factor for tropical forest from the CDM A/R tool. If transparent and verifiable information can be provided, then different values may be selected from the following sources, in order of preference.</p> <p>(a) Project-specific calculation, regional/national inventories e.g. national forest inventory, national GHG inventory.</p> <p>(b) Inventory from neighbouring countries with similar conditions.</p> <p>(c) Globally available data applicable to the project site or to the region/country where the site is located</p> |
| Purpose of Data | Calculation of ex-post project emissions |
| Comments | - |

| | |
|--|--|
| Data / Parameter | <i>EF_{CH₄,i}</i> |
| Data unit | g kg ⁻¹ dry matter burnt |
| Description | Emission factor for CH ₄ in stratum i |
| Source of data | CDM A/R Methodological Tool “Estimation of non-CO ₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 04.0.0) |
| Value applied: | 6.8 (unless transparent and verifiable information can be provided to justify a different value) |
| Justification of choice of data or description of | Default emission factor for tropical forest from the CDM A/R tool. If transparent and verifiable information can be provided, then different |

| | |
|---|---|
| measurement methods and procedures applied | <p>values may be selected from the following sources, in order of preference.</p> <p>(a) Project-specific calculation, regional/national inventories e.g. national forest inventory, national GHG inventory.</p> <p>(b) Inventory from neighbouring countries with similar conditions.</p> <p>(c) Globally available data applicable to the project site or to the region/country where the site is located</p> <p>(d) Default values as follows: Tropical Forest=6.8</p> |
| Purpose of Data | Calculation of ex-post project emissions |
| Comments | - |

| | |
|---|--|
| Data / Parameter | GWP_{CH_4} |
| Data unit | Dimensionless |
| Description | Global warming potential for CH ₄ |
| Source of data | CDM A/R Methodological Tool “Estimation of non-CO ₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 04.0.0) |
| Value applied: | 28 |
| Justification of choice of data or description of measurement methods and procedures applied | Default value in the CDM A/R Methodological Tool. |
| Purpose of Data | Calculation of ex-post project emissions |
| Comments | - |

| | |
|-------------------------|--|
| Data / Parameter | $EF_{N_2O,i}$ |
| Data unit | g kg ⁻¹ dry matter burnt |
| Description | Emission factor for N ₂ O in stratum i; |
| Source of data | CDM A/R Methodological Tool “Estimation of non-CO ₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 04.0.0) |

| | |
|---|--|
| Value applied: | 0.20 |
| Justification of choice of data or description of measurement methods and procedures applied | <p>Default emission factor for tropical forest from the CDM A/R tool. If transparent and verifiable information can be provided, then different values may be selected from the following sources, in order of preference.</p> <p>(a) Regional/national inventories e.g. national forest inventory, national GHG inventory.</p> <p>(b) Inventory from neighbouring countries with similar conditions.</p> <p>(c) Globally available data applicable to the project site or to the region/country where the site is located.</p> <p>(d) Default values as follows: Tropical Forest=0.20</p> |
| Purpose of Data | Calculation of ex-post project emissions |
| Comments | - |

| | |
|---|--|
| Data / Parameter | GWP_{N2O} |
| Data unit | Dimensionless |
| Description | Global warming potential for N ₂ O |
| Source of data | CDM A/R Methodological Tool “Estimation of non-CO ₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” (Version 04.0.0) |
| Value applied: | 265 |
| Justification of choice of data or description of measurement methods and procedures applied | Default value in the CDM A/R Methodological Tool. |
| Purpose of Data | Calculation of ex-post project emissions |
| Comments | - |

| | |
|---|---|
| Data / Parameter | SOC_{REF} |
| Data unit | t C ha ⁻¹ |
| Description | SOC stock corresponding to the reference condition in native lands by climate region and soil type applicable to the land receiving the displaced activity. |
| Source of data | The value of this parameter is taken from Table 3 of the “Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities” |
| Value applied: | 65/38 |
| Justification of choice of data or description of measurement methods and procedures applied | Default reference SOC stocks value for tropical moist biome and soils with low activity clay (HAC) minerals (value 65). Default reference SOC stocks value for tropical dry biome and soils with low activity clay (HAC) minerals (value 38) . |
| Purpose of Data | Calculation of project emissions/removals and leakage (ex-ante and ex-post) |
| Comments | - |

| | |
|---|---|
| Data / Parameter | f_{LU} |
| Data unit | Dimensionless |
| Description | Relative SOC stock change factors for baseline land-use. |
| Source of data | A/R CDM Tool ‘tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities’ |
| Value applied: | Cropland: 0.82 for short term cultivation and temperate/boreal and moist/wet biome Cropland: 0.93 for short term cultivation and temperate/boreal and dry biome. This value represents the most conservative assumption. Grassland: 1 |
| Justification of choice of data or description of measurement methods and procedures applied | Cropland: Value from table 4 of the tool, short term cultivation in tropical moist and tropical dry climate region Grassland: Value from table 6 of the tool, unique value. |

| | |
|---|--|
| Purpose of Data | Calculation of project emissions/removals and leakage (ex-ante and ex-post) |
| Comments | For leakage calculation different values may be applied depending on the characteristics of potential displacements |
| Data / Parameter | f_{MG} |
| Data unit | Dimensionless |
| Description | Relative SOC stock change factors for baseline management. |
| Source of data | A/R CDM Tool 'tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities' |
| Value applied: | Cropland: 1.15 for tropical moist biome Cropland: 1.09 for tropical dry biome Grassland: 1 |
| Justification of choice of data or description of measurement methods and procedures applied | Cropland: Value from table 6 of the tool, reduced tillage in tropical moist and tropical dry climate region Grassland: Value from table 6 of the tool, non -degraded lands. This represents the most conservative assumption. |
| Purpose of Data | Calculation of project emissions/removals and leakage (ex-ante and ex-post) |
| Comments | For leakage calculation different values may be applied depending on the characteristics of potential displacements |
| Data / Parameter | f_{IN} |
| Data unit | Dimensionless |
| Description | Relative SOC stock change factors for baseline inputs regime. |
| Source of data | A/R CDM Tool 'tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities' |
| Value applied: | Cropland: 0.92 for tropical moist biome Cropland: 0.95 for tropical dry biome Grassland: 1 |
| Justification of choice of data or description of | Cropland: Value from table 5 of the tool, low nutrient input in tropical moist and tropical dry climate region |

| | |
|---|---|
| measurement methods and procedures applied | Grassland: Value from table 6 of the tool, low nutrient input in tropical moist climate region. |
| Purpose of Data | Calculation of project emissions/removals and leakage (ex-ante and ex-post) |
| Comments | For leakage calculation different values may be applied depending on the characteristics of potential displacements |

6.2 Data and Parameters Monitored

Complete the table below for all data and parameters to be monitored during the project crediting period (copy the table as necessary for each data/parameter). The values provided are used to estimate the net GHG emissions and removals for the project crediting period in Section 4 above. Data and parameters determined or available at validation are included in Section 5.1 (Data and Parameters Available at Validation) above.

| | |
|--|---|
| Data / Parameter | A_i |
| Data unit | Ha |
| Description | Area of tree biomass estimation stratum i |
| Source of data | GIS or/and GPS |
| Description of measurement methods and procedures applied | Areas in project area has been tracked in the field using the GPS. |
| Frequency of monitoring/recording | Before the start of the project (planting) and adjusted thereafter every monitoring since the year of the initial verification |
| Value applied: | See section 4.2 of this PD including the stratification |
| Monitoring equipment | GPS (Garmin), GPS Smartphones and GIS. |
| QA/QC procedures applied | Field-team members are fully aware of all procedures and the importance of collecting data as accurately as possible; all field team members are trained in GPS/GIS application |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | GIS tool |

| | |
|-----------------|---|
| Comments | - |
|-----------------|---|

| | |
|--|---|
| Data / Parameter | $ASHRUB_i$ |
| Data unit | Ha |
| Description | Area of shrub biomass estimation stratum i |
| Source of data | GIS or/and GPS |
| Description of measurement methods and procedures applied | Areas in project area will be tracked in the field using the GPS. All the project area is considered potential area of shrub biomass. |
| Frequency of monitoring/recording | Before the start of the project (planting) and adjusted thereafter every three years since the year of the initial verification |
| Value applied: | See section 4.2 of this PD including the stratification. |
| Monitoring equipment | GPS (Garmin), GPS Smartphones and GIS. |
| QA/QC procedures applied | Field-team members are fully aware of all procedures and the importance of collecting data as accurately as possible; all field team members are trained in GPS/GIS application |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | GIS tool |
| Comments | - |

| | |
|-------------------------|---|
| Data / Parameter | w_i |
| Data unit | Dimensionless |
| Description | Ratio of the area of stratum i to the sum of areas of tree biomass estimation strata. |
| Source of data | Calculated |

| | |
|---|---|
| Description of measurement methods and procedures applied | N/A |
| Frequency of monitoring/recording | Calculated for each monitoring event, at least every five years |
| Value applied: | See ex-post w_i in section 6.3. of this PD. |
| Monitoring equipment | N/A |
| QA/QC procedures applied | N/A |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | Area of the stratum i divided by the project area |
| Comments | - |

| | |
|---|--|
| Data / Parameter | n_i |
| Data unit | Dimensionless |
| Description | Number of sample plots in stratum i |
| Source of data | Calculated |
| Description of measurement methods and procedures applied | N/A |
| Frequency of monitoring/recording | n_i is calculated for each monitoring event, at least every five years |
| Value applied: | See monitoring plan in section 5.3. of this PD. |
| Monitoring equipment | N/A |
| QA/QC procedures applied | N/A |

| | |
|---------------------------|---|
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | The calculation method is described in the tool “Calculation of the number of sample plots for measurements within A/R CDM project activities” (version 02.1.0) ⁵⁷ |
| Comments | - |

| | |
|--|--|
| Data / Parameter | s_i |
| Data unit | t d.m. (or t d.m. ha ⁻¹) |
| Description | Estimated standard deviation of biomass stock in stratum i |
| Source of data | Sampling or default value |
| Description of measurement methods and procedures applied | N/A |
| Frequency of monitoring/recording | s_i is calculated for each monitoring event, at least every five years |
| Value applied: | See ex-post n in section 6.3. of this PD. |
| Monitoring equipment | N/A |
| QA/QC procedures applied | N/A |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | Excel or tool available to calculate standard deviation |
| Comments | Provide any additional comments |

⁵⁷ Annex 15 of the Executive Board report at its 58th meeting.

| | |
|--|--|
| Data / Parameter | $APLOT_i$ |
| Data unit | Ha |
| Description | Size of sample plot in stratum i |
| Source of data | Calculated |
| Description of measurement methods and procedures applied | <p>After calculating the number of sample plots required to achieve the desired precision level (90/10) a stratified random selection is carried out. One type of plot sizes has been considered for the first monitoring of the first project activity instance:</p> <p>Circular plot $r=10$ m</p> |
| Frequency of monitoring/recording | $APLOT_i$ is calculated for each monitoring event, at least every five years |
| Value applied: | Area: 0.0314 ha, circular plot $r = 10$ m |
| Monitoring equipment | N/A |
| QA/QC procedures applied | Field-team members are fully aware of all procedures and the importance of collecting data as accurately as possible; all field team members are trained in GPS/GIS application |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | $APLOT_i$ will be calculated depending on the expected density (trees/ha) in each stratum, with the objective of having from 15 to 20 trees per sample plot. |
| Comments | - |

| | |
|--|--|
| Data / Parameter | X_i |
| Data unit | Variable |
| Description | Variables measured per tree for the calculation of above-ground biomass an allometric equation for species |
| Source of data | Measured |
| Description of measurement methods and procedures applied | Depending on the variable |
| Frequency of monitoring/recording | Measured every monitoring event, at least every five years |
| Value applied: | N/A |
| Monitoring equipment | Depending on the variable (tape, calliper, etc.) |
| QA/QC procedures applied | Quality control/quality assurance (QA/QC) procedures prescribed in the SOP are applied. In absence of this, QA/QC procedures under national forest inventory; QA/QC procedures from published handbooks; or from the IPCC GPG LULUCF 2003, are applied |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | N/A |
| Comments | See section 6.1 for parameters of the first monitoring of the first project activity instance. |

| | |
|--|--|
| Data / Parameter | T |
| Data unit | Year |
| Description | Time period elapsed between two successive estimations of carbon stock in a carbon pool |
| Source of data | Recorded time |
| Description of measurement methods and procedures applied | N/A |
| Frequency of monitoring/recording | N/A |
| Value applied: | N/A |
| Monitoring equipment | N/A |
| QA/QC procedures applied | N/A |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | N/A |
| Comments | If the two successive estimations of carbon stock in trees are carried out at different points of time in year t_2 and t_1 , (e.g. in the month of April in year t_1 and in the month of September in year t_2), then a fractional value is assigned to T . See section 6.1 for value applied in the first monitoring of the first project activity instance. |

| | |
|--|---|
| Data / Parameter | $ABURN_{i,t}$ |
| Data unit | Ha |
| Description | Area burnt in stratum i |
| Source of data | Field measurement, remote sensing measurement or any other spatial information available |
| Description of measurement methods and procedures applied | The area shall be delineated either on the ground using GPS, from georeferenced remote sensing data or from any other spatial information available |
| Frequency of monitoring/recording | This area is measured whenever forest fire has occurred |

| | |
|---------------------------------|--|
| Value applied: | N/A |
| Monitoring equipment | GPS (if applied) |
| QA/QC procedures applied | Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | N/A |
| Comments | Only used in case wild fires occur. |

| | |
|--|--|
| Data / Parameter | $ADISP,t$ |
| Data unit | Ha |
| Description | Area of land from which agricultural activity is being displaced in year t |
| Source of data | Field measurement. |
| Description of measurement methods and procedures applied | Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied |
| Frequency of monitoring/recording | At every verification |
| Value applied: | N/A |
| Monitoring equipment | GPS |
| QA/QC procedures applied | Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied |
| Purpose of data | Calculation of leakage |

| | |
|---|--|
| Calculation method | N/A |
| Comments | Not expected in the first project activity instances. |
| Data / Parameter | $CC_{SHRUB,i}$ |
| Data unit | Dimensionless |
| Description | Crown cover of shrubs in shrub biomass estimation stratum i at the time of estimation, expressed as a fraction (e.g. 10 per cent crown cover implies= 0.10) |
| Source of data | Field measurement. |
| Description of measurement methods and procedures applied | Standard operating procedures (SOPs) prescribed under national forest inventory are applied. In the absence of these, SOPs from published handbooks, or from the IPCC GPG LULUCF 2003, may be applied |
| Frequency of monitoring/recording | At every verification |
| Value applied: | N/A |
| Monitoring equipment | GPS |
| QA/QC procedures applied | Quality control/quality assurance (QA/QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA/QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied |
| Purpose of data | Calculation of project emissions/removals |
| Calculation method | N/A |
| Comments | - |

6.3 Monitoring Plan

Following the selected methodology (AR-ACM0003-Version 02.0) requirements, the monitoring plan provides the necessary guidelines for the collection of all relevant data necessary for:

- Verification that the applicability conditions of the methodology have been met: some applicability conditions of the methodology and of the applied tools have been demonstrated ex-ante (see section 2.2) and some others will be verified in the monitoring of the project boundary and of forest establishment.

During the monitoring it will be demonstrated that:

- a. The land subject to the project activity does not fall in wetland category.
 - b. Soil disturbance attributable to the ARR project activity does not cover more than 10 % of area
- Verification of changes in carbon stocks in the pools selected: methodology described in the monitoring process described below in the sub-section “Monitoring of net anthropogenic GHG removals”.
 - Verification of project emissions and leakage emissions: methodology described in the monitoring process described below in the sub-section “Monitoring of net anthropogenic GHG removals”.

This project is part of the portfolio of the PROXYLO S.A.P.I DE C.V and for the monitoring process it will follow the Monitoring of PROXYLO Projects Series – Operating Procedures. These procedures consist in several guidance documents for all monitoring phases: Mapping and stratifying; Pilot inventory; Field work planning; Field work; etc.

The following subsections contain a summary description of the monitoring plan, further information on specific issues is included in the mentioned Operating Procedures.

STRATIFICATION AND SAMPLING DESIGN

Stratification

Biomass distribution over the project area is not homogeneous; therefore, stratification should be carried out to improve the precision of biomass estimation. Different stratifications may be required for the baseline and the project scenarios always looking for higher homogeneity inside each stratum to improve precision.

In the first project activity instance only five strata have been considered in baseline estimations (see section 4.1.).

In the case of actual net GHG removals by sinks the stratification for ex ante estimations is based on the project planting plan (see sections 4.4).

Table 22 Stratification of first project activity instance

| Planting yea | Species | Stratum | Area (ha) | Area (%) |
|--------------|------------------------|---------|-----------|----------|
| 2017 | <i>Gmelina arborea</i> | 1 | 314.42 | 26% |
| 2018 | | 2 | 264.42 | 22% |
| 2019 | | 3 | 196.83 | 16% |
| 2020 | | 4 | 41.36 | 3% |
| 2021 | | 5 | 197.79 | 16% |
| 2021 | | 6 | 204.18 | 17% |
| Total | | | 1219.01 | 100% |

The ex post stratification will be updated periodically, if necessary, because different events are likely to affect current strata: unexpected disturbances occurring during the crediting period affecting differing impacts on various parts of an originally homogenous stratum; two or more different strata may be similar enough to allow their merging into one stratum; etc.

Sampling procedure

Carbon sampling will take place within the stratified project area. The project will use temporary or permanent sample plots to monitor carbon stock changes in different carbon pools. The number of sample plots will be calculated to reach the targeted precision level of $\pm 10\%$ of the mean of the measured variables at the 90% confidence level in a cost-effective manner, using the last version of the ⁵⁸CDM A/R Methodological Tool “Calculation of the number of sample plots for measurements within A/R CDM project activities”.

Ex-post, the number of plots needed in each stratum will be estimated using the A/R Methodological Tool “Calculation of the number of sample plots for measurements within A/R CDM project activities” (Version 02.1.0). According to the tool the number of sample plots will be calculated iteratively. In the first iteration, the number of sample plots for the project area will be calculated applying equation 1 of this tool:

⁵⁸A/R Methodological Tool Calculation of the number of sample plots for measurements within A/R CDM project activities (Version 02.1.0)

[CDM: Calculation of the number of sample plots for measurements within A/R CDM project activities \(unfccc.int\)](https://unfccc.int/)

$$n = \frac{N \times t_{val}^2 \times (\sum_i w_i \times s_i)^2}{N \times E^2 + t_{val}^2 \times \sum_i w_i \times s_i^2}$$

Where:

- n = Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless
- N = Total number of possible sample plots within the project boundary (i.e. the sampling space or the population); dimensionless
- t_{val} = Two-sided Student's t-value at infinite degrees of freedom for the required confidence level; dimensionless
- E = Acceptable margin of error (i.e. one-half the confidence interval) in estimation of biomass stock within the project boundary; t d.m. (or t d.m. ha-1)
- w_i = Relative weight of the area of stratum i (i.e. the area of the stratum i divided by the project area); dimensionless
- s_i = Estimated standard deviation of biomass stock in stratum i; t d.m. (or t d.m. ha-1)

If the number of sample plots n calculated in the first iteration using equation 1 is less than 30, then equation 1 is applied in the second iteration using the t-value for degrees of freedom equal to $(n-1)$. The value of n obtained in the second iteration is the final value of n . If the number calculated in the first iteration is 30 or more, then no further iteration is carried out

Based on the tool, when the area sampled is expected to be less than 5% of the project area, the following simplified equation has to been used for estimating the number of sample plots:

$$n = \left(\frac{t_{val}}{E}\right)^2 \times (\sum w_i \times s_i)^2 \quad \text{(Equation 2 of the tool)}$$

Where:

- n = Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless
- t_{val} = Two-sided Student's t-value at infinite degrees of freedom for the required confidence level; dimensionless
- E = Acceptable margin of error (i.e. one-half the confidence interval) in estimation of biomass stock within the project boundary; t d.m. (or t d.m. ha-1)
- w_i = Relative weight of the area of stratum i (i.e. the area of the stratum i divided by the project area); dimensionless

s_i = Estimated standard deviation of biomass stock in stratum i ; t d.m. (or t d.m. ha⁻¹)

Before each monitoring, a pre-monitoring will be conducted to obtain the necessary parameters to use the tool (such as the mean and standard deviation of total carbon stock for each stratum).

In the case of the first monitoring not pilot inventory has been done to estimate the parameters necessary to calculate the number of sample plots, as an alternative expert opinion has been considered. Discount rates indicated in Appendix 2 of AR-TOOL 14 will be considered if the sampling error is higher than expected.

The following table shows the number of sample plots designed per stratum.

Table 23. Number of sample plots per stratum used in the monitoring of the first project activity instance.

| Planting year | Species | Stratum | Area (ha) | w _i | n _i |
|---------------|------------------------|---------|-----------|----------------|----------------|
| 2017 | <i>Gmelina arborea</i> | I | 314.42 | 0.26 | 343 |
| 2018 | | II | 264.42 | 0.22 | 341 |
| 2019 | | III | 196.83 | 0.16 | 267 |
| 2020 | | IV | 41.36 | 0.03 | 41 |
| 2021 | | X | 197.79 | 0.16 | |
| 2021 | | XI | 204.18 | 0.17 | |
| Total | | | 1,219.01 | 1,00 | 992 |

Thus, when the uncertainty in the estimated mean value of a parameter is more than 10 %, the estimated mean value is either increased or decreased by a percentage of the uncertainty. Table 1 in of AR-TOOL 14 provides the uncertainty discount factors to be applied for different ranges of uncertainty.

Table 24. Uncertainty discount factors

| Uncertainty | Discount (% of U) |
|-----------------------|-------------------|
| $U \leq 10\%$ | 0% |
| $10\% < U \leq 15\%$ | 25% |
| $15\% < U \leq 20\%$ | 50% |
| $200\% < U \leq 25\%$ | 75% |
| $U > 30\%$ | 100% |

MONITORING OF NET ANTHROPOGENIC GHG REMOVALS

Ex post estimation of the baseline net GHG removals by sinks

The baseline net GHG removals by sinks are estimated following AR-TOOL14. Baseline net GHG removals by sinks will not be monitored during the crediting period.

Ex post estimation of the actual net GHG removals by sinks

The project participants will put in place a unit dedicated to the monitoring processes. This unit will benefit from the expertise of a forest carbon specialist who will oversee the design and calculations of the monitoring. International consultants will support this unit in its initial phase, with the goal of internalizing the right know-how.

Project boundary

The unit will determine any changes in carbon stocks via measuring and monitoring of the project area that has been planted. The size of the project area in each stratum where the project activity has been implemented will be measured in the field using GPS and checked and recorded using GIS tools. This will be performed once before the first verification. In following monitoring processes any changes in project boundary will be accounted in all calculations of actual net GHG removals by sinks.

Forest establishment

Forest establishment will be monitored, reporting the verification that plantation has been performed.

This activity will be monitored once after the plantation period and recorded in a database (during the first 5 years).

Estimation of actual net GHG removals

- Changes in carbon stocks in tree and shrub biomass: once the project area is stratified and the sampling design is accomplished, ex-post changes in carbon stocks in tree and shrub biomass will be estimated according to AR-TOOL14. In the estimation of tree biomass, it would be necessary to find species-specific volume or allometric equations or develop own ones. When using volume or allometric equations for the estimation of biomass stock and stock change, it would be necessary to measure in all trees included inside the designed sampling plots the variables required by the selected equation. Usually, these variables are diameter at breast height (DBH) and total tree height (H). DBH should be measured with a calliper, a diameter tape, a measuring tape, or any other technique able to provide an accurate measurement of the variable. In the case of H it is recommended the use of hypsometer, clinometer and measuring tape, or any other technique able to provide an accurate measurement of the variable. The area of each sample plot is a key factor in biomass inventories, it is recommended to estimate it based on the tree density (the number of trees per sample plot should be around 20 in order to have a good estimation of the mean living biomass per plot).
- Changes in carbon stocks in deadwood will be calculated based on AR-AM0012 and monitoring will be performed based on this tool. When conservative default-factor based method is selected, then no monitoring of data and parameters will be required.
- Changes in carbon stocks in soil organic carbon pools will be done using the default methods proposed in AR-AM0016, therefore no monitoring is needed.
- GHG emissions within the project boundary: the only source of GHG emission considered in the selected methodology is burning of biomass attributable to the project activity and it will be calculated using the A/R CDM Methodological tool: “Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity, (Version 04.0.0)”.

Ex post estimation of leakage

Displacement of agricultural activities will be monitored based on AR-TOOL15.

Ex post estimation of the net anthropogenic GHG removals

The net anthropogenic greenhouse gas removals by sinks will be calculated based on the selected methodology as the actual net greenhouse gas removals by sinks minus the baseline net greenhouse gas removals by sinks minus leakage as appropriate.

QUALITY CONTROL AND QUALITY ASSURANCE (QA/QC) PROCEDURES

A rigid quality control and quality assurance (QA/QC) method involving Standard Operating Procedures will be implemented to ensure: (i) reliability of collection of field measurements, (ii) verification of the methods used to collect field data, (iii) verification of data entry and analysis techniques, (iv) verification of data maintenance and archiving and (v) upgrading of electronic data with technological changes, shall be followed as discussed below.

Procedures to ensure reliable field measurements.

Collecting reliable field measurement data is an important step in the quality assurance plan. Those responsible for the measurement work will be trained in all aspects of the field data collection and data analyses. It is good practice to develop Standard Operating Procedures (SOPs) for each step of the field measurements, which should be always adhered to. These SOPs describe in detail all steps to be taken of the field measurements and contain provisions for documentation for verification purposes so that future field personnel can check past results and repeat the measurements in a consistent way. For biomass monitoring it would be necessary to measure in the inventory sample plots the parameters of trees and shrub required in the selected equations. To secure the quality of the standard operating the collection and maintenance of reliable field data:

- Field-team members will be fully aware of all procedures and the importance of collecting data as accurately as possible.
- New staff will be adequately trained; and
- Field teams will install test plots if needed in the field and measure all pertinent components using the SOPs to estimate measurement errors.

Procedures to verify field data collection

To verify that sample plots have been installed and the measurements taken correctly, a re-measurement of a percentage (e.g. 5%) of the plots by different crew members from the original field crews will be performed at the end of the fieldwork. Key data points to be re-measured are location and size of sample plots, number of trees per plot and tree's variables (e.g. DBH, and heights). The verifying crew will be experienced in forest measurement and highly attentive to details. Field data collected at this stage will be compared with the original data. Any errors found will be corrected and recorded. Any errors discovered will be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error.

Procedures to verify data entry and analysis

The field data will be collected in each of the PSP with an iPad 11 by using the software ArboReal. The software measures diameters and heights of the trees within the PSP and generates an Excel file with the data captured. Today's AR technology makes it easy and reliable to perform forest measurements without the need to use pen and paper, this minimizes possible errors in the process.

Communication between all personnel involved in measuring and analysing data will be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot will not be used in the analysis.

In an additional check, another independent person will enter data from a percentage (e.g. 5%) of the excel data into the data analysis software. These two data sets can then be compared to check for errors. Any errors detected will be corrected in the master file. If the calculated measurement error is greater than a defined percentage (e.g. 10%), then all data will be re-entered.

Data maintenance and storage

Because of the relatively long-term nature of these project activities, data archiving will be an important component of the work. Data archiving should take on several forms and, copies of all data should be provided to each project participant.

Copies (electronic and/or paper) of all field data, data analyses and models, estimates of the changes in carbon stocks and corresponding calculations and models used, any GIS products, as well as copies of the measuring and monitoring reports, should all be stored in a dedicated and safe place, preferably offsite. Given the time frame over which the project activity will take place and the pace of production of updated versions of software and new hardware for storing data, it is recommended that the electronic copies of the data and report be updated periodically or converted to a format that could be accessed by any future software application. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period of the project activity.

OPERATIONAL AND MANAGEMENT STRUCTURE

A Monitoring Unit staffed with well-trained members will conduct monitoring (field survey, data collection, QA/QC, GHG removals, etc.). The Monitoring Unit will have the following structure:

- **Monitoring teams:** Considering the amount of information to be collected and the tasks required, a forest inventory field crew is composed by at least two members, one for Tabasco and one Tamaulipas, respectively. Additional people may be included to improve performance of the field crews when conditions require greater resources. It is intended that the field crews are hired locally and act as guides in the field. These teams will be coordinated by the implementing partner (PROXYLO in the case of the first activity instances).
- **Coordination:** in charge of the coordination of the monitoring teams and interface with the person in charge of quality and data analysis. This coordinator, from the implementing partner, will be responsible of team training, data quality, data treatment and storage, and technical and logistics management.
- **Forest carbon expert:** in charge of GHG removals and QC/QA calculations.
- **A series of manuals** will be specifically designed for the project monitoring to ensure the quality of the field work. Data will be processed and calculated in accordance with the applied methodology. The monitoring report will be elaborated by the Monitoring Unit and will be sent to the VVB for verification.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

| Data / Parameter | <i>A_i</i> | | | | | | | | | | | | | | | |
|-------------------------|--|---------|------------------|---|--------|---|--------|---|--------|---|-------|---|--------|---|--------|--|
| Data unit | Ha | | | | | | | | | | | | | | | |
| Description | Area of tree biomass estimation stratum <i>i</i> | | | | | | | | | | | | | | | |
| Value applied: | <table border="1"> <thead> <tr> <th>Stratum</th> <th>A_i)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>314.42</td> </tr> <tr> <td>2</td> <td>264.42</td> </tr> <tr> <td>3</td> <td>196.83</td> </tr> <tr> <td>4</td> <td>41.36</td> </tr> <tr> <td>5</td> <td>197.79</td> </tr> <tr> <td>6</td> <td>204.18</td> </tr> </tbody> </table> | Stratum | A _i) | 1 | 314.42 | 2 | 264.42 | 3 | 196.83 | 4 | 41.36 | 5 | 197.79 | 6 | 204.18 | |
| Stratum | A _i) | | | | | | | | | | | | | | | |
| 1 | 314.42 | | | | | | | | | | | | | | | |
| 2 | 264.42 | | | | | | | | | | | | | | | |
| 3 | 196.83 | | | | | | | | | | | | | | | |
| 4 | 41.36 | | | | | | | | | | | | | | | |
| 5 | 197.79 | | | | | | | | | | | | | | | |
| 6 | 204.18 | | | | | | | | | | | | | | | |
| Comments | - | | | | | | | | | | | | | | | |

| Data / Parameter | $A_{SHRUB,i}$ | | | | | | | | | | | | | | |
|-------------------------|--|---------|---------------|---|--------|---|--------|---|--------|---|-------|---|--------|---|--------|
| Data unit | Ha | | | | | | | | | | | | | | |
| Description | Area of shrub biomass estimation stratum i | | | | | | | | | | | | | | |
| Value applied: | <table border="1"> <thead> <tr> <th>Stratum</th> <th>$A_{SHRUB,i}$</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>314.42</td> </tr> <tr> <td>2</td> <td>264.42</td> </tr> <tr> <td>3</td> <td>196.83</td> </tr> <tr> <td>4</td> <td>41.36</td> </tr> <tr> <td>5</td> <td>197.79</td> </tr> <tr> <td>6</td> <td>204.18</td> </tr> </tbody> </table> | Stratum | $A_{SHRUB,i}$ | 1 | 314.42 | 2 | 264.42 | 3 | 196.83 | 4 | 41.36 | 5 | 197.79 | 6 | 204.18 |
| Stratum | $A_{SHRUB,i}$ | | | | | | | | | | | | | | |
| 1 | 314.42 | | | | | | | | | | | | | | |
| 2 | 264.42 | | | | | | | | | | | | | | |
| 3 | 196.83 | | | | | | | | | | | | | | |
| 4 | 41.36 | | | | | | | | | | | | | | |
| 5 | 197.79 | | | | | | | | | | | | | | |
| 6 | 204.18 | | | | | | | | | | | | | | |
| Comments | Same strata for tree and shrub biomass have been considered | | | | | | | | | | | | | | |

| Data / Parameter | w_i | | | | | | | | | | | | | | |
|-------------------------|---|---------|-------|---|------|---|------|---|------|---|------|---|------|---|------|
| Data unit | Dimensionless | | | | | | | | | | | | | | |
| Description | Ratio of the area of stratum i to the sum of areas of tree biomass estimation strata. | | | | | | | | | | | | | | |
| Value applied: | <table border="1"> <thead> <tr> <th>Stratum</th> <th>w_i</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.26</td> </tr> <tr> <td>2</td> <td>0.22</td> </tr> <tr> <td>3</td> <td>0.16</td> </tr> <tr> <td>4</td> <td>0.03</td> </tr> <tr> <td>5</td> <td>0.16</td> </tr> <tr> <td>6</td> <td>0.17</td> </tr> </tbody> </table> | Stratum | w_i | 1 | 0.26 | 2 | 0.22 | 3 | 0.16 | 4 | 0.03 | 5 | 0.16 | 6 | 0.17 |
| Stratum | w_i | | | | | | | | | | | | | | |
| 1 | 0.26 | | | | | | | | | | | | | | |
| 2 | 0.22 | | | | | | | | | | | | | | |
| 3 | 0.16 | | | | | | | | | | | | | | |
| 4 | 0.03 | | | | | | | | | | | | | | |
| 5 | 0.16 | | | | | | | | | | | | | | |
| 6 | 0.17 | | | | | | | | | | | | | | |
| Comments | - | | | | | | | | | | | | | | |

| Data / Parameter | n_i | | | | | | | | | | | | | | |
|-------------------------|--|---------|-------|---|-----|---|-----|---|-----|---|----|---|--|---|--|
| Data unit | Dimensionless | | | | | | | | | | | | | | |
| Description | Number of sample plots in stratum i | | | | | | | | | | | | | | |
| Value applied: | <table border="1"> <thead> <tr> <th>Stratum</th> <th>n_i</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>343</td> </tr> <tr> <td>2</td> <td>341</td> </tr> <tr> <td>3</td> <td>267</td> </tr> <tr> <td>4</td> <td>41</td> </tr> <tr> <td>5</td> <td></td> </tr> <tr> <td>6</td> <td></td> </tr> </tbody> </table> | Stratum | n_i | 1 | 343 | 2 | 341 | 3 | 267 | 4 | 41 | 5 | | 6 | |
| Stratum | n_i | | | | | | | | | | | | | | |
| 1 | 343 | | | | | | | | | | | | | | |
| 2 | 341 | | | | | | | | | | | | | | |
| 3 | 267 | | | | | | | | | | | | | | |
| 4 | 41 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
| Comments | - | | | | | | | | | | | | | | |

| Data / Parameter | s_i | | | | | | | | | | | | | | |
|-------------------------|--|---------|-------|---|----|---|----|---|----|---|---|---|------|---|------|
| Data unit | t d.m. (or t d.m. ha ⁻¹) | | | | | | | | | | | | | | |
| Description | Estimated standard deviation of biomass stock in stratum i | | | | | | | | | | | | | | |
| Value applied: | <table border="1"> <thead> <tr> <th>Stratum</th> <th>s_i</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>46</td> </tr> <tr> <td>2</td> <td>42</td> </tr> <tr> <td>3</td> <td>32</td> </tr> <tr> <td>4</td> <td>9</td> </tr> <tr> <td>5</td> <td>0.00</td> </tr> <tr> <td>6</td> <td>0.00</td> </tr> </tbody> </table> | Stratum | s_i | 1 | 46 | 2 | 42 | 3 | 32 | 4 | 9 | 5 | 0.00 | 6 | 0.00 |
| Stratum | s_i | | | | | | | | | | | | | | |
| 1 | 46 | | | | | | | | | | | | | | |
| 2 | 42 | | | | | | | | | | | | | | |
| 3 | 32 | | | | | | | | | | | | | | |
| 4 | 9 | | | | | | | | | | | | | | |
| 5 | 0.00 | | | | | | | | | | | | | | |
| 6 | 0.00 | | | | | | | | | | | | | | |
| Comments | - | | | | | | | | | | | | | | |

| | |
|-------------------------|----------------------------------|
| Data / Parameter | $A_{PLOT,i}$ |
| Data unit | Ha |
| Description | Size of sample plot in stratum i |

| | |
|-----------------------|--|
| Value applied: | Area: 0.0314 ha, circular plot $r = 10$ m. |
| Comments | - |

| | |
|-------------------------|--|
| Data / Parameter | X_i |
| Data unit | Variable |
| Description | Variables measured per tree for the calculation of above-ground biomass an allometric equation for species |
| Value applied: | N/A |
| Comments | - |

| | |
|-------------------------|---|
| Data / Parameter | T |
| Data unit | Year |
| Description | Time period elapsed between two successive estimations of carbon stock in a carbon pool |
| Value applied: | 5.55 |
| Comments | Between 11st January 2017 and 30th July 2022 |

| Data / Parameter | $CC_{SHRUB_BSL,i}$ | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|--|-------------------------|------|-------------------------|---|------|-------|---|------|-------|---|------|-------|---|------|---|---|------|---|---|------|---|
| Data unit | Dimensionless | | | | | | | | | | | | | | | | | | | | | |
| Description | Crown cover of shrubs in baseline stratum i at a given point of time in year t | | | | | | | | | | | | | | | | | | | | | |
| Value applied: | <table border="1"> <thead> <tr> <th>STRATA</th> <th>YEAR</th> <th>CC_{SHRUB_BSL}</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2017</td> <td>23.68</td> </tr> <tr> <td>2</td> <td>2018</td> <td>33.76</td> </tr> <tr> <td>3</td> <td>2019</td> <td>39.84</td> </tr> <tr> <td>4</td> <td>2020</td> <td>0</td> </tr> <tr> <td>5</td> <td>2021</td> <td>0</td> </tr> <tr> <td>6</td> <td>2021</td> <td>0</td> </tr> </tbody> </table> | STRATA | YEAR | CC _{SHRUB_BSL} | 1 | 2017 | 23.68 | 2 | 2018 | 33.76 | 3 | 2019 | 39.84 | 4 | 2020 | 0 | 5 | 2021 | 0 | 6 | 2021 | 0 |
| STRATA | YEAR | CC _{SHRUB_BSL} | | | | | | | | | | | | | | | | | | | | |
| 1 | 2017 | 23.68 | | | | | | | | | | | | | | | | | | | | |
| 2 | 2018 | 33.76 | | | | | | | | | | | | | | | | | | | | |
| 3 | 2019 | 39.84 | | | | | | | | | | | | | | | | | | | | |
| 4 | 2020 | 0 | | | | | | | | | | | | | | | | | | | | |
| 5 | 2021 | 0 | | | | | | | | | | | | | | | | | | | | |
| 6 | 2021 | 0 | | | | | | | | | | | | | | | | | | | | |
| Comments | - | | | | | | | | | | | | | | | | | | | | | |

| Data / Parameter | $CC_{TREE_BSL,i}$ | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|--|----------------------|------|----------------------|---|------|------|---|------|------|---|------|------|---|------|------|---|------|-------|---|------|------|
| Data unit | Dimensionless | | | | | | | | | | | | | | | | | | | | | |
| Description | Crown cover of trees in baseline stratum i at a given point of time in year t | | | | | | | | | | | | | | | | | | | | | |
| Value applied: | <table border="1"> <thead> <tr> <th>Strata</th> <th>YEAR</th> <th>CC_{TREE,i}</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2017</td> <td>3.07</td> </tr> <tr> <td>2</td> <td>2018</td> <td>3.48</td> </tr> <tr> <td>3</td> <td>2019</td> <td>6.15</td> </tr> <tr> <td>4</td> <td>2020</td> <td>0.00</td> </tr> <tr> <td>5</td> <td>2021</td> <td>11.82</td> </tr> <tr> <td>6</td> <td>2021</td> <td>0.36</td> </tr> </tbody> </table> | Strata | YEAR | CC _{TREE,i} | 1 | 2017 | 3.07 | 2 | 2018 | 3.48 | 3 | 2019 | 6.15 | 4 | 2020 | 0.00 | 5 | 2021 | 11.82 | 6 | 2021 | 0.36 |
| Strata | YEAR | CC _{TREE,i} | | | | | | | | | | | | | | | | | | | | |
| 1 | 2017 | 3.07 | | | | | | | | | | | | | | | | | | | | |
| 2 | 2018 | 3.48 | | | | | | | | | | | | | | | | | | | | |
| 3 | 2019 | 6.15 | | | | | | | | | | | | | | | | | | | | |
| 4 | 2020 | 0.00 | | | | | | | | | | | | | | | | | | | | |
| 5 | 2021 | 11.82 | | | | | | | | | | | | | | | | | | | | |
| 6 | 2021 | 0.36 | | | | | | | | | | | | | | | | | | | | |
| Comments | - | | | | | | | | | | | | | | | | | | | | | |

| | |
|-------------------------|-----------------------------|
| Data / Parameter | $A_{BURN,i,t}$ |
| Data unit | Ha |
| Description | Area burnt in stratum i |
| Value applied: | 0 |
| Comments | No wildfires have occurred. |

| | |
|-------------------------|--|
| Data / Parameter | $A_{DISP,t}$ |
| Data unit | ha |
| Description | Area of land from which agricultural activity is being displaced in year t |
| Value applied: | N/A |
| Comments | Activity displacement has not occurred |

| | |
|-------------------------|---|
| Data / Parameter | $CC_{SHRUB,i}$ |
| Data unit | dimensionless |
| Description | Crown cover of shrubs in shrub biomass estimation stratum i at the time of estimation, expressed as a fraction (e.g. 10 per cent crown cover implies= 0.10) |
| Value applied: | N/A |
| Comments | Activity displacement has not occurred |

| | |
|-------------------------|--|
| Data / Parameter | <i>DBH</i> |
| Data unit | cm |
| Description | Diameter of trees planted at 1.30m height |
| Value applied: | See details in the Excel file: Monitoring |
| Comments | Diameters of trees were measured in centimetres with one decimal (for example 1.3 cm). They were measured with iPad 11 by using the software ArboReal always in the direction perpendicular to the line connecting the centre of the plot with the tree. |

7.2 Baseline Emissions

Baseline emissions for this monitoring period was calculated following the approach demonstrated in section 5.1. The table below displays the baseline carbon stocks for the pre-existing trees and shrubs for the planting years 2017-2021 which are subject to this monitoring period.

Table 25. Baseline biomass for this monitoring period

| Year | Annual planted area | $C_{TREE_BSL,t}$ t CO ₂ -e | $C_{SHRUB_BSL,t}$ t CO ₂ -e | $C_{DW_BSL,t}$ t CO ₂ -e | $C_{LI_BSL,t}$ t CO ₂ -e | $C_{BSL,t}$ t CO ₂ -e |
|--------------------------|---------------------|---|--|---|---|-------------------------------------|
| 11-01-2017 to 31-12-2017 | 314 | 1,122 | 970 | 67 | 11 | 2,171 |
| 01/01/2018-31/01/2018 | 264 | 1,070 | 1,163 | 64 | 10 | 2,308 |
| 01/01/2019-31/01/2019 | 196 | 1,408 | 1,021 | 84 | 14 | 2,528 |
| 01/01/2020-31/01/2020 | 41 | 0 | 0 | 0 | 0 | 0.0 |
| 01/01/2021-31/01/2021 | 401 | 2,805 | 0 | 164 | 30 | 3,000 |

7.3 Project Emissions

Project emissions of the first verification period of the first project activity instance have been calculated following section 4.2. of this document.

Change in carbon stocks in project - $\Delta C_{P,t}$

Change in carbon stock in tree biomass - $\Delta C_{TREE_PROJ,t}$

Estimation of change in carbon stock in tree biomass (ΔC_{TREE}) have been done following next steps:

Step 1: Selection specific allometric equations.

According to the applied CDM A/R Methodological Tool “Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities”⁵⁹, a species or group of species-specific allometric equation derived from trees growing in edapho-climate conditions similar to those in the project area is considered appropriate, and hence can be used for ex post estimation of tree biomass, if [as one of the sufficient conditions], the equation was derived from a data set of at least 30 sample trees, and the value of coefficient of determination (R2) was not less than 0.85.”

In order to determine which allometric equation to use in the first verification, an exhaustive literature review was carried out based on different criteria. Since one of the main requirements of the tool is that the equation must be derived from trees growing in soil and climatic conditions similar to those of the project area, allometric equations of *Gmelina arborea* in Mexico were searched for. The following equations were obtained from this search:

Allometric equations of *Gmelina arborea* in Mexico

| Specie | Equation | R2 | Sample size | Author | Year |
|-----------------|---|------|-------------|-----------------------|------|
| Gmelina arborea | $Biomass=0.7075D^2 -16.24*DBH+153.36$ | 0.75 | 15 | Sáenz et al. | 2021 |
| Gmelina arborea | $Biomass = \exp(0.641384 + 2.75382*\text{Log}_{10}(DBH)^2)$ | 0.93 | 125 | Ruiz-Blandon et al. | 2020 |
| Gmelina arborea | $Volume=\pi*(DBH^2) *H*ff/4$ | - | 207 | Telles Antonio et al. | 2019 |

⁵⁹ Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities” (Version 01.0.0)
A/R Methodological tool (unfccc.int)

These equations were discarded for use in ex post calculations, as they did not meet the requirements of the tool sample size >30, R2>85. In the case of the equation (Telles Antonio et al., 2019), the age of the sample trees was 15 years, much older than the monitoring trees.

Subsequently, a search was carried out by species, under similar edapho-climatic conditions, from which the following equations were obtained

Gmelina arborea allometric equations according to tool requirements

| Specie | Equation | R2 | Sample size | Author | Year | Location |
|------------------------|---|------|-------------|------------------------|------|------------|
| <i>Gmelina arborea</i> | Biomass = 5,401,24*DBH | 0.82 | 30 | Rodríguez et al. | 2019 | Costa Rica |
| <i>Gmelina arborea</i> | Biomass = 0.1602* DBH ^(2.1937) | 0.97 | 24 | Arias et al. | 2011 | Costa Rica |
| <i>Gmelina arborea</i> | Biomass = exp(0,641384+ 2,75382*Log10(DBH) ²) | 0.93 | 125 | Fonseca-González et al | 2021 | Costa Rica |

The first two equations were discarded as they did not meet the requirements of the tool sample size >30, R2>85 and the age ranges of the samples were higher than the monitoring age.

Following the conditions of the tool, the allometric equation that has been used in the project is Biomass and carbon models for *Gmelina arborea* trees in clonal plantations (Fonseca-González et al., 2021)⁶⁰ (see table below).

Table 26. Allometric equation used in the project

⁶⁰ Biomass and carbon models for *Gmelina arborea* trees in clonal plantations Modelos de biomasa y carbono para árboles de *Gmelina arborea* en plantaciones clonales (scielo.sa.cr)

| Specie | Source | Sample size | R2 | Range DBH (cm) | Equation |
|------------------------|---------------------------------|-------------|------|----------------|---|
| <i>Gmelina arborea</i> | (Fonseca-González et al., 2021) | 125 | 0,93 | 3,9-39,8 | $B_{TREE} = \exp(0,641384 + 2,75382 * \text{Log}_{10}(\text{DBH})^2)$ |

DBH = Diameter at breast height; cm

BTREE: biomass of the whole tree

This allometric equation is constructed with sample size >30, R2>85, with individuals aged between 1 and 8 years and DBH range between 3.9-39.8 cm. The study included 3 zones in Costa Rica: north, north pacific and south, with climatic conditions of 2865 mm of average rainfall and an average temperature of 25.6 °C.

Strata 5 and 6 corresponding to the 2021 planting year do not have adequate dimensions to be able to account for biomass according to the allometric equation. Conservatively, they have been accounted as BTREE =0. It is expected that in subsequent verifications they can be accounted as BTREE >0.

Step 2: Calculation of change in carbon stock in tree biomass

This step is developed in the following sub-steps:

Sub-step 3.1: Calculation of total biomass per tree (B_{TREE}) per tree ($f_j(X_{1,i}, X_{2,i}, X_{3,i}, \dots)$) based on the trees variables measured and using the selected allometric equation (see results in Excel file “Field data and calculations.xlsx”);

Sub-step 3.3: Calculation of the carbon stock in tree biomass within the project boundary at t_2 ($C_{TREE, t2}$, first monitoring date) and t_1 ($C_{TREE, t1}$, project starting date). As this is the first verification $C_{TREE, t1}$ has been set equal to zero. $C_{TREE, t2}$ is calculated in the Excel file “Field data and calculations.xlsx” based on equations of section 4.2 (see summary results in table below);

- Sub-step 3.4: Discount rate application to the calculation of the carbon stock in tree biomass based on monitoring uncertainty. The estimation of the mean carbon stock in tree biomass based on field sampling provides an uncertainty of 2,78% (calculated using equations 15, 16 and 17 or AR-TOOL14).

Table 27. Summary results in the calculation of $C_{TREE, t2}$

| Stratum | Area (ha) | wi | bTREE ,t,i |
|---------|-----------|------|-------------|
| | | | t d.m. ha-1 |
| 1 | 314.42 | 0.26 | 96 |
| 2 | 264.42 | 0.22 | 67 |

| Stratum | Area (ha) | wi | bTREE ,t,i | | bTREE ,t | BTREE ,t | CTREE ,t2 |
|---------|-----------|------|-------------|--|-------------|----------|-----------|
| | | | t d.m. ha-1 | | | | |
| 3 | 196.83 | 0.16 | 40 | | | | |
| 4 | 41.36 | 0.03 | 16 | | | | |
| 5 | 197.79 | 0.16 | 0 | | | | |
| 6 | 204.18 | 0.17 | 0 | | t d.m. ha-1 | t d.m. | t CO2-e |
| TOTAL | 1,219.01 | 1.0 | - | | 46 | 57,202 | 98,578 |

 Table 28. Uncertainty of *bTREE ,t*

| Stratum | Area (ha) | si | | ni | (wixsi)2/ni | uc |
|---------|-----------|-------------|--|--------|-------------|-------|
| | | t d.m. ha-1 | | | | |
| 1 | 314.42 | 46.37 | | 343 | 0.42371 | |
| 2 | 264.42 | 41.72 | | 341 | 0.24708 | |
| 3 | 196.83 | 31.65 | | 267 | 0.09604 | |
| 4 | 41.36 | 9.16 | | 41 | 0.00184 | |
| 5 | 197.79 | 0.00 | | 0 | 0.00000 | |
| 6 | 204.18 | 0.00 | | 0 | 0.00000 | uc |
| TOTAL | 1,219.01 | 128.90 | | 992.00 | 0.77 | 0.031 |

Based on the results of above tables the conservative value (applying the discount rate) of *CTREE ,t2* has been calculated as zero t CO2-e. The discount has been applied following Appendix 2 of AR-TOOL14 “Applying uncertainty discount” where is it indicated that for uncertainties equal or less than 10%, the discount rate should be 0% of the uncertainty.

As *CTREE,t1* is zero, then $\Delta C_{TREE} = C_{TREE,t2}$, and $\Delta C_{TREE_PROJ,t} = \Delta C_{TREE} / T = C_{TREE,t2} / T = 98,578 / 5.55 = 17,761$ t CO2-e.

Change in carbon stock in shrub biomass - $\Delta C_{SHRUB_PROJ,t}$

Change in carbon stock of shrubs may be estimated as zero.

Change in carbon stock in dead wood - $\Delta C_{DW_PROJ,t}$

Following section 4.2. DF_{DW} is 6% for strata 1 to 5, and 2% is used for strata 6, therefore: $C_{DW,i,t2} = C_{TREE,i,t2} * DF_{DW1-5} + C_{TREE,i,t2} * DF_{DW6}$ (see table 29)

In this first verification $\Delta C_{DW_PROJ,t} = dC_{DW(t1,t2)} * 1 \text{ year} = (C_{DW,t2} - C_{DW,t1})/T * 1 \text{ year} = C_{DW,t2}/T * 1 \text{ year}$ (see table 29)

Change in carbon stock in litter – $\Delta C_{LI_PROJ,t}$

Following section 4.2. DF_{LI} is 1% for strata 1 to 5, and 4% is used for strata 6, therefore: $C_{LI,i,t2} = C_{TREE,i,t2} * DF_{LI1-5} + C_{TREE,i,t2} * DF_{LI6}$ (see table 29)

In this first verification $\Delta C_{LI_PROJ,t} = dC_{LI(t1,t2)} * 1 \text{ year} = (C_{LI,t2} - C_{LI,t1})/T * 1 \text{ year} = C_{LI,t2}/T * 1 \text{ year}$ (see table 29)

Change in carbon stock in the soil organic carbon (SOC) pool - $\Delta C_{SOC_PROJ,t}$

$\Delta C_{SOC_PROJ,t}$, is calculated using equations and parameters of section 4.2. All calculations are included in the Excel file “Field data and calculations.xlsx”, and results are summarized in the following table.

Table 29. Summary results of $\Delta C_{SOC_PROJ,t}$ calculations

| Project year | Time per planting campaign (years) Tabasco | | | | | SOC Annual carbon stock change per planting campaign (tCO2e yr-1) Tabasco | | | | | |
|--------------------------|--|------|------|------|------|---|--------|--------|------|------|---------------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
| 11-01-2017 to 31-12-2017 | 0.97 | | | | | 407.95 | 0.00 | 0.00 | 0.00 | 0.00 | 407.95 |
| 01/01/2018-31/01/2018 | 1 | 1 | | | | 420.57 | 117.61 | 0.00 | 0.00 | 0.00 | 538.17 |
| 01/01/2019-31/01/2019 | 1 | 1 | 1 | | | 420.57 | 117.61 | 205.54 | 0.00 | 0.00 | 743.72 |

| | Time per planting campaign (years) Tabasco | | | | | SOC Annual carbon stock change per planting campaign (tCO2e yr-1) Tabasco | | | | | |
|--------------------------|--|-------------|-------------|-------------|-------------|---|---------------|---------------|--------------|---------------|-----------------|
| 01/01/2020-31/01/2020 | 1 | 1 | 1 | 1 | | 420.57 | 117.61 | 205.54 | 65.27 | 0.00 | 808.99 |
| 01/01/2021-31/01/2020 | 1 | 1 | 1 | 1 | 1 | 420.57 | 117.61 | 205.54 | 65.27 | 126.98 | 935.97 |
| 01-01-2022 to 30-07-2022 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 | 243.9 | 68.2 | 119.2 | 37.9 | 73.6 | 542.9 |
| Total | 5.55 | 4.58 | 3.58 | 2.58 | 1.58 | 2,334.1 | 538.65 | 735.85 | 168.4 | 200.63 | 3,977.66 |

| Project year | Time per planting campaign (years) Tabasco | | | | | SOC Annual carbon stock change per planting campaign (tCO2e yr-1) Tamaulipas | | | | | |
|--------------------------|--|----------|----------|----------|-------------|--|----------|----------|----------|--------------|--------------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
| 11-01-2017 to 31-12-2017 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01/01/2018-31/01/2018 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01/01/2019-31/01/2019 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01/01/2020-31/01/2020 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01/01/2021-31/01/2021 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 52.61 | 52.61 |
| 01-01-2022 to 30-07-2022 | 0 | 0 | 0 | 0 | 0.58 | 0 | 0 | 0 | 0 | 30.51 | 30.51 |
| Total | 0 | 0 | 0 | 0 | 1.58 | 0 | 0 | 0 | 0 | 83.12 | 83.12 |

Increase of non-CO2 GHG emissions within the project boundary - GHGE,t

Following the CDM A/R Methodological Tool “Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity” ⁶¹and taking into account that there will not be use of fire in site preparation or to clear the land of harvest residue prior to replanting of the land, it has been assumed that GHGE,t is = 0. In the case of forest fires, the only potential source of emissions in the project area, it has been considered zero in this first verification as indicated in the tool: “For the first verification, emission of non-CO2 GHGs resulting from the loss of trees due to natural or anthropogenic forest fire is assumed to be zero”.

Actual net greenhouse gas removals by sinks - $\Delta C_{ACTUAL,t}$

Actual net GHG removals by sink are calculated in an Excel file available to VVB on request (Field data and calculations.xlsx), based on equation $\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHGE,t$, where $GHGE,t = 0$ and therefore $\Delta C_{ACTUAL,t} = \Delta C_{P,t}$.

Summary result of $\Delta C_{ACTUAL,t}$ are included in the following table.

Table 30. Actual net GHG removals by sinks

| Project year | $\Delta C_{TREE,t}$ | $\Delta C_{DW,t}$ | $\Delta C_{LI,t}$ | $\Delta C_{SOC,t}$ | $\Delta C_{PROJ,t}$ |
|--------------------------|---------------------|-------------------|-------------------|--------------------|---------------------|
| | t CO2-e | t CO2-e | t CO2-e | t CO2-e | t CO2-e |
| 11-01-2017 to 31-12-2017 | 9,219 | 553 | 92 | 408 | 10,289 |
| 01/01/2018-31/01/2018 | 16,314 | 979 | 163 | 538 | 18,079 |
| 01/01/2019-31/01/2019 | 20,120 | 1,207 | 201 | 744 | 22,381 |
| 01/01/2020-31/01/2020 | 20,514 | 1,231 | 205 | 809 | 22,868 |
| 01/01/2021-31/01/20 | 20,514 | 1,231 | 205 | 989 | 23,089 |

⁶¹ Annex 31 of the Executive Board report at its 65th meeting.

| Project year | $\Delta C_{TREE,t}$ | $\Delta C_{DW,t}$ | $\Delta C_{LI,t}$ | $\Delta C_{SOC,t}$ | $\Delta C_{PROJ,t}$ |
|--------------------------|---------------------|-------------------|-------------------|--------------------|---------------------|
| | t CO2-e | t CO2-e | t CO2-e | t CO2-e | t CO2-e |
| 01-01-2022 to 30-07-2022 | 11,898 | 714 | 119 | 573 | 13,392 |
| TOTAL | 98,578 | 5,915 | 986 | 4,061 | 110,097 |
| Mean/Year | 17,762 | 1,066 | 178 | 732 | 19,837 |

7.4 Leakage

The only leakage emission source considered in the selected methodology is leakage due to the displacement of agricultural activities and must be calculated using the tool AR-TOOL15⁶².

In the project area of the first project activity instance, as described in section 4.3., displacement of pre-project agricultural activities is not expected. Therefore, leakage in the area will be set equal to zero ($LK_t = 0$).

7.5 Net GHG Emission Reductions and Removals

Net GHG removals by sinks in the first monitoring period of this first project activity instance are summarized in the following table (calculations are available in the Excel file “Field data and calculations”).

Table 31. Net GHG removals by sinks.

⁶² CDM A/R Methodological tool: Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity. Version 02.0
http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf/history_view

| Year | Baseline emissions or removals (tCO2e) | Project emissions or removals (tCO2e) | Leakage emissions (tCO2e) | Net GHG emission reductions or removals (tCO2e) | Buffer pool allocation | VCUs eligible for issuance |
|--------------------------|--|---------------------------------------|---------------------------|---|------------------------|----------------------------|
| 11-01-2017 to 31-12-2017 | 2,172 | 10,272 | 0 | 8,101 | 1,215 | 6,885 |
| 01/01/2018-31/01/2018 | 2,308 | 17,994 | 0 | 15,686 | 2,353 | 13,332 |
| 01/01/2019-31/01/2019 | 2,528 | 22,272 | 0 | 19,744 | 2,962 | 16,782 |
| 01/01/2020-31/01/2020 | 0 | 22,759 | 0 | 22,759 | 3,414 | 19,344 |
| 01/01/2021-31/01/20 | 3,001 | 22,938 | 0 | 19,938 | 2,991 | 16,947 |
| 01-01-2022 to 30-07-2022 | 0 | 13,304 | 0 | 13,304 | 1,996 | 11,308 |
| Total | 10,009 | 109,539 | 0 | 99,531 | 14,930 | 84,598 |

The total GHG removals for the first project instance during the 1st monitoring period (11-01-2017 to 30/7/2022) are 99,531 tCO2e . The non permanence risk rating is 15% (as determined in the AFOLU non-permanence risk report attached as a separate document). Therefore, the total number of buffer credits that need to be deposited into the AFOLU pooled buffer account 14,930t CO2-e. The number of GHG credits eligible to be issued as VCUs for the first project instances of this monitoring period is 84,598 tCO2e. The long-term average GHG benefit is 95,701 t CO2-e, (See Appendix).

| | <u>Ex-ante emissions reductions/removals (tCO2e)</u> | <u>Achieved emissions reductions/removals (tCO2e)</u> | <u>Percent difference</u> | <u>Justification for the difference</u> |
|---------------------------------|--|---|---------------------------|--|
| Year 1 (11-01-2017--31-12-2017) | 2,770 | 8,101 | -66% | Ex ante estimations are based on full rotation mean annual increments from ex-post results. For strata where no data were available, conservative increments were assumed. Accordingly, the ex-ante increments are below the increments observed for strata where ex-post results are available. For younger trees, as in this case (< 1 year of age), the MAI can vary substantially. Stratum 1 (the only stratum already established in year 1) showed ex-post increments substantially higher than project increments assumed in the ex-ante. |
| Year 2 (1-01-2018--31-12-2018) | 10,802 | 15,686 | -31% | As mentioned above, explanation. Stratum 1 and 2 (the only strata already established in year 2) showed ex-post increments substantially higher than increments assumed in the ex-ante. |
| Year 3 (1-01-2019--31-12-2019) | 17,164 | 19,744 | -13% | As mentioned above, explanation. Strata 1-3 (the only strata already established in year 3) showed ex-post increments substantially higher than increments assumed in the ex-ante. |
| Year 4 (1-01-2020--31-12-2020) | 22,980 | 22,759 | 1% | As mentioned above, conservative increments were applied in ex-ante. |

| | <u>Ex-ante emissions reductions/removals (tCO2e)</u> | <u>Achieved emissions reductions/removals (tCO2e)</u> | <u>Percent difference</u> | <u>Justification for the difference</u> |
|--------------------------------|--|---|---------------------------|--|
| Year 5 (1-01-2021--30-07-2021) | 28,120 | 19,938 | 41% | This stratum did not reach the minimum measurable diameter in the monitoring event. The GHG removals for this stratum are interpolated from the average $\Delta\text{CTREE,PROJ,t}$ (t CO2-e). Besides this, the ex-ante estimation could not be updated with the ex-post estimation, so it comes from the literature, as explained in section 5, and the ex-ante estimations are above the ex-post. |
| Year 6 (1-01-2022--30-07-2022) | 19,220 | 13,304 | 44% | Idem stratum 5 |
| Total | 101,056 | 99,531 | 2% | The difference 1,525 (tCO2e) is under a conservative ratio. The ex-ante estimation is based on full rotation increments, For strata without monitoring data, conservative increments were assumed. This leads to underestimation of strata where ex-post results are available and overestimation of strata where ex-post results are not yet available. At the overall project level, the estimation error is very small (less than 2%). The difference is under a logical margin |

APPENDIX 1: LONG-TERM AVERAGE GHG BENEFIT CALCULATION

Section 3.2.25 of the VCS Standard v4.4 states that "The long-term average GHG benefit shall be calculated at each verification event". Thus, in this verification event, the long-term average GHG benefit was recalculated based on the forest management plan and monitoring data. For this purpose, the growth equations for the ex-ante growth predictions were updated taking into account the field monitoring data from this first verification event (see detailed description in supporting documentation)

Table 32. Estimated Net GHG Emission Reductions and Removals

| Year | Estimated baseline emissions or removals (tCO ₂ e) | Estimated project emissions or removals (tCO ₂ e) | Annual change in GHG benefit (tCO ₂ e) | Expected total GHG benefit to-date (tCO ₂ e) | Total credits available each year tCO ₂ e |
|--------------------------|--|---|--|--|---|
| | BE | PE | PE _t -PE _{t-1} | PE _t -BE _t | VCUs |
| 11-01-2017 to 10-01-2018 | | | | | |
| 11-01-2018 to 10-01-2019 | 2,170 | 4,940 | 4,940 | 2,770 | 2,687 |
| 11-01-2019 to 10-01-2020 | 4,475 | 18,048 | 13,107 | 13,573 | 10,802 |
| 11-01-2020 to 10-01-2021 | 7,000 | 37,737 | 19,689 | 30,737 | 17,164 |
| 11-01-2021 to 10-01-2022 | 7,000 | 60,716 | 22,980 | 53,716 | 22,980 |
| 11-01-2022 to 10-01-2023 | 8,322 | 90,158 | 29,442 | 81,836 | 28,120 |
| 11-01-2023 to 10-01-2024 | 9,997 | 124,971 | 34,812 | 114,974 | 13,948 |
| 11-01-2024 to 10-01-2025 | 9,997 | 105,174 | -19,797 | 95,178 | 0 |

| Year | Estimated baseline emissions or removals (tCO ₂ e) | Estimated project emissions or removals (tCO ₂ e) | Annual change in GHG benefit (tCO ₂ e) | Expected total GHG benefit to-date (tCO ₂ e) | Total credits available each year tCO ₂ e |
|--------------------------|--|---|--|--|---|
| 11-01-2025 to 10-01-2026 | 9,997 | 89,861 | -15,313 | 79,864 | 0 |
| 11-01-2026 to 10-01-2027 | 9,997 | 86,955 | -2,906 | 76,958 | 0 |
| 11-01-2027 to 10-01-2028 | 9,997 | 111,954 | 24,999 | 101,958 | 0 |
| 11-01-2028 to 10-01-2029 | 9,997 | 76,399 | -35,555 | 66,403 | 0 |
| 11-01-2029 to 10-01-2030 | 9,997 | 105,841 | 29,442 | 95,845 | 0 |
| 11-01-2030 to 10-01-2031 | 9,997 | 140,654 | 34,812 | 130,657 | 0 |
| 11-01-2031 to 10-01-2032 | 9,997 | 120,857 | -19,797 | 110,860 | 0 |
| 11-01-2032 to 10-01-2033 | 9,997 | 105,544 | -15,313 | 95,547 | 0 |
| 11-01-2033 to 10-01-2034 | 9,997 | 102,638 | -2,906 | 92,641 | 0 |
| 11-01-2034 to | 9,997 | 127,637 | 24,999 | 117,640 | 0 |

| Year | Estimated baseline emissions or removals (tCO ₂ e) | Estimated project emissions or removals (tCO ₂ e) | Annual change in GHG benefit (tCO ₂ e) | Expected total GHG benefit to-date (tCO ₂ e) | Total credits available each year tCO ₂ e |
|--------------------------|--|---|--|--|---|
| 10-01-2035 | | | | | |
| 11-01-2035 to 10-01-2036 | 9,997 | 92,082 | -35,555 | 82,085 | 0 |
| 11-01-2036 to 10-01-2037 | 9,997 | 121,524 | 29,442 | 111,527 | 0 |
| 11-01-2037 to 10-01-2038 | 9,997 | 156,337 | 34,812 | 146,340 | 0 |
| 11-01-2038 to 10-01-2039 | 9,997 | 135,800 | -20,536 | 125,804 | 0 |
| 11-01-2039 to 10-01-2040 | 9,997 | 119,314 | -16,486 | 109,317 | 0 |
| 11-01-2040 to 10-01-2041 | 9,997 | 114,815 | -4,499 | 104,818 | 0 |
| 11-01-2041 to 10-01-2042 | 9,997 | 138,113 | 23,298 | 128,117 | 0 |
| 11-01-2042 to 10-01-2043 | 9,997 | 100,318 | -37,795 | 90,321 | 0 |
| 11-01-2043 to 10-01-2044 | 9,997 | 127,520 | 27,202 | 117,523 | 0 |

| Year | Estimated baseline emissions or removals (tCO ₂ e) | Estimated project emissions or removals (tCO ₂ e) | Annual change in GHG benefit (tCO ₂ e) | Expected total GHG benefit to-date (tCO ₂ e) | Total credits available each year tCO ₂ e |
|--------------------------|--|---|--|--|---|
| 11-01-2044 to 10-01-2045 | 9,997 | 160,092 | 32,572 | 150,095 | 0 |
| 11-01-2045 to 10-01-2046 | 9,997 | 138,055 | -22,037 | 128,058 | 0 |
| 11-01-2046 to 10-01-2047 | 9,997 | 120,501 | -17,554 | 110,504 | 0 |
| 11-01-2017 to 10-01-2018 | 9,997 | 115,355 | -5,146 | 105,358 | 0 |
| SUM | | | | 2,871,028 | 95,701 |
| LA | | | | 95,701 | |